

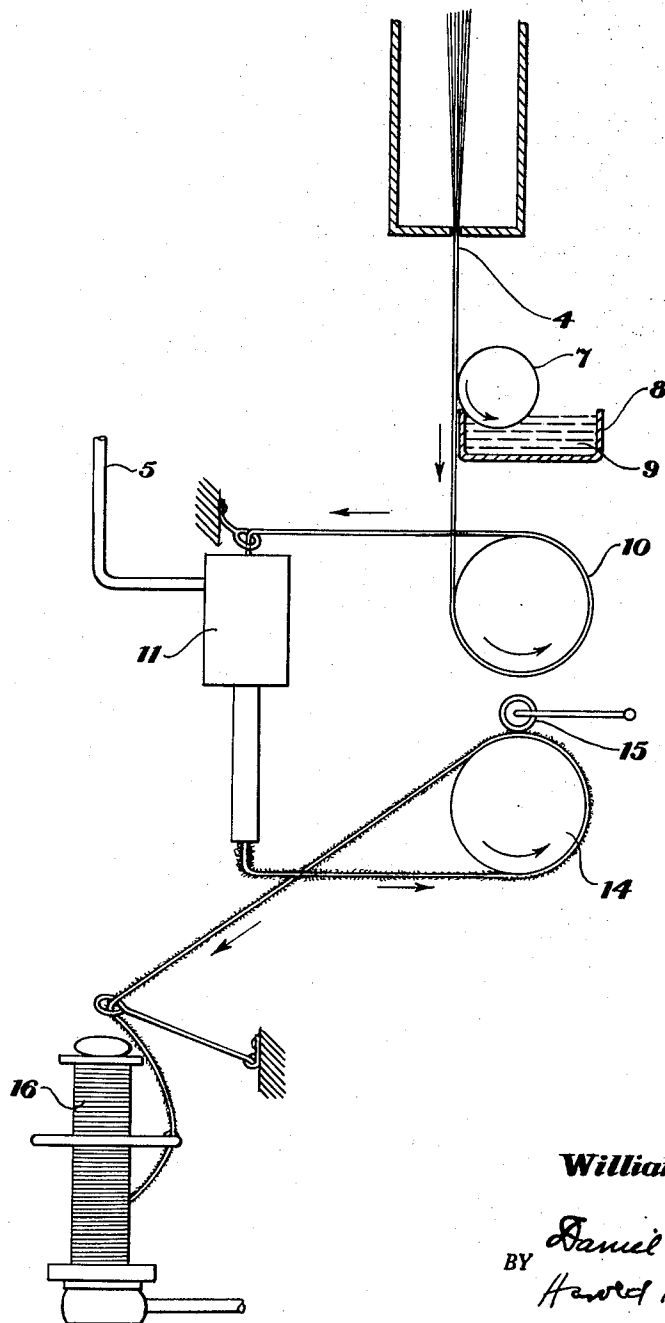
Oct. 1, 1957

W. I. HEAD

2,807,864

COMPOSITION AND PROCESS FOR TREATING YARN

Filed June 24, 1954



William I. Head
INVENTOR.

BY *Daniel S. Wayne,*
Harold N. Powell
ATTORNEYS

1

2,807,864

COMPOSITION AND PROCESS FOR TREATING YARN

William I. Head, Kingsport, Tenn., assignor to Eastman Kodak Company, Rochester, N. Y., a corporation of New Jersey

Application June 24, 1954, Serial No. 439,145

5 Claims. (Cl. 28—75)

This invention relates to a composition and process of treating yarn. More particularly the invention concerns a yarn treating composition having special characteristics and properties which render it particularly useful in the process of making loopy or bulky type synthetic yarn.

It is conventional in the textile industry to apply to yarn and fibers various treating agents, textile assistants, lubricants and the like for the purpose of facilitating the processing of the yarn. For example, in winding, twisting or the like processing of yarn, it is desirable to have medium on the yarn which facilitates the passage of the yarn over the rolls or guides. Hence a great number of compositions have been proposed for use in applying to yarns prior to and during the processing of the yarn in various manners. Many of these compositions contain a substantial content of oily materials and are sometimes specifically referred to as yarn lubricants.

There is carried out in the textile industry a process of treating continuous filament yarn for producing loops and whorls thereon for obtaining a softer, wooly-like, more bulky yarn. In further detail, yarn having 35-75 or more filaments per strand is drawn through an air jet with low or a minimum of tension. In this jet the continuous strand of yarn is subjected to contact with a blast of air or the like gaseous medium which produces loops and whorls in a number of these filaments, particularly those on the surface. There is then withdrawn from this jet the looped or bulked yarn which comprises a continuous filament product having the appearance of greater volume and softness and the like properties. The withdrawn yarn which has been thus treated in a jet is then twisted and wound up.

In the passage of continuous filament yarn through a type of treatment as aforesaid, since the yarn is subject to contact with the guides, and distortion, it has been customary to apply to the yarn the usual lubricants or textile assistants conventionally used in the art. While such yarn lubricants or textile assistants serve to minimize friction, impart softness or flexibility, prevent wear and the like and thereby to have advantages, I have found that such compositions may, in certain respects, actually be working against the production of high quality loopy yarn at high production rates.

For example, it is very desirable that the loops which are formed in the yarn by the process outlined be permanently locked in, and not be pulled out under any stresses which are placed on the looped yarn in subsequent processing. There are several references in the trade journals to the fact that heretofore it has been common for the loops in the yarn to be removed by sufficient stresses on the yarn. Normally the majority of the loops are locked in sufficiently to resist the usual stresses encountered in processing loopy yarn. However, repeated stresses applied to the loopy yarn tend to work the loops out even though none of the applications of stress are excessive. I have found, however, that by

2

the application of suitable yarn treating compositions it is possible to lock the loops into the yarn so firmly that they are not removed even by stresses of such magnitude as to break the yarn. This represents a highly desirable improvement over the prior art of making loopy yarn.

It is therefore apparent that the development of a special yarn treating composition which not only serves to protect the yarn against damage from yarn guide friction or the friction of other machinery parts, but which permits the production of a particularly good loopy yarn at high rates of production speeds, and substantially permanently locks the loops in, represents a highly desirable result. After extended investigation I have found a yarn composition and method of employment thereof in processes of the class referred to above, which greatly facilitates the production of loopy yarn.

This invention has for one object to provide a new yarn treating composition. Another object is to provide a yarn treating composition which is particularly effective in a process of converting conventional yarn to a substantially permanently looped yarn. Still another object is to provide a process of making looped yarn wherein the yarn treating composition is correlated with the process of looping the yarn. Still a further object is to provide a yarn treating composition which is particularly suitable for treating cellulose ester types of continuous filament yarn. Another and particular object is to provide a composition and process particularly adapted to the conversion of conventional continuous filament yarn of a variety of deniers to loop yarn. Other objects will appear hereinafter.

I have found that in making looped yarn rather than employ the conventional yarn lubricants having low static frictional properties and antistatic electrical properties, that the yarn treating composition should be of a scroopy, high static type as will be set forth in detail hereinafter.

For a more complete understanding of my invention reference is made to the attached drawing forming a part of the present specification. The attached drawing is a semi-diagrammatic side elevation view showing one type of arrangement which may be used in carrying out the process of the present invention and producing the new product of the present invention.

In the attached drawing 4 designates a source of multi-filament yarn which is to be processed by the present invention. This source of yarn may be from supply packages of any convenient size, not shown. This yarn to be treated is passed in contact with roll 7 which roll is positioned in the trough 8. The trough 8 contains the special treating composition of the present invention. By the rotation of the roll 7 which is bathed in the special treating composition 9, the roll 7 picks up the treating composition and applies it to the yarn undergoing processing in accordance with the present invention.

It will be noted that the trough 8 and associated parts are generally similar in arrangement to the apparatus described in U. S. Patent 2,161,354, referred to hereinafter. As referred to hereinafter, the exact manner of applying the treating agent of the present invention is not a limitation on the present invention inasmuch as in place of roll 7 wicks or other suitable applicator means may be used.

The multi-filament yarn, after having applied thereto the special treating composition of the present invention, then passes around advancing roll 10 which is a conventional type feed roll. From the feed roll the yarn is fed to jet 11 supplied by compressed air through conduit 5. The exact construction of this jet forms no part of the present invention. For example, a jet construction such as shown in expired Taylor Patent 2,067,-

251 may be employed. It is sufficient that the yarn be subjected to turbulence which causes the formation of loops and curls on the yarn thereby bulking it.

The blown yarn emerging from jet 11 passes around a second roll 14 also of conventional construction. This second roll may be provided with a weighted idle roll 15 to prevent yarn slippage on roll 14.

From the second roll the processed yarn carrying the special treating composition of the present invention is led to a conventional bobbin type wind-up at 16. In this conventional bobbin wind-up any desired amount of twist may be inserted in the yarn as it is wound on the bobbin.

In further detail, in converting conventional continuous filament yarn which may have 35 or more filaments therein, to loop yarn, one purpose of the treatment is to secure a large number of loops or whorls in the filaments so that the apparent volume or size of the filament bundle, yarn or strand is increased, thereby obtaining increased bulk. Such increase in bulk, of course, causes somewhat of a contraction in the yarn. That is, the input and output yarn feed rolls are set up and operated at speeds, for example, to provide for a theoretical 20% contraction of the yarn due to the formation of the loops and the increase in, so to speak, external volume of the yarn. The actual increase in volume of the processed yarns is measured and the theoretical percentage bulking efficiency may be expressed as the ratio of actual bulk to theoretical bulk times 100.

Another measure of bulkiness is a specific volume measurement based on the cubic inch volume of one pound of bulk yarn and is compared with the specific volume of unbulk yarn. This formation is obtained by winding under controlled tension enough yarn onto a precision made spool to fill the spool. Then knowing the volume of the spool and the net weight of the yarn on the spool, it is possible to calculate the specific volume of the yarn. Bulk yarn made with a 20% contraction due to the feed roll speed differential has a specific volume of 78.5 cu. in. per lb. as compared to 32.5 for unbulk yarn. Bulk yarn with a 10% contraction has a specific volume of 62.5, and 30% contraction bulk yarn has a specific volume of 86.2 cu. in./lb. A Y-shaped cross-section filament 20% contraction bulk yarn has a specific volume of 96.5 cu. in./lb.

The foregoing has been referred to as it provides a comparative measuring basis which may be used for describing the improvement obtainable by the present invention.

Expressed in another manner, I have found that continuous multi-filament yarn treated with prior art compositions might be processed to obtain a certain volume or bulk increase. On the other hand, the same type of yarn when having the yarn treating composition of the

as a suitable textile assistant on the yarn, but permits the yarn to be looped or bulked to a much greater amount than heretofore obtainable and so locks in the loops as to resist pulling out even at the stress required to rupture the yarn.

A specific illustration of a composition in accordance with my invention is as follows:

	Percent
Low viscosity mineral oil-----	60
Petroleum sulfonates-----	20
Terpene glycol ethers-----	10
Oleic acid-----	2.5
2-amino-2-methyl-1-propanol -----	0.5
Water -----	7.0

The mineral oil component which may be used may comprise the conventional type of white mineral oil or a solvent refined type. The viscosity of the oil may be from say about 50 seconds Saybolt up to 115 seconds viscosity.

The petroleum sulfonate component refers to products obtained by reaction of strong sulfuric acid on the unsaturated bodies of crude petroleum during the course of manufacture of white oils. These acidic sulfonates are neutralized by reaction with caustic to form the petroleum sulfonates of commerce, also well known as mahogany sulfonates.

The terpene ether component we prefer is in accordance with the type of product described in Humphreys U. S. Patent 2,136,011, patented November 8, 1938.

The oleic acid does not require further description except to indicate that good quality material would be used. The amino methyl propanol employed is such as described in U. S. Patent No. 2,139,122 (Hass et al.), patented December 6, 1938.

The percentages given are for the purposes of illustrating my preferred embodiment. However, the proportions may be varied as follows: The mineral oil component may fall in the range of from 40% to 85% of the total. The petroleum sulfonates may vary from 5% to 40%. The terpene glycol ethers may vary from 4% to 20%, the fatty acid from 1.5% to 10% and the amine from 0.2% to 5%, the specific amounts being those necessary for complete blending and proper emulsifiability of the total formulation. Also, certain of the components may be partly or entirely replaced, as for example the mineral oil may be in part or entirely replaced by monohydric alcohol esters of fatty acids such as methyl oleate, butyl palmitate, propyl stearate. The terpene glycol ethers may be replaced in part or entirely by polyhydric alcohols such as diethylene glycol or by fatty alcohols such as lauryl or oleyl alcohol.

The improvement exhibited by my preferred composition is readily illustrated by the following table:

	Agent No. 1			Composition of present invention		
	Low static	Friction	Lubricant	High static	Friction	Lubricant
Percent material on yarn.....	0.50	1.1	2.59	0.4	1.3	1.9
Percent bulk efficiency-----	67.5	67.5	67.5	84	93.5	110

present invention applied thereto, and processed in a comparable manner for securing volume increase, indicated that by proceeding in accordance with my invention it was possible to secure, for example 25-50% or even more improvement in loopiness or bulking.

I have found that a yarn treating composition containing mineral oil, certain petroleum sulfonate derivatives, certain terpene derivatives, long chain aliphatic acids, and certain alkylol amines, not only functions

In the above table, Agent #1 was essentially comprised of low viscosity mineral oil of good quality which is frequently used in the textile trades for applying to yarn. It will be observed that when multi-filament continuous yarn was subjected to processing for increasing the bulk thereof that even when using Agent #1 in an amount greater than 2.5%, only a little over 50% efficiency was obtained in the volume or bulk increase. Furthermore, under stress as many as 50% of the loops

5

pulled out. In contrast thereto, it will be observed that when using the composition of the present invention even with 0.4%, bulking to the extent of 84% was obtained. Still further runs were made using 2% of the composition of the present invention with the continued upward improvement in bulking to values in excess of the indicated 110%. Moreover, the loops did not pull out even at the breaking stress of the yarn. When using the higher amounts of the composition of the present invention it is preferred to employ two-step feed rolls in combination with the twistors which take up the bulk yarn.

The yarn treating composition of the present invention can be applied in any suitable manner to the yarn, preferably prior to the passage to the first feed roll. That is, the application can be from the neat oil or from aqueous emulsion by rollers, wick or any other suitable manner for applying a small amount, usually within the range of 1-2.5% to the yarn prior to its processing, twisting and forming into packages. A suitable apparatus is described in Imray U. S. Patent 2,161,354 of June 6, 1939.

After the application of a suitable amount of composition in accordance with the present invention, the yarn thus treated was processed for increasing its volume in accordance with general procedure already referred to above. That is, the yarn was fed from a feed roll through an air jet, the yarn being under a minimum of tension. In the jet the yarn was subjected to a blast of air which caused the formation of numerous loops and whorls thereon to produce yarn having increased volume as already discussed above. Thereafter the yarn was given a slight twist and wound up with only a small amount of tension. The yarn treated and its manner of treatment, both with Agent #1 and when using the composition of the present invention, were approximately the same in both instances in order to furnish a basis of comparison.

In addition to using Agent #1 of the prior art, other yarn treating compositions in conventional use were employed. That is, compositions employing various amino salts, contents of neat's-foot oil and the like were tested. However, none of the compositions gave results comparable to the new composition of the present invention.

While it is not desired to be bound by any theory of operation concerning the present invention, the following commentary may be of assistance in better understanding the present invention. It is difficult to explain the present invention in that there is no standard or universal quantitative measurement of static and the ratio of static to kinetic friction. Only a qualitative comparison can be made of the effect of various yarn treating compositions on yarn and processing. Thus, in general, it is only possible to say, for example, that one yarn treating composition has more static than another one, or that this composition has more scroop than some other composition. However, a low bulking efficiency obtained by conventional yarn treating compositions apparently may be caused by the loops being pulled out of the yarn during the windup operation. Therefore, the frictional or static characteristics of such compositions are not sufficient to keep the filaments from slipping. On the other hand, a yarn treating composition in accordance with the present invention may be regarded as having certain scroopy, relatively high static properties as compared with conventional compositions as to permit loop retention after the process has put in the loops. My novel composition imparts sufficient lubricity to the treated yarn so that it passes through yarn guides with facility and without frictional damage to the yarn; yet on the other hand, within the yarn body the lubricity is insufficient so that the imparted loopiness and increase in volume are not materially reduced upon winding up of the yarn.

It is apparent from the foregoing that the new composition and process utilizing my composition, permit various synthetic yarns and particularly cellulose organic

6

ester yarn to be processed to impart a high amount of substantially permanent loopiness or increase in volume to the yarn. While my process is particularly adapted to the treatment of cellulose ester yarn such as cellulose acetate, cellulose acetate propionate, cellulose acetate butyrate, certain of the principles herein may likewise be applied to other synthetic yarn such as acrylonitrile yarns, polyvinyl yarns, polyester yarns and the like.

The denier and number of filaments of the yarn treated may vary between wide ranges. For example, 300 denier, 75 filament yarn with 5 turns, represents a yarn which may be readily processed in accordance with the present invention. However, 4000 denier yarns with 1.7 turns may likewise be processed. Or other types of yarns such as 2 plies of 150 denier, 38 filament yarn with 5 turns or 1 ply of 100 denier, 35 filament yarn with 5 turns may be treated in accordance with the present invention. The loop size put into the yarn for increasing the volume or bulk may vary from $\frac{1}{32}$ " to $\frac{1}{4}$ ". Other changes may be made such as to use sufficient air pressure to break an appreciable percentage of the looped filaments and form a yarn having both a spun staple yarn and loopy yarn effect.

I claim:

1. A process of increasing the volume of a multi-filament continuous synthetic yarn which comprises applying a yarn treating composition containing a major amount of mineral oil, an amount of petroleum sulfonate from $\frac{1}{2}$ to $\frac{1}{3}$ of the amount of mineral oil, an amount of terpene ether $\frac{1}{2}$ the amount of the sulfonate, and small contents of oleic acid and alkylol amine, feeding the treated yarn under low tension through a treatment which produces numerous loops in the filaments on the surface of the yarn, withdrawing the looped yarn from the treatment, twisting the treated yarn slightly and winding it up, said composition serving to substantially eliminate the pulling out of said loops under any stress up to the breaking point of the yarn.

2. A process for treating a multi-filament cellulose acetate yarn which comprises applying to the yarn from a small amount up to about 2% of a yarn treating composition containing substantial amounts of both mineral oil and petroleum sulfonate, said treating composition having scroopy and high static properties, subjecting the multi-filament cellulose acetate yarn to a blowing treatment which increases its bulk with greater than 80% efficiency as herein defined, twisting and winding up this cellulose acetate yarn which has been treated with the composition and blown, whereby said treating composition assists in permitting the retention of more than 90% of the loops formed in the yarn.

3. The process which comprises applying to a multi-filament cellulose ester yarn, a small amount of a yarn treating composition principally comprised of mineral oil and petroleum sulfonate but also containing small amounts of terpene ethers, oleic acid, amino propanol and water, subjecting the cellulose ester yarn which has been treated with the treating composition just described, to a processing which increases the bulk of the yarn with greater than 80% efficiency by putting a multitude of loops and coils into the yarn, then winding up the treated yarn into a package whereby said treating composition aforementioned aids in the retention in the yarn of the aforesaid bulkiness.

4. A process of producing a bulky, loopy yarn which is characterized by the resistance of the yarn to the removal of the loops, which comprises treating a multi-filament continuous yarn with a yarn treating composition which contains mineral oil from 40-85%, petroleum sulfonate from 5-40% and small amounts of one or more of other ingredients from the group consisting of glycol ethers, fatty acids and amino alcohols, subjecting the yarn which has been treated with the treating composition just described, to a processing which increases the bulk of the yarn with greater than 80% efficiency by

putting a multitude of loops and coils into the yarn, then winding up the treated yarn into a package whereby said treating composition aforementioned aids in the retention in the yarn of the aforesaid bulkiness.

5 5. As a new article of manufacture, a synthetic yarn having a plurality of loops and whorls thereon and characterized in that the bulkiness of the yarn is increased at least 20% as compared with a yarn without said loops and whorls, said yarn also carrying a coating of a yarn
10 treating composition characterized by high scroop and static properties it imparts to the yarn, said composition containing substantial amounts of mineral oil and pe-

troleum sulfonate and smaller amounts of a terpene ether, a long chain aliphatic acid and an alkylol amine.

References Cited in the file of this patent

UNITED STATES PATENTS

1,986,945	Schwartz et al.	Jan. 8, 1935
2,079,803	Holtzelaw et al.	May 11, 1937
2,294,958	Caldwell	Sept. 8, 1942
2,379,824	Mummary	July 3, 1945
2,575,399	Seymour et al.	Nov. 20, 1951
2,638,146	Rounseville et al.	May 12, 1953