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SPIN FINISH FOR POLYAMIDE YARN PROCESSED AT HIGH TEMPERATURE

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U.S. Cl. 252—8.7 4 Claims

ABSTRACT OF THE DISCLOSURE

A spin finish composition for nylon feeder yarn to be processed at high temperature into carpet yarn, such as by steam jet texturing, comprising coconut oil, sulfonated natural petroleum product and other essential components results in improved processing and better quality yarn.

BACKGROUND OF THE INVENTION

This invention relates to a yarn finish. More specifically, this invention relates to a spin finish for polyamide feeder yarn to be processed at high temperature into carpet yarn such as by steam jet texturing.

Various finishes for synthetic filaments are disclosed in the prior art for high temperature processing. However, none of the prior art teach a specific combination of ingredients to achieve the specific beneficial results of the composition of this invention. The critical amounts and ingredients are shown in the discussion below. Many of the prior art finishes flash off in high temperature processing such as steam jet texturing for yarn. Others fail to have emulsion stability or have insufficient yarn lubrication.

SUMMARY OF THE INVENTION

For treating polyamide feeder yarn to be processed at high temperature, such as in steam jet texturizing processes, the spin finish composition shown below improves processing and gives better quality yarn. This finish composition has a unique combination of coconut oil and sulfonated petroleum product which provides an unusually even distribution of finish on the fiber in the yarn. In this way, more consistent frictional and physical properties of the yarn results. The unique spin finish of this invention is for high temperature carpet yarn processing, and is specifically designed for steam jet texturing processes. A level of 0.5 to 1.2 percent weight of oil on textured yarn can be achieved even though the finish is applied prior to steam jet texturizing, i.e. when the yarn is spun. The composition has excellent stability to high temperature process conditions, provides lubrication, static protection and plasticity to the yarn for subsequent drawing and steam jet texturing or other high temperature processing. The yarn has more consistent physical and frictional properties from package to package and within the same package. Following is a list of the benefits of the composition of this invention.

(1) It is nonfuming, that is, it does not flash off in high temperature processing such as steam jet texturing.
(2) It has excellent emulsion stability.
(3) This spin finish lubricates the yarn even after passing through high temperature processing such as steam jet.
(4) The finish improves texturing performance.
(5) An even distribution of the finish is achieved.
(6) The finish prevents static buildup.
(7) Plasticity is imparted to the yarn.
(8) Tuftability of the carpet yarn is improved.

This invention is a finish of an oil in water emulsion of about 10 to 20 percent by weight of the oil portion. The oil portion is made up of from about 55 to 65 percent by weight of coconut oil, about 3 to 8 percent of polyoxyethylene castor oil, about 5 to 10 percent by weight of decaglycerol tetraoleate, about 2 to 5 percent of glycerol monooleate, about 2 to 7 percent by weight of polyoxyethylene sorbitan monooleate, about 9 to 11 percent by weight of polyoxyethylene tallow glyceride, and about 8 to 12 percent by weight of sulfonated petroleum product. Preferably, the coconut oil is refined coconut glyceride, the ethoxylated castor oil contains about 25 moles of ethylene oxide per mole of castor oil, the ethoxylated sorbitan monooleate contains about 20 moles of ethylene oxide per mole of sorbitan monooleate, the ethoxylated tallow glyceride contains about 15 moles of ethylene oxide per mole of tallow glyceride and the sulfonated petroleum product is sodium petroleum sulfonate present as about 60 to 62 percent by weight atcive ingredient in mineral oil. More preferably, the sodium petroleum sulfonate is based on an alkyl-aryl petroleum sulfonate having a typical formula $(C_nH_{2n-10})SO_3Na$ where n is between about 20 and about 30. Even more preferably, the average molecular weight of the above chemical formula is about 430 and 30 percent of the petroleum product remains unsulfonated mineral oil.

Since, as shown in the data in the preferred embodiments, very little of this finish flashes off in high temperature processing, about 0.5 to 1.2% by weight of yarn, of oil is applied as spin finish, and about 0.5 to 1.2%, by weight, of the oil remains on the yarn after high temperature processing.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Table I shows the finish composition of the preferred embodiment of this invention. Table II shows the criticality of the ingredients and the amounts of ingredients necessary in order to provide a stable emulsion. Note that only the finish identified as A provides excellent emulsion stability after 48 hours. Varying the amounts or leaving out various components results in only fair or poor emulsion stability.

Table III shows criticality of the amounts and the presence of various components in the processing of yarn. Note that only the composition labeled A has excellent texturing performance, tuftability, loses only 0.01 percent of the finish after steam jet texturing, and has by far the lowest yarn to metal friction reading.

TABLE I

Finish composition

	Percent
Coconut oil	59.0
Polyoxyethylene(25)[a] castor oil	5.5
Decaglycerol tetraoleate	7.5
Glycerol monooleate	3.0
Polyoxyethylene (20)[a] sorbitan monooleate	5.0
Polyoxyethylene (15)[a] tallow glyceride	10.0
Sulfonated petroleum product	10.0

Formula of sulfonated petroleum product

Alkyl-aryl petroleum sulfonate typical formula

$$(C_nH_{2n-10})SO_3Na,$$

$n>20$, <30 with 30% mineral oil content average molecular weight 430; sulfonate (SO_3Na) 62% by weight.

TABLE II.—FINISH COMPOSITIONS

Finish identities	Finish components A	B	C	D	E	F	G	H	I	J	
Refined coconut glyceride	59.0	59.0	59.0	60.0	59.0	60.0	60.0	60.0	58.0	59.0	Lubricant.
Ethoxylated castor oil (25EO)[a]	5.5	3.0	6.0	------	5.5	8.0	13.0	16.0	5.0	------	Emulsifier.
Decaglycerol tetraoleate	7.5	9.0	7.0	6.0	7.5	8.0	6.0	9.0	4.0	4.0	Do.
Glycerol monooleate	3.0	3.0	------	4.0	3.0	7.0	5.0	5.0	10.0	5.0	Do.
Ethoxylated sorbitan monooleate (20EO)[a]	5.0	7.0	7.0	6.0	5.0	7.0	6.0	10.0	4.0	------	Do.
Ethoxylated tallow glyceride (15EO)[a]	10.0	7.0	9.0	13.0	10.0	10.0	------		5.0	12.0	Do.
Sodium petroleum sulfonate 60-62% active in mineral oil	10.0	12.0	12.0	11.0	------		10.0	------			Antistat emulsifier.
Sulfated glycerol trioleate					10.0	------			14.0	14.0	Do.
Ethoxylated tallow amine (20EO)										6.0	Do.
Emulsion stability* after 48 hours	E	P	P	F	F	F	F	P	F	P	

[a] See footnote at end of Table I.
*E=Excelent—Translucent bluish-white, particle size less than 1 micron. No separation. F=Fair—Milky white, particle size up to 4 microns. Slight ring of oil separation on surface. P=Poor—Chalky white, particle size above 4 microns. Creaming on surface.

TABLE III.—FINISH AND FIBER PROCESS DATA

	Finish components A	K	L	M	N	O	
Finish identities:							
Mineral oil (viscosity 50 SUS)	------	50.0	50.0	------			Lubricant.
Butyl stearate	------	------	------	50.0	50.0	------	Do.
Hexadecyl stearate	------	------	------	------	------	50.0	Do.
Refined coconut glyceride	59.0	------	------	------	------	------	Do.
Sorbitan monooleate	------	------	25.0	25.0	------	5.0	Do.
Oleic sodium soap	------	15.0	------	------	17.0	8.0	Antistat-emulsifier.
Ethoxylated lauric acid (15EO) [a]	------	10.0	------	------	8.0	15.0	Emulsifier.
Ethoxylated oleyl ether (10EO) [a]	------	5.0	------	------	7.0	7.0	Do.
Ethoxylated castor oil (25EO) [a]	5.5	------	------	------	------	------	Do.
Decaglycerol tetraoleate	7.5	------	------	------	------	------	Do.
Glycerol monooleate	3.0	------	------	------	------	------	Do.
Ethoxylated sorbitan monooleate (20EO) [a]	5.0	------	------	------	------	------	Do.
Ethoxylated tallow glyceride (15EO) [a]	10.0	------	------	------	------	------	Do.
Sodium petroleum sulfonate 60-62% active on mineral oil	10.0	------	------	------	------	------	Antistat-emulsifier.
Sulfated glycerol trioleate	------	20.0	------	------	18.0	15.0	Do.
Ethoxylated tallow amine (20EO)	------	------	25.0	25.0	------	------	Do.
Fiber process data:							
Percent finish on drawn yarn by weight	.76	1.03	.93	.95	1.08	.85	
Percent finish on yarn after steam jet texturing [2]	.75	.52	.51	.50	.58	.68	
Texturing performance [1]	E	P	P	P	P	F	
Yarn to metal friction of text. yarn in grams	64	98	136	120	105	58	
Tufting [3]	G	P	P	P	P	F	

[1] Steam jet texturing at 3,000 f.p.m.—E=Excellent; F=Fair; P=Poor.
[2] Major part of butyl-stearate or mineral oil lost by volatization.
[3] Tufting=Tufting performance per 50 yards length of 180 ends carpet on the 30" slot type tufting machine (5/32" gauge)—G=Good—Less than 25 pull backs and less than 15 snags; F=Fair—Less than 5 pull backs and less than 30 snags. P=Poor—More than 50 pull backs and more than 30 snags.
[a] See footnote at end of Table I.

What is claimed is:

1. A spin finish for polyamide yarn to be processed at high temperature, said finish being an oil in water emulsion of about 10 to 20 percent by weight of said oil portion, said oil portion consisting essentially of about 55 to 65 percent by weight of coconut oil, about 3 to 8 percent by weight of polyoxyethylene castor oil, about 5 to 10 percent by weight of decaglycerol tetraoleate, about 2 to 5 percent by weight of glycol monooleate, about 2 to 7 perecnt by weight of polyoxyethylene sorbitan monooleate, about 9 to 11 percent by weight of polyoxyethylene tallow glyceride, and about 8 to 12 percent by weight of sodium alkyl aryl petroleum sulfonate having a formula $(C_nH_{2n-10})SO_3Na$ where n is between about 20 and about 30.

2. A spin finish for polyamide yarn to be processed at high temperature, said finish being an oil in water emulsion of about 10 to 20 percent by weight of said oil portion, said oil portion consisting essentially of about 55 to 65 percent by weight of refined coconut glyceride, about 3 to 8 percent by weight of polyoxyethylene castor oil containing about 25 moles of ethylene oxide per mole of castor oil, about 5 to 10 percent by weight of decaglycerol tetraoleate, about 2 to 5 percent by weight of glycerol monooleate, about 2 to 7 percent by weight of polyoxyethylene sorbitan monooleate containing about 20 moles of ethylene oxide per mole of sorbitan monooleate, about 9 to 11 percent by weight of polyoxyethylene tallow glyceride containing about 15 moles of ethylene oxide per mole of tallow glyceride, and about 8 to 12 percent by weight of sodium petroleum sulfonate present as about 60 to 62% by weight active ingredient in mineral oil.

3. The spin finish of claim 2 wherein the sodium petroleum sulfonate is based on an alkyl-aryl petroleum sulfonate having a formula $(C_nH_{2n-10})SO_3Na$ where n is between about 20 and about 30.

4. The spin finish of claim 3 is wherein the average molecular weight of the $(C_nH_{2n-10})SO_3Na$ is about 430, and 30% of the petroleum product remains unsulfonated mineral oil.

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HERBERT B. GUYNN, Primary Examiner

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28—72.12, 75 WT; 117—138.8 N, 139.5 C.Q.; 252—8.9

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,781,202 Dated December 25, 1973

Inventor(s) Robert Moore Marshall et al.

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 2, line 19, "atcive" should be --active--

Column 2, in Table I, add footnote (a) after "weight", --[a] = moles of ethylene oxide per mole of base material--

Table III, Footnote 3 under item "F", after "Less than", the numeral "5" should be --50--

Column 4, claim 4, line 1, "is" should be deleted after "claim 3"

Signed and sealed this 18th day of June 1974.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents

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