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## PROCESS FOR SETTING TWIST IN RAYON KNITTING YARNS

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This invention relates to a composition and process for setting twist in rayon knitting yarns, and has particular application to high twist rayon yarns.

In order to impart increased elasticity, greater strength or a particular appearance to the finished textile product, twist is inserted into a yarn before it is knitted or woven into a fabric. This twist, particularly when the amount inserted is relatively high, results in a certain lively behaviour of the yarn and a tendency for it to kink and snarl into loops, which are adverse properties from a point of view of subsequent manipulation. Such uncontrollable behaviour of the yarn which results from high twist is particularly serious in the operation of knitting, to the point where, without some treatment to counteract these undesirable properties, the passage of the yarn through a knitting machine may be rendered completely impossible.

To overcome the difficulties associated with high twist it is possible in the case of certain fibres to treat the yarn spun from them in such a manner as to cause the energy stored up by the twist to be dissipated and thereby remove the "lively" and unmanageable characteristics. In the case of wool, and to a lesser extent silk, this fixing or "setting" of the twist, as it is referred to in the trade, is generally accomplished by exposing the twisted yarn to the action of steam, or a warm, moist atmosphere for several hours. In the case of cellulosic yarns, and particularly high twisted rayon yarns, the twist cannot be effectively fixed or set by such steam treatment.

High twisted rayon yarns are desirable for knitting into hosiery and attention has been directed towards means for the treatment of these yarns such that satisfactory knitting can be accomplished. One method which has been proposed to attain this end is the treatment of the twisted yarn with oil or waxes dissolved in a solvent. After this treatment the solvent is removed by evaporation; and the oils or waxes are removed subsequent to weaving or knitting, either by solvent extraction or more customary scouring methods. Such methods have, however, the disadvantage of high cost and require the introduction of operations not normal to the textile technological practice. Desirable requisites for a process to enable cellulosic yarns to knit satisfactorily are:

1. Adequate fixation or setting of the twist.
2. Application in quantity by customary textile practice and the use of simple equipment.
3. Ability to permit easy reduction of the knitted fabric to a clean condition, free from contaminants and thereby suitable for dyeing and finishing.

The present invention to be described has the merit of requiring only such technical operations as the textile industry is accustomed to in the soaking of silk yarns. Low cost is ensured by the use of relatively cheap chemicals applied in aqueous emulsion form. Subsequent removal of the applied chemical is effected in a complete and efficient manner by the simple operation of scouring normally employed.

We have found that certain partially esterified glycerides in conjunction with wax such as paraffin wax, can readily be applied to yarn in emulsion form and have the desired property of setting the twist. Not all partially esterified glycerides nor all grades of wax are suited to the present invention. The limitations to be placed upon suitable compounds are described more particularly in what follows. The treatment is carried out in an aqueous emulsion of the chemicals and is applied to the yarn in skein form by a simple soaking operation before the high twist is inserted. Following the twisting the yarn is subjected to heat at around 150° F. in moist air in order to achieve the maximum twist-setting effect from the described treatment. As a result of the preliminary soaking operations whereby the application of a desired percentage of the emulsified chemical is attained, the twist is then found to be satisfactorily set and the yarn is in a quiescent state suitable for further manipulation.

According to the present invention one or more of the following partially esterified glycerides are used:

Stearic monoglyceride
Stearic diglyceride
Palmitic monoglyceride
Palmitic diglyceride

These mono- and di-glycerides are solid at ordinary temperatures and may be removed by scouring with a simple solution of soap or other

detergent composition commonly employed in mill practice and does not involve the use of chemical solvents. The mono- and di-glycerides can be produced in quantity at a relatively low price; for example, hydrogenated palm oil, a packing house product, comprises a mixture of palmitic and stearic triglycerides which can readily be converted to a mixture of palmitic and stearic mono-glycerides. This latter mixture is highly satisfactory for the purpose of the present invention.

It is also necessary to the process that an emulsion of the chemical having good stability can be formed, in order that uniform treatment of the immersed skeins will result and that a saving can be effected by the re-use of the majority of the emulsion liquor on subsequent batches. Partially esterified glycerides which are liquid at ordinary temperatures, such as can be prepared from oleic acid or castor oil do not produce the results desired. The presence of such liquid glycerides mixed with stearic and palmitic mono- and diglycerides results in an emulsion of reduced stability and their presence even in small quantities is undesirable.

In order to achieve low cost in the chemical to be applied as well as for other economies which can be effected, it has been found desirable to incorporate a solid paraffin wax in mixture. It has further been found desirable that such added waxes should not have a melting point higher than 130° F. Paraffin waxes having a melting point higher than 130° F. do not form as stable emulsions as waxes of lower melting point, and as a result of their greater hardness show a tendency to strip off the yarn in its passage through the knitting machine.

Waxes having a melting point of less than 117° F. are not suitable due to their softening in extreme summer temperatures and consequent inability to set the twist firmly. Somewhat reduced stability also characterizes emulsions formed from low melting point waxes.

The mixture of partially esterified glycerine and wax may consist of up to 80% of the wax component. If the percentage of glyceride to paraffin wax is less than 10% it is insufficient to produce stability. Percentages between 10% and 20% result in emulsions which do not completely separate and may be stirred back to uniformity with ease. 20% or more produces a stable emulsion, and it is preferred that proportions of 25% or more be used. A preferred composition is a mixture consisting of one part of the mono stearic ester of glycerol together with three parts by weight of paraffin wax having a melting point of 121 to 123° F.

The following is by way of illustration, a decription of a preferred complete treatment.

Paraffin wax and the glyceride in the proportions of 3 parts to 1 by weight are mixed together in the melted state. The required quantity of 0.4% soap solution is then weighed out and heated to approximately 80° C. The hot melted wax-glyceride mixture is then added slowly to the soap solution, vigorous stirring being maintained during this operation. The concentration of the wax-glyceride mixture in the aqueous emulsion is 5% by weight. Emulsions prepared in quantity from paraffin wax and stearic mono-glyceride in soap solution by this method have remained stable over periods of months without any indication of separation or deterioration in any way.

Skeins of rayon yarn prior to twisting are immersed in the emulsion for a period of two hours, the ratio of emulsion liquor to weight of rayon to be treated being six to one. The temperature of the liquor is kept at 120° F. during the period of immersion of the skeins. The rayon is then removed, centrifuged and dried. Operations of winding and twisting the yarn then follow. The bobbins or packages of twisted yarn are subjected to a treatment of high humidity at 150° F. for one to two hours. The yarn is then in a condition suitable for knitting. The emulsion remaining in the soaking bath may be re-used by additon of such quantity of fresh emulsion as is required to produce the necessary volume for a subsequent batch of yarn.

While the above description is a preferred procedure, it is recognized that certain deviations from the precise conditions given will provide satisfactory results. Such deviations are, for example, the use of emulsions varying in concentration both lower and higher than 5%, the use of partially esterified glycerides in varying proportions to the amount of wax, or the substitution of glycerol mono-stearate by one or a combination of the other partially esterified glycerides having the essential physical properties.

What we claim as our invention is:

1. In a process of twist setting for rayon knitting yarns, the steps of applying thereto an aqueous emulsion of paraffin wax having a melting point between about 117° F. and 130° F. and at least one glyceride which is solid at ordinary temperature and is selected from the group consisting of:

Stearic mono-glyceride
Stearic di-glyceride
Palmitic mono-glyceride
Palmitic di-glyceride.

2. In a process of twist setting for rayon knitting yarns, the steps of applying thereto an aqueous emulsion of soap, paraffin wax having a melting point between about 117° F. and 130° F. and at least one glyceride which is solid at ordinary temperature and is selected from the group consisting of:

Stearic mono-glyceride
Stearic di-glyceride
Palmitic mono-glyceride
Palmitic di-glyceride.

3. In a process of twist setting for rayon knitting yarns, the steps of applying thereto an aqueous emulsion of paraffin wax having a melting point between about 117° F. and 130° F., a small quantity of soap, and 20% or more of at least one glyceride which is solid at ordinary temperature and is selected from the group consisting of:

Stearic mono-glyceride
Stearic di-glyceride
Palmitic mono-glyceride
Palmitic di-glyceride.

4. In a process of twist setting for rayon knitting yarns, the steps of immersing the yarn in an aqueous emulsion of soap, paraffin wax having a melting point between about 117° F. and 130° F. and at least one glyceride which is solid at ordinary temperature and is selected from the group consisting of:

Stearic mono-glyceride
Stearic di-glyceride
Palmitic mono-glyceride
Palmitic di-glyceride,

maintaining the temperature of the emulsion at

approximately 120° F. while the yarn is immersed therein, removing the yarn from the emulsion, and drying the yarn.

5. In a process of twist setting for rayon knitting yarns, the steps of immersing the yarn for a period of approximately two hours in an aqueous emulsion of soap, paraffin wax having a melting point between about 117° F. and 130° F. and at least one glyceride which is solid at ordinary temperature and is selected from the group consisting of:

Stearic mono-glyceride
Stearic di-glyceride
Palmitic mono-glyceride
Palmitic di-glyceride,

maintaining the temperature of the emulsion at approximately 120° F. while the yarn is immersed therein, removing the yarn from the emulsion, and drying the yarn.

6. In a process of twist setting for rayon knitting yarns, the steps of immersing the yarn in an aqueous emulsion of soap, paraffin wax and at least one glyceride selected from the group consisting of:

Stearic mono-glyceride
Stearic di-glyceride
Palmitic mono-glyceride
Palmitic di-glyceride,

maintaining the temperature of the emulsion at approximately 120° F. while the yarn is immersed therein, removing the yarn from the emulsion, drying the yarn, applying a twist to the yarn, and subjecting the yarn to an atmosphere of high humidity at a temperature of approximately 150° F.

7. In a process of twist setting for rayon knitting yarns, the steps of immersing the yarn for a period of approximately two hours in an aqueous emulsion of soap, paraffin wax and at least one glyceride selected from the group consisting of:

Stearic mono-glyceride
Stearic di-glyceride
Palmitic mono-glyceride
Palmitic di-glyceride,

maintaining the temperature of the emulsion at approximately 120° F. while the yarn is immersed therein, removing the yarn from the emulsion, drying the yarn, applying a twist to the yarn, and subjecting the yarn to an atmosphere of high humidity at a temperature of approximately 150° F. for a period of about an hour or more.

8. Rayon knitting yarn having applied thereto a twist setting composition comprising paraffin wax having a melting point between about 117° F. and 130° F. and at least one glyceride which is solid at ordinary temperature and is selected from the group consisting of:

Stearic mono-glyceride
Stearic di-glyceride
Palmitic mono-glyceride
Palmitic di-glyceride.

9. Rayon knitting yarn having applied thereto a twist setting composition comprising paraffin wax, having a melting point between about 117° F. and 130° F., soap, and at least one glyceride which is solid at ordinary temperature and is selected from the group consisting of:

Stearic mono-glyceride
Stearic di-glyceride
Palmitic mono-glyceride
Palmitic di-glyceride.

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