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COMPOSITION FOR CONDITIONING THREAD

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This invention relates to a composition for conditioning thread; i. e., fibers, filaments, yarns, cords, thread bundles, etc., particularly thread of cellulosic origin.

In such textile operations as coning, knitting and weaving, thread is exposed to abrasive wear, externally as the thread passes over metal and rubber surfaces and internally as the thread is twisted, bent and wound into different configurations. To minimize injurious wearing action on or in the thread, various conditioning compositions have been developed: most of these compositions are fairly satisfactory for lubricating the thread, but all have some objectionable features. Examples are corrosiveness to metal machinery; inability to remain homogeneous, permitting separation of constituents; instability toward light and air, causing decomposition; and loss of conditioning properties on storage.

To effect lubrication of a thread, it might be supposed that mineral oil alone would suffice; however, it is well recognized that cones of thread lubricated with mineral oil tend to bulge out of shape.

By the present invention, which contemplates the addition to mineral oil of an oil-soluble ester of a higher polyhydric alcohol, a conditioning compound is obtained which not only provides a well-formed, non-bulging cone but also permits of an increase in the size of cone from approximately 4 lbs. to as much as or more than 5.8 lbs. In addition to such esters as sorbitol trioleate, modified forms of which sorbitan trioleate is an example constitute agents which may be used with mineral oil in the practice of the invention. In these modified forms, two of the hydroxyl groups present in the alcohol have reacted to form an inner ether with the elimination of a molecule of water.

In forming a cone, the thread being drawn from the supply source is subjected to an increasing tension as the peripheral speed of the cone increases with the increase in its diameter. Notwithstanding this state of affairs, by using a conditioning composition formed by dissolving an ester of a higher polyhydric alcohol in a refined mineral oil in the viscosity range between 30 to 55 seconds Saybolt at 100° F., a thread results having a low, uniform friction. Having the important advantage of being formed from thread of low, uniform friction, the cone builds up solidly, minimizing the incidence of such imperfections as soft centers, bulging ends and underwind.

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Friction testing apparatus similar to that described by W. B. Sellars in the December, 1934, issue of "Textile World" gives proof of the improved properties of the compositions of the present invention. When thread treated with the usual commercially obtainable coning oils is tested, the pointer usually fluctuates violently, showing that the friction is far from uniform. On the other hand, when thread prepared in accordance with the teachings of the present invention is tested, the behavior of the apparatus indicates that a low, uniform friction along the entire thread is obtained immediately. That these characteristics are retarded on storage can be demonstrated by repetition of the tests after a nine to twelve months' interval.

The relative stability of the compositions of the instant invention provides a further marked advantage as compared with the instability of the usual commercially available conditioning oils. For example, a shipment of commercial coning oil can give at the outset every indication of being a stable, uniform product, yet on standing a quantity of sludge will develop at the bottom of the drum. Coincident with the formation of the sludge is an equally undesirable change in the frictional properties of the oil; viz., whereas the initial friction imparted to the thread by such an oil may give a reading of 95 gm., later tests may give a reading as high as 125 gm. By contrast, the compositions of the instant invention have been kept without the slightest sludge formation for over nine months, at the end of which period they have been found to impart a low, uniform friction to thread.

The importance of these factors appears in practice in various respects. In knitting stockings, for example, a thread having a low, uniform friction as the result of treatment with the conditioning composition of the instant invention can readily be knitted into a stocking of the desired length. A similar thread having a high friction as the result of treatment with another conditioning oil may give rise to, and in tests has been found to yield, a stocking 3 to 4 inches short of the intended length. Inasmuch as other conditions can be controlled without difficulty, the improvement is apparently due to low, uniform friction imparted by the conditioning composition of the present invention.

Knitters know from experience that with variation of thread friction there will be a corresponding variation in the looseness or tightness

of the stitch. To obtain a uniformly knitted product, knitting machines have to be adjusted for tension if the friction of the thread changes. For these reasons, the composition of the instant invention, which gives rise to a soft, supple thread having a smooth running surface, is better suited for knitting machine operation than the unstable compositions heretofore used, which on decomposing leave a gummy surface on the thread.

Not only this, but the improved compositions of the present invention adequately condition a thoroughly "setup" thread when only relatively small quantities are used. Whereas it would require substantially 5 to 11% of the usual commercially available oils to impart comparable knitting characteristics to a thread, by appropriately regulating the oiling device a given thread can be made to take up amounts of the improved conditioning compositions ranging from a value in excess of 4% to the remarkably low value of less than 1%. Experiments prove that threads containing not more than 4% of the improved composition consistently give better knitted stocking hems than threads containing 5 to 7% of the commercially available coning oils previously used.

Another advantage of the invention is flexibility in the matter of ingredients, which allows a close control over frictional and related characteristics which these compositions impart to the thread. In the examples of compositions given later in this application, two components of the mineral oil portion are #15 technical white oil and mineral seal oil: these are refined mineral oils which were chosen because of their viscosities, which are 30 seconds and 40 seconds Saybolt respectively. Since the frictional characteristics imparted to a thread are functions of the viscosities of the mineral oils augmented by the effect of other ingredients in the composition, by changing the viscosities of the mineral oils the frictional characteristics of the composition will be changed. Other things being equal, the lower the viscosity of the mineral oil content of the conditioning composition, the lower the friction which it imparts to a given thread.

The viscosity of the oils used in this composition is preferably in the 30 to 50 seconds Saybolt at 100° F. range, but the invention is not necessarily restricted to these limits. It is conceivable that a mineral oil of 25 seconds viscosity would produce a composition which would impart such a low friction to a thread that thread knot tying would be difficult for machine operators. By using a mineral oil of higher viscosity; for example 40 seconds viscosity, the friction would increase and improve the tying characteristics of the thread. The increase of friction may be shown by treating a thread with a composition comprising 80% #10 Eldrol Tech white oil of 85 seconds viscosity, 15% #15 Tech white oil of 32 seconds viscosity, and 5% sorbitan trioleate: the resulting thread friction of 40 grams compares to 20 grams in cases where the mineral oil content of the composition is in the lower viscosity range.

Further flexibility of these conditioning compositions is shown, too, in the quantity of the compositions taken up by the thread. Other things, including the roll speed of the oiling device, being equal, the lower the viscosity of the mineral oil, the lower the quantity of the composition taken up by the thread. If some particular knitting operation calls for a thread containing a higher oil content than is provided by a conditioning composition containing mineral oils in the preferred viscosity range of 30 to 50

seconds, then another mineral oil of higher viscosity, such as #10 Eldrol white oil of 85 seconds viscosity, can be used in the composition. In this manner, the oil content of the thread can be increased to a value well above 4%.

Among other things, this method of producing a thread containing a relatively small percentage of the improved conditioning composition of the present invention differs from the methods heretofore employed in that the composition consists solely of ingredients having lubricating and conditioning properties. Thus it is possible to avoid entirely the use of extraneous vehicles, such as water and acetone, which necessitate extraction by drying to prepare the thread for coning, knitting or weaving operations. Not only this, but the invention provides a stable, neutral, non-corrosive, penetrating composition which imparts a high degree of suppleness to the thread.

Examples of higher polyhydric alcohol esters suitable for use in a thread conditioning composition made according to the present invention are sorbitol mono-oleate, sorbitol di-oleate, sorbitol tri-oleate, sorbitan mono-oleate, sorbitan di-oleate, sorbitan tri-oleate, mannitol mono-oleate, mannitol di-oleate, mannitol tri-oleate, mannitan mono-oleate, mannitan di-oleate, mannitan tri-oleate, sorbitol mono-laurate, sorbitol di-laurate, sorbitol tri-laurate, sorbitan mono-laurate, sorbitan di-laurate, sorbitan tri-laurate, hydroxy ethyl ether of sorbitol mono-oleate, hydroxy ethyl ether of sorbitol mono-laurate, hydroxy ethyl ether of sorbitan mono-oleate, hydroxy ethyl ether of sorbitan mono-laurate, etc.

Being liquids soluble in or at least compatible with mineral oil, these compounds can readily be dispersed in the mineral oil constituents of the composition.

A modified higher alcohol ester such as sorbitan tri-oleate is in and of itself soluble in mineral oil. A modified alcohol ester such as sorbitan mono-oleate may be further modified by treatment with ethylene oxide to form the hydroxy ether of sorbitan mono-oleate, a substance which is not only partially soluble in mineral oil but somewhat dispersible in water. Together, sorbitan tri-oleate and the modified sorbitan mono-oleate are both soluble in mineral oil. The presence of the sorbitan tri-oleate increases the solubility of modified sorbitan mono-oleate in mineral oil, but neither constitutes an extraneous vehicle inasmuch as both serve to impart lubricating and/or conditioning properties to the thread.

Mineral oils of the kind employed in the practice of the invention are preferably refined mineral oils substantially in the 30 to 50 seconds Saybolt viscosity range. Mineral seal oil and #15 white oil are examples of such oils. Although mineral oil and various modified polyhydric alcohol esters constitute the main portion of the composition, small portions of other ingredients such as castor oil may, if desired, be added to augment the conditioning properties of the composition.

Many different thread-conditioning compositions may be made up by mixing these ingredients together in the desired proportions. Three examples in which proportions are by weight follow:

Example I

	Per cent
#15 technical white oil.....	47½
Mineral seal oil.....	47½
Sorbitan tri-oleate.....	5

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Example II

	Per cent
#15 technical white oil.....	45
Mineral seal oil.....	45
Sorbitan tri-oleate.....	7½
Castor oil.....	2½

Example III

	Per cent
Mineral seal oil.....	90
Sorbitan tri-oleate.....	5
Modified sorbitan mono-oleate.....	5

The word "modified" in Example III indicates that the sorbitan mono-oleate therein employed was treated with ethylene oxide as hereinabove described.

These compositions have relatively low viscosities: at 100° F., they have viscosities of 37 sec., 39 sec., and 47.5 sec. Saybolt, respectively. The specific gravities are as follows: Example I, .807; Example II, .813; Example III, .834, all taken at 15.5° C. To the compositions the derivatives of the higher polyhydric alcohols impart a slight amber tinge; however, even with such additions the compositions comprise clear, oleaginous solutions which are entirely stable in respect of ordinary oxidation.

While conditioning compositions are beneficial for coning, knitting and weaving operations, they must be removed from the thread prior to the dyeing operation. Some conditioning oils are claimed to be easily removable from the thread because they are self-emulsifying in aqueous solution. The ingredients added to an oil to make it self-emulsifying usually consist of sulphonated oils which on storage tend to form rancid decomposition compounds injurious to the strength of the threads. These so-called self-emulsifying conditioning oils are self-emulsifying in water, but after they have been applied to thread some change occurs which apparently destroys the self-emulsifying property.

To remove the so-called self-emulsifying oils from the thread, a scouring process is required employing such agents as tri-sodium phosphate, sodium carbonate or soap: water alone will not remove them from the thread. In such a scouring operation, the conditioning compositions of the present invention form an excellent white emulsion due to the effect of the slightly alkaline solution on the higher polyhydric alcohol ester. The compositions of the present invention can thus be just as easily removed from the thread as the so-called self-emulsifying compositions without, however, involving the hazard of injuring the thread or the possibility of developing rancid odors.

Not only may the compositions of the present invention be readily removed from the thread, but a scoured thread which originally contained 1.50% of one of these compositions has a very soft "hand" comparable to or better than that of a similar thread which originally contained 4.00% of an ordinary coning oil.

Thus the advantages of the instant invention manifest themselves throughout the successive steps of coning, knitting or weaving, and scouring. In the coning process, these compositions so improve the frictional characteristics of the thread as to permit the building up of larger and more nearly perfect cones while using only a very small percentage of oil. In the knitting process, they protect the knitting needles from undue chemical attack; moreover, they impart such a low, uniform friction to the thread that the machines

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produce better fabrics. Should the thread be stored, the conditioning composition remains stable, without injury to the thread as a result of decomposition. Finally reaching the scouring bath, the composition is readily emulsified and removed from the thread, leaving a thread having a soft, desirable "hand."

It is evident that without departing from the spirit of the invention numerous modifications of the compositions hereinabove described can be made, both in respect of the proportions of the ingredients and in respect of the ingredients themselves.

Companies producing refined mineral oils, such as mineral seal oil and #15 white oil, give names or numbers to the mineral oils to differentiate between oils of different viscosity ranges. Thus while #10, #12, #15 and many other white mineral oils falling in the preferred viscosity range between 30 to 50 seconds Saybolt at 100° F., are suitable for use in these compositions, mineral oils of various other viscosities such as 60, 85, 90, etc. are also valuable, particularly if blended with lower viscosity mineral oils to impart the desired frictional and knitting characteristics to thread. It is to be understood that to this extent mineral oils characterized by the above-mentioned variations fall within the scope of the invention.

In addition to alcohols already mentioned, other higher polyhydric alcohols containing four or more hydroxyl groups such as erythritol, pentitols, hexitols, heptitols, etc. give esters having properties valuable in these conditioning compositions. While the invention describes certain modified esters of higher polyhydric alcohols containing ethyl ether groups, it is not intended that this phase of the invention shall be restricted to the ethyl group, as propyl, butyl and other alkyl groups may be substituted therefor. The satisfactory use of both oleic and lauric acid derivatives of the higher polyhydric alcohols provides evidence that not only saturated but unsaturated acid esters can constitute desirable ingredients of the improved conditioning compositions.

It is intended that the patent shall cover, by suitable expression in the appended claims, whatever features of patentable novelty reside in the invention.

What is claimed is:

1. A thread conditioning composition which comprises low viscosity mineral oil and sorbitan trioleate, said sorbitan trioleate being present in a minor proportion, by weight, to said mineral oil.

2. A thread conditioning composition which comprises low viscosity mineral oil, sorbitan trioleate and castor oil, said sorbitan trioleate being present in a minor proportion, by weight, to said mineral oil.

3. A thread conditioning composition which comprises low viscosity mineral oil, sorbitan trioleate and a hydroxy ethyl ether of sorbitan mono-oleate, said sorbitan trioleate being present in a minor proportion, by weight, to said mineral oil.

4. A thread conditioning composition which comprises a low viscosity mineral oil and an oil-soluble higher fatty acid ester of a polyhydric alcohol selected from the group consisting of hexahydric alcohols and the anhydro derivatives of such alcohols, and said ester containing substantially no combined lower fatty acids, and said ester being present in a minor proportion, by weight, to said mineral oil.

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5. A thread conditioning composition which comprises a low viscosity mineral oil; an oil-soluble higher fatty acid ester of a polyhydric alcohol selected from the group consisting of hexahydric alcohols and the anhydro derivatives of such alcohols; and a hydroxy ethyl ether of a higher fatty acid ester of a polyhydric alcohol selected from the group consisting of hexahydric alcohols and the anhydro derivatives of such alcohols, said ester being present in a minor proportion, by weight, to said mineral oil. 10

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6. A thread conditioning composition which comprises a low viscosity mineral oil, a vegetable oil and an oil-soluble higher fatty acid ester of a polyhydric alcohol selected from the group consisting of hexahydric alcohols and the anhydro derivatives of such alcohols, said ester being present in a minor proportion, by weight, to said mineral oil.

ROBERT D. MacLAURIN.

Certificate of Correction

Patent No. 2,404,240.

July 16, 1946.

ROBERT D. MacLAURIN

It is hereby certified that errors appear in the printed specification of the above numbered patent requiring correction as follows: Column 2, line 14, for "retarded" read *retained*; column 3, line 67, for "compositions" read *composition*; line 70, for "quantity" read *quantity*; column 6, line 72, claim 4, before the word "said" strike out "and"; and that the said Letters Patent should be read with these corrections therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 8th day of October, A. D., 1946.

[SEAL]

LESLIE FRAZER,

First Assistant Commissioner of Patents.

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5. A thread conditioning composition which comprises a low viscosity mineral oil; an oil-soluble higher fatty acid ester of a polyhydric alcohol selected from the group consisting of hexahydric alcohols and the anhydro derivatives of such alcohols; and a hydroxy ethyl ether of a higher fatty acid ester of a polyhydric alcohol selected from the group consisting of hexahydric alcohols and the anhydro derivatives of such alcohols, said ester being present in a minor proportion, by weight, to said mineral oil. 10

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6. A thread conditioning composition which comprises a low viscosity mineral oil, a vegetable oil and an oil-soluble higher fatty acid ester of a polyhydric alcohol selected from the group consisting of hexahydric alcohols and the anhydro derivatives of such alcohols, said ester being present in a minor proportion, by weight, to said mineral oil.

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