(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 010 764**
A2

(12) EUROPEAN PATENT APPLICATION

(21) Application number: **79104267.4**

(22) Date of filing: **02.11.79**

(51) Int. Cl.³: **D 06 M 13/16**, C 10 M 1/08, D 06 M 13/18, D 06 M 13/26, D 06 M 13/34

(30) Priority: **06.11.78 US 957786**

(43) Date of publication of application: **14.05.80 Bulletin 80/10**

(84) Designated Contracting States: **AT BE DE FR GB IT NL**

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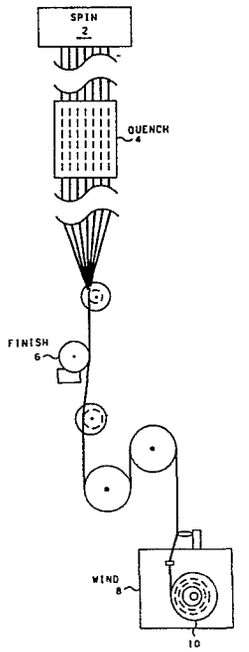
(54) Polypropylene yarn product of improved stability and method for preparing a textile material.

(57) A finishing composition for improving the thermal stability of polypropylene textile materials; comprising, an ethoxylated textile lubricant, in an amount sufficient to impart lubricating properties to said composition, and an antistatic agent comprising phosphate esters, in an amount sufficient to impart antistatic properties to said composition and increase the thermal stability of said polypropylene textile materials. Also disclosed is a process for utilizing the finishing composition and the products thereof.



EP 0 010 764 A2

Polypropylene Yarn Product of Improved Stability and Method for Preparing a Textile Material

The present invention relates to an improved finishing composition for filaments, yarns and other textile materials. The present invention further relates to an improved process for utilizing the novel finishing composition and the textile products thereof.

In the formation of textile materials from melt spun polypropylene it is normally necessary to apply a finishing composition to the filaments, yarns and other textile embodiments thereof to make such materials more amenable to the various operations to which they are subjected during processing, for example, spinning, winding, yarn-forming, weaving, knitting, etc., and to improve the properties of the finished products. In the processing of the textile materials, the finishing composition is intended to reduce friction between the yarn and various pieces of equipment with which it comes into contact, such as guides, rollers and the like, and in both the processing and use of the textile materials to reduce friction between the fibers themselves, to prevent fiber and yarn breakage and to minimize

excessive attraction or repulsion of the filaments caused by electrostatic charges. Accordingly, such finishing compositions usually contain a lubricant and an antistatic agent. Various other additives such as bactericides, corrosion inhibitors, etc. may also be added to the finishing composition.

However, it has been found that not all thermoplastic materials respond to finishing compositions in the same manner, not all combinations of finishing agents are compatible with one another and not all finishing agents are compatible with stabilizers and the like added to the thermoplastic melt. Specifically, it has been found, in accordance with the present invention, that polypropylenes do not respond to certain lubricants in the same manner as other thermoplastic fiber-forming materials, particularly when the polypropylenes contain less than the normal amounts of stabilizing agents, such as antioxidants, or when they contain specific types of stabilizing agents. By less than normal amounts of stabilizers is meant polypropylene containing from about 0.1 to about 0.6 weight percent total stabilizers. It has also been found that certain textile lubricants have an antagonistic effect on certain stabilizers included in polypropylene melts.

It is therefore an object of the present invention to provide an improved textile finish composition, a process utilizing the same and the products thereof. A further object of the present invention is to provide an improved textile finish composition including a textile lubricant and an antistatic agent, a process utilizing the same and the products thereof. Yet another object of the present invention is to provide an improved textile finish composition which is useful in the treatment of polypropylene textiles, a process for the utilization thereof and the products thereof. Another and further object of the present invention is to provide an improved textile finishing material for trea-

ting polypropylene textiles containing certain types of antioxidants, a process utilizing the same and the products thereof. Yet another object of the present invention is to provide an improved finish composition adapted to improve the thermal stability of polypropylene textiles, a process for utilizing the same and the products thereof. A still further object of the present invention is to provide an improved textile finish composition adapted to improve the thermal, light and/or color stability of polypropylene textile materials, a process for utilizing the same and the products thereof.

These and other objects of the present invention will be apparent from the following description.

In accordance with the present invention a textile finish composition is provided for improving the stability of polypropylene textile materials comprising, an ethoxylated textile lubricant, in amounts sufficient to impart lubricating properties to the composition, and an antistatic agent comprising phosphate esters, in an amount sufficient to impart antistatic properties to the composition and increase the stability of the polypropylene textile materials. In a more specific aspect, the improved finish composition is particularly effective in the treatment of polypropylene textile materials containing less than the normal amounts of stabilizers and still more specifically stabilizers including hindered phenols. The method of preparing an as-spun polypropylene textile material includes melt spinning a polypropylene, particularly a polypropylene melt containing a hindered phenol antioxidant, applying the specified finish composition to the filamentary materials, forming a yarn from said filamentary materials and packaging the yarn. The yarn may also be draw-twisted before or after the packaging of the yarn. Such draw-twisted yarns may be woven into products particularly suitable for use as dye bags, laundry bags, and the like.

Figure 1 of the drawings illustrates the process for preparing an as-spun yarn in accordance with the present invention and Figure 2 illustrates one embodiment of a process for draw-twisting the yarns produced by the process of Figure 1.

Ethoxylated lubricants have heretofore been found to be highly superior to conventional textile lubricants, particularly when utilized in finish compositions for treating melt spun thermoplastic materials and particularly polypropylenes. Accordingly, it is highly desirable to utilize these synthetic lubricants in the finish composition. However, it has been found in accordance with the present invention that melt spun polypropylene textile materials are in some way deleteriously affected by the use of ethoxylated textile lubricants. Specifically, it has been found that the ethoxylated textile lubricants have a tendendy to reduce the thermal, light and/or color stability of the textile materials both during the processing thereof and in the end products produced. This has been found to be particularly true when the polypropylenes melts have been stabilized by the inclusion therein of a stabilizer system including a tris-(4-hydroxybenzyl)isocyanurate, a substituted pentaerythritol diphosphite, a trihydrocarbyl thiophosphite and optionally thiomethylene phenol. It has further been found that, when hindered phenols are included in stabilizer systems for the polypropylene melt, some antagonistic reaction occurs between an ethoxylated lubricant and the hindered phenol which results in decreasing the thermal, light and/or stability of the textile products.

It has been found, in accordance with the present invention, that, by including significant amounts of at least one phosphate ester in a textile finish composition containing an ethoxylated lubricant, the stability of polypropylene textile materials can be substantially improved. It has also been found that, in many cases, the color stability

of such polypropylene textile materials can also be improved by the specified combination of synthetic lubricant and antistatic agent. The finish composition optionally, but desirably, contains minor amounts of a bactericide and may also contain minor amounts of other additives such as corrosion inhibitors and the like.

In accordance with one embodiment of the present invention, a polypropylene melt, particularly including minor amounts of a stabilizing system and still more particularly a stabilizing system including at least one hindered phenol, is melt spun, the subject combination of synthetic lubricant and antistatic agent is applied thereto, the filamentary materials are formed into a yarn and the yarn is then wound up to form a package. While the novel finish composition may be applied to the textile materials at any time during the processing thereof, it is preferably applied to the filaments as soon as they have set, so that the full benefit of the stabilizing properties thereof can be realized during the later processing thereof. Thus, in accordance with this embodiment, there is produced as-spun polypropylene yarns of highly improved thermal stability and in many cases of improved light and/or color stability.

In a preferred embodiment of the present invention, the yarns thus produced are draw-twisted and again packaged. The draw-twisting can also be applied in a continuous process prior to the initial winding or packaging of the yarn. The draw-twisted yarns have been found to be highly effective for the production of dye bags, laundry bags and the like when woven and formed into appropriate articles.

The thermoplastic textile materials to which the present invention is particularly directed are homopolymers of propylene and copolymers of propylene and another aliphatic 1-olefin containing 2 to 8 carbon atoms, in which the comonomer constitutes up to about 20 mol percent of the copolymer.

The synthetic lubricants utilized in accordance with the present invention include any of the known ethoxylated lubricants such as polyethylene glycols, mixed polyethylene-polypropylene glycols, monoalkyl esters of mixed polyethylene-polypropylene glycols, ethoxylated esters of fatty acids, rosin acids and tall oil acids, ethoxylated castor oils, ethoxylated hydrogenated castor oils, etc. More specifically, the ethoxylated lubricants includes, ethoxylated aliphatic alcohols, ethoxylated alkylphenols, ethoxylated sorbitan (anhydrosorbitol) esters, ethoxylated sorbitol esters, ethoxylated glycerol esters, ethoxylated pentaerythritol esters, ethoxylated fatty acids, ethoxylated fatty acid amides, ethoxylated-propoxylated fatty acids, ethoxylated-propoxylated fatty acid esters, ethoxylated-propoxylated castor oils, ethoxylated- propoxylated hydrogenated castor oils, ethoxylated-propoxylated aliphatic alcohols, ethoxylated-propoxylated alkyl phenols, etc.

Presently preferred ethoxylated lubricants include the random copolymers of the monobutyl ether of poly(oxyethylene-oxy-1,2-propylene) having viscosities in terms of Saybolt Universal Seconds (SUS) at 100° F (38° C) ranging from about 170 to about 5100 and even more preferably from about 250 to about 3500, the methyl ether of poly(oxyethylene-oxy-1,2-propylene) laurate wherein the number of moles of combined ethylene oxide, is about 7 and the number of moles of combined propylene oxide is about 2, and the isododecyl ether/poly(oxyethylene) adduct wherein the number of moles of combined ethylene oxide is about 6 per mole hydrophobe.

A more complete description of the ethoxylated lubricants is given in Kirk-Othmer, Encyclopedia of Chemical Technoloby, 2nd Edition 19, 531-554 (1969). A more complete description of the polyethylene glycols, etc. is given in volume 10, pages 654-659 of the reference encyclopedia.

When the polypropylene melt composition includes a stabilizing system having a hindered phenol the hindered phenols are utilized as thermal stabilizers or antioxidants. Such materials are known in the art. Typical of such stabilizers are 2,6-di-t-butyl-4-methylphenol (BHT); octadecyl[3-(3,5-di-t-butyl-4-hydroxyphenyl)] propionate (Irganox 1076, Ciba-Geigy Chemical Co.); tetrakis[methylene(3,5-di-t-butyl-4-hydroxyhydrocinnimate)] methane (Irganox 1010, Ciba-Geigy Chemical Co.), di-n-octadecyl(3,5-di-t-butyl-4-hydroxybenzyl) phosphonate; 1,3,5-trimethyl-2,4,6-tris(3,5-di-t-butyl-4-hydroxybenzyl) benzene and the like. Such thermal stabilizers are generally added to the propylene melt composition in amounts of from about 0.01 to about 1.0 part by weight per 100 parts by weight of the polymer (phr).

The phosphate-type antistatic materials utilized in accordance with the present invention include hydrocarbyl phosphate esters, ethoxylated hydrocarbyl phosphate esters, partially hydrolyzed hydrocarbyl phosphate esters or their salts. By hydrocarbyl is meant a hydrocarbon radical selected from the alkyl, cycloalkyl, aryl and combinations thereof such as alkylauryl,etc., containing from 1 to about 20 C atoms. Usually a mixture of di- and monoalkyl esters are utilized but the composition is also effective when completely esterified phosphoric acid compounds are employed. It has also been found that the use of the phosphate-type antistatic agents of the present invention are quite effective in inhibiting color formation during gas fired heat treatments if the polypropylene melt composition contains a hindered phenol as an antioxidant. It has further been found that the inhibition of color formation is influenced by the pH and the neutralizing cations employed. The lower the pH the less color produced. Preferably, the pH is maintained between about 3 and about 9 and preferably between about 4 and about 7. The preferred phosphate-type antistatic materials are the partially neutralized acid esters of phosphoric acid or the equivalent partially hydrolyzed

triesters of phosphoric acid. The present order of neutralizing cations has been found to be ammonium, mono-, di- and triethanolammonium, lithium, sodium and potassium. The potassium was found to be the least desirable, although useable in accordance with the present invention.

The finish composition of the present invention alsodesirably contains a bactericide such as 6-acetoxy-2,4-dimethyl-m-dioxane (Givgard DXN(R), Givaudan Corp., Clifton, NJ).

The relative amounts of the ingredients of the finish composition of the present application are not particularly critical. However, the ethoxylated lubricant should of course be used in amounts sufficient to lubricate the textile materials and the antistatic agent in amounts sufficient to prevent undesirable electrostatic charges from building up in the textile materials. Preferably, the ethoxylated lubricant is utilized in amounts between about 50 and about 98 percent by weight of the finish composition and most desirably between about 60 and 95 percent by weight of the composition. The balance of the finish composition is preferably the antistatic agent in amounts between about 2 and 50 percent by weight and most desirably between about 5 and 40 percent by weight of the finish composition The bactericide may be present in amounts between about 0 and about 1.0 percent by weight of the final composition and like minor amounts of other suitable additives may be included, such as corrosion inhibitors.

A preferred embodiment of the present invention will be illustrated by reference to the accompanying drawings.

In accordance with Figure 1, the polypropylene melt is extruded from a plural orifice spinneret 2, of conventional design. While spinneret 2 is shown in the drawings as producing a single threadline it is obvious that the spinneret may produce two or more threadlines. The filaments

from spinneret 2 are passed through a conventional quench zone 4 where the filaments are cooled and set. Finish is applied by conventional finish applicator means 6 which may take any appropriate form. For example, a "kiss" roll may be utilized to apply finish to the filaments as a gathered threadline or yarn or as a band spread across the finish roll. A slot type finish applicator could also be utilized, the only requirement being that the finish be uniformly applied to the filaments or yarn. The yarn is then wound on an appropriate conventional winder 8 to form a yarn package 10. Appropriate guides, guide rolls, godet rolls, and the like will of course be utilized. The process as illustrated in Figure 1 produces a yarn in its as-spun state. However, it is also possible to draw-twist the yarn before winding the same on package 10. Whether draw-twisting is practiced as a part of the spinning operation will depend to some extent upon whether the yarn is partially oriented yarn or a conventional undrawn yarn. Normally it is considered that winder takeup speeds in excess of about 1500 meters per minute will produce a partially oriented yarn whereas takeup speeds of less than about 1500 meters per minute, for example about 800 meters per minute, produce an unoriented or undrawn yarn.

Figure 2 illustrates a preferred draw-twisting operation in accordance with the present invention. In Figure 2 yarn is withdrawn from yarn package 10 by means of the draw means 12 made up of conventional draw rolls, 12a and 12b, respectively. Thereafter, twist means 14 conventionally applies by means of a flyer 16 as it is wound on package 18. Obviously any appropriate drawing and twisting apparatus may be utilized. It will also be apparent to one skilled in the art that the system would include appropriate guides, guide rolls, draw heaters, etc.

The draw-twisted yarn when converted into an appropriate fabric and formed into a bag or the like has been found to

make excellent dye bags, laundry bags and the like. The resultant products have superior temperature stability compared with conventionally finished textile materials of polypropylene and to conventional dye bag textiles. In addition, certain of the polypropylenes have been found to have superior inhibition to color formation as compared with conventionally finished polypropylenes and commercially available dye bag textiles.

The following examples will illustrate the advantages of the present invention.

Example 1

The following series of tests were run to illustrate the thermal stability benefits of the combination of ethoxylated lubricant and phosphate-type antistatic agent in accordance with the present invention. In this series of tests a commercial resin having a melt flow of about 12 had added thereto the finish compositions indicated in Table 1 below. Yarns, to which the designated finishes had been applied, were tested for thermal stability by knitting sleeves from the yarns, about one and one-half inches by two inches,and placing the sleeves on wooden dowel rods in an electrically heated, forced air oven at 130° C. The specimens were examined periodically (typically every 24 hours) until the degradation appeared substantial. The number of hours until degradation of the sample is given in Table 1 below.

Table 1

Run	Finish	Wt.% Solids Based on Wt. of Yarn	Hours to Degradation
1	Lubricant[(a)]	4.0	31
2	Lubricant[(a)] +20% hexyl phosphate	3.6	230
3	Lubricant[(a)] +20% ethoxylated lauryl phosphate	4.0	140
4	Multicomponent Finish[(b)]	4.5	77

(a) Butyl ether of random copolymer, poly(oxyethylene-oxy-1,2-propylene) having SUS viscositiy of 260 (Union Carbide Co.).

(b) 90 wt.% ethoxylated coconut acid (9 moles ethylene oxide per mole acid); 10 wt.% ethoxylated coconut amino ethanolamide (3 moles ethylene oxide per mole coconut derivative) - commercially available ethoxylated lubricants.

Example 2

The stability of polypropylene yarns with and without the phosphate-type antistatic agents was determined in laundering cycle tests in the present example.

In this test, a polypropylene melt composition was prepared by adding to the polypropylene 0.05 parts by weight per 100 parts of polypropylene (phr) of calcium stearate, 0.3 phr tris(3,5-di-t-butylhydroxybenzyl)isocyanurate, 0.1 phr hydrolysis resistant distearyl pentaerythritol disphosphite, 0.1 phr trilauryl trithiophosphite and about 0.375% titanium oxide. The polypropylene had a melt flow of 12 and when combined with the specified stabilizing system is designated hereinafter as resin B.

The finish designated in Table 2 below as finish I contains the following:

90 wt.% ethoxylated coconut acid (9moles ethylene oxide per mole acid)

10 wt.% ethoxylated coconut amino ethanolamide (3 moles ethylene oxide per mole coconut derivative) - commercially available ethoxylated lubricants.

The finish designated as finish II contains the following:

Lubricant

32.15% methyl ether of poly(oxyethylene-/7 moles/oxy-1,2-propylene/2moles/) laurate (Imperial Chemical, Inc., TL 1038)
32.15% poly(oxyethylene/6.5 moles/) isodecyl alcohol ether (Imperial Chemical, Inc. TL 1074)
19.4% butyl ether of random copolymer, poly(oxyethylene-oxy-1,2-propylene) having SUS viscosity of 2000 (Union Carbide Co.)

Antistatic Agent

13.19% mixture of di- and mono-hexyl phosphoric acid (Imperial Chemical, Inc. G2199)
2.05% NaOH
0.96% diethanolamine

Bactericide

0.1% 6-acetoxy-2,4-dimethyl-m-dioxane (Givgard DXN, Givaudan Corp. Clifton, N.J.)

The specified finishes were applied to the yarns at essentially the same rate as Example 1 above.

In the test, the yarn was knitted into a sleeve and the sleeve trimmed so that the yarn could be easily unravelled for sampling. The sleeve, weighing about 5 grams, was placed in a 500 milliliter, flat bottom flask fitted with a water cooled reflux condenser. 200 milliliters of a 0.2% AATCC Standard Soap Solution was boiled under reflux for 6 hours after which time the sleeve was removed, rinsed free from the solution and squeezed dry. The sleeve was then dried for 15 hours at 130° C in an electrically heated, forced air oven to complete the cycle. About a 5 foot sample of the yarn was removed from the sleeve and

tested for strength and elongation retention on an Instron Tensile Tester after 3, 5 and 8 cycles, respectively.

The results of this test are set forth in Table 2 below:

Table 2

Run	Resin	Finish	Cycles to Failure	% Strength Retention After 8 Cycles
5	B + TiO_2	I	<3	-
6	B + TiO_2	II	>8	103

Example 3

The ultravilolet stability of the polypropylene yarns referred to in Table 2 above was also tested.

The ultraviolet stability was measured by exposing 2" by 3" knitted sleeves mounted on black backed Atlas mounting fadeometer cards. Degradation is either when the fabric tears or when the fabric flakes while being gently scratched with a fingernail. Usually if the sleeve is of fine denier yarn the fabric will tear and it is the sleeve surface closest to the black backing which tears before the surface closest to the arc. With heavier denier fabrics flaking of the surface facing the arc usually occurs before the fabric can be torn. Table 3 below gives the results of these tests.

Table 3

Run	Resin	Finish	Hours to Flaking	Hours to Break
7	B + TiO_2	I	120	260
8	B + TiO_2	II	260	>300

It is obvious from the above examples that finishes containing an ethoxylated lubricant and the phosphate-type antistatic agents, in accordance with the present invention, (finish II) were vastly superior to finishes containing only ethoxylated lubricants and balanced finishes containing the ethoxylated lubricants and antistatic agents other than the phosphate-type antistatic agents utilized in accordance with the present invention, which other lubricant compositions have been highly successful as finishes for other textile materials.

Example 4

In this example the finish compositions of the present invention were tested for use as dye bag yarns. The yarns were made from a stabilized polypropylene melt designated resin B in the above examples and were finished with either finishes I or II as specified in the previous examples. The finish was metered onto the yarn with no problems. The yarn was draw-twisted using a standard 1680/280 yarn process. Eight positions of a draw twister processing 1680/280 yarns were used. Again no problems were seen. The yarns were then coned into ten ounce packages and knitted into dye bags for testing.

The following tests were made:

Stability to up to 8 cycles of an accelerated mock dyeing test

Stability up to 8 cycles of an accelerated laundering test

Stability to C-Arc fadeometer exposure test

Stability to GMB-Arc fadeometer exposure test

Accelerated gas fade color development test

AATCC gas fade color development test

In addition to testing yarn with finish II of the present invention and the yarn with finish I as a control, in some cases competitive dye bag yarns, designated C, were tested

for comparison.

The mock dye cycle test is the same as the previously described laundering cycle except that the treating solution was 200 milliliters of the following:

0.3% Alkanol ND (Dupont) - sodium alkyl diaryl sulfonate

0.16% Merpol OJS (Dupont) - ethylene oxide condensate

0.3% MSP - monosodium phosphate

The GMC-Arc fadeometer exposure test was substantially the same as the previously described carbon arc fadeometer test.

The accelerated gas fade color development test simulates processes which involve heating and curing or drying in gas fired ovens. It also produces colors which have been seen transiently under the same kinds of storage conditions which have not heretofore been simulated. The test provides for a 10 minute heating cycle at 130° C followed by a 2-hour treatement in an atmospheric fume chamber (AATCC test method 23-1975).

The regular gas fade test is described in AATCC test method 23-1975.

The results were recorded and the percent toughness retained was calculated for each sample. The toughness is defined as:

$$\text{Toughness} = \text{Tenacity} \times (\%\ \text{Breaking Elongation})^{1/2}$$

The results of this series of tests are set forth in Tables 4, 5, 6 and 7 below:

Stability Properties of Dye Bag Yarns

Sample	Finish	Thermal Stability Hours to Degrade	UV-Stability GMC-Arc	UV-Stability C-Arc	Initial Yarn Strength g/d Tenacity	Initial Yarn Strength % Breaking Elongation	% Toughness Retained After Treatments Laundering 3 Cycles	Laundering 5 Cycles	Laundering 8 Cycles	Mock Dyeing 3 Cycles	Mock Dyeing 5 Cycles	Mock Dyeing 8 Cycles
Resin B 840/140	II	644	195	600	3.99	59.0	82	79	65	82	81	79
Resin B 1680/280	I	68	300	680	3.60	31.0	-	-	-	113	109	0
Commercial Dye Bag Yarn C-165/35	Unknown	41	180	-	3.25	20.8	118	87	32	54	0	0

Table 4

Table 5

Effect of Repeated Simulated Dye and Laundering Cycles on the Breaking Strength and Elongation of Various Yarns

Yarn	Finish	Initial Strength grms	Initial %Elongation	After 3 Cycles Strength grms	After 3 Cycles %Elongation	After 5 Cycles Strength grms	After 5 Cycles %Elongation	After 8 Cycles Strength grms	After 8 Cycles %Elongation
Dye Cycle									
Resin B 840/140	II	3280	67.1	3708	34.9	3716	34.1	3676	33.6
Resin B	I	6032	31	6444	34.4	6396	32.9	Degraded	
Commercial Dye Bag Yarn C-165/35	Unknown	537	20.8	358	13.9	Degraded			
Launder Cycle									
Resin B 840/140	II	3280	67.1	3846	36.7	3812	37.5	3658	30.6
Resin B 840/140	II	3432	50.8	3438	30.3	3190	28.5	2840	22.7
Commercial Dye Bag Yarn C-165/35	Unknown	537	20.8	596	23.5	486	19.9	256	9.1

Table 6

Commercial Dye Bag Yarns
Number of Laundering Cycles to Degradation

Denier	Commercial Dye Bag Yarn	Finish	% Cycles to Failure
165/35	C	Unknown	7
210/35	C	Unknown	5
840/140	C	Unknown	4

Table 7

Gas Fading of Dye Bag Yarns

Yarn	Finish	1 Cycle	2 Cycle	3 Cycle	Accelerated Gas Fade
Resin B 840/140	II	4-5	3	2	4-5
Commercial Dye Bag Yarn C 165/35	Unknown	4-5	3	2	4-5
Commercial Dye Bag Yarn C 840/140	Unknown	4	3-4	3	4-5

The above results are analyzed below.

Selection of commercial dye bag yarn C having a 165/35 denier for the quantitative strength retention test was made on the basis of laundering cycle tests in which three commercial dye bag yarns from the same manufacturer were cycled to failure. The commercial yarn having a denier of 165/35 was found to be the most stable of the three yarns

tested (see Table 6 above).

In the quantitative dyeing/laundering simulations it is the elongation which is most rapidly affected, the toughness factor is used as the critical criterion because it balances the elongation and the tenacity into a property which has been found to be the equivalent to performance in actual practice.

Although the color of the yarns has not been quantitatively evaluated, the dye bag yarns in accordance with the present invention are whiter than the control yarn and than the commercial dye bag yarn; it remains whiter in the cycling test, the thermal stability tests and in actual laboratory storage experiments. Accelerated gas fade tests showed no pinking problems with the dye bag yarns of the present invention and no such problems have been observed with the control yarns. In 3-cycle gas fade tests, the yarns show quite a severe color development. However, this is not believed to be a problem in dye bag yarns since the only place it will show up is after long storage in a high nitrogen oxide atmosphere. The dye bag yarns would not be subjected to such an environment since legislation has essentially ruled out this kind of contamination.

Example 5

Tests were also conducted utilizing a 12 melt flow polypropylene melt composition stabilized with 0.30% distearylthiodipropionate, 0.10% tetrakis[methylene(3,5-di-t-butyl-4-hydroxy hydrocinnimate)] methane and 0.05% calcium stearate and a 12 melt flow polypropylene having a stabilizer system; comprising, 0.30% distearylthiodipropionate, 0.10% tetrakis[methylene(3,5-di-t-butyl-4-hydroxy hydrocinnimate)] methane (Irganox 1010, Ciba-Geigy), 0.05% calcium stearate and 0.10% hydrolysis resistant distearyl pentaerythritol

diphosphate Weston 619, a product of Borg-Warner Chemicals, Parkersburg, W.Va. Both of the stabilizing systems utilized in the polypropylene melt composition are seen to contain hindered phenols. It was found that about 2% of an ethoxylated textile lubricant applied to these textile materials will reduce the thermal stability at 130° C from 400 hours to 60 hours or from 1500 hours to 200 hours depending on the denier of the product. However, the presence of about 10% to 50% of the phosphates of the present invention and the same ethoxylated lubricants the textile materials recover substantially all of the strength thus lost.

It was also found that a further benefit from the use of the finish compositions of the present invention is attained when the polypropylene melt composition contains a hindered phenol. Specifically, inhibition of color formation during gas fired heat treatments is improved. For example, yarns spun from resin formulations B and C above when heated to 130° C and exposed for 2 hours in a nitrogen oxide gas fade oven will turn pink. This pink color will be increased in the presence of an ethoxylated textile lubricant-containing finish unless the finish has added thereto a phosphate type antistatic agent as taught in the present invention.

While specific examples, materials and amounts of ingredients have been set forth in the illustrative examples, it is to be understood that such specific references are not to be considered limiting and variations thereof will be apparent to one skilled in the art.

Claims

1. Polypropyleneyarn product of improved stability, comprising: a melt spun polypropylene formed from a melt containing from about 0.1 to about 0.6 weight percent of a stabilizer system including a hindered phenol and having applied thereto a finish composition; comprising, an ethoxylated textile lubricant, in an amount sufficient to impart lubricating properties to said composition, and an antistatic agent comprising phosphate esters, in an amount sufficient to impart antistatic properties to said composition and to increase the stability of said melt spun polypropylene.

2. A product in accordance with claim 1, wherein the finish composition additionally contains a bactericide, in an amount sufficient to impart antibacterial properties to said composition.

3. A product in accordance with claim 1, wherein the antistatic agent is a phosphate ester.

4. A product in accordance with claim 1 wherein the antistatic agent is an at least partially neutralized salt of a phosphoric acid which exhibits a pH sufficient to inhibit color formation in the polypropylene textile material.

5. A product in accordance with claim 4, wherein the pH is between about 3 and about 9.

6. A product in accordance with claim 4 wherein the phosphoric acid ester is neutralized with a neutralizing composition including ammonia.

7. A product in accordance with claim 4 wherein the phosphoric acid ester is neutralized with a material selec-

ted from the group consisting of a monoethanolamine, diethanolamine, triethanolamine, sodium hydroxide, lithium hydroxide, ammonium hydroxide and mixtures thereof.

8. A product in accordance with claim 1 wherein the phosphoric acid ester is an ethoxylated alkyl phosphate ester.

9. A product in accordance with at least one of claims 1 to 8 wherein the ethoxylated lubricant is present in a major proportion and the antistatic agent is present in a significant proportion.

10. A product in accordance with at least one of claims 1 to 9 wherein the yarn product is a draw-twisted, melt spun polypropylene.

11. A process for preparing a polypropylene textile material comprising:

a) melt spinning polypropylene filaments from a melt containing from about 0.1 to about 0.6 weight percent of a stabilizer system including a hindered phenol; and

b) applying to said melt spun polypropylene a finish composition according to one of claims 1 to 9.

12. A process in accordance with claim 11, wherein the melt spun polypropylene is formed into a yarn and the yarn is draw-twisted.

13. A process in accordance with claim 11, wherein the finish composition is applied to the melt spun filaments shortly after they have set.

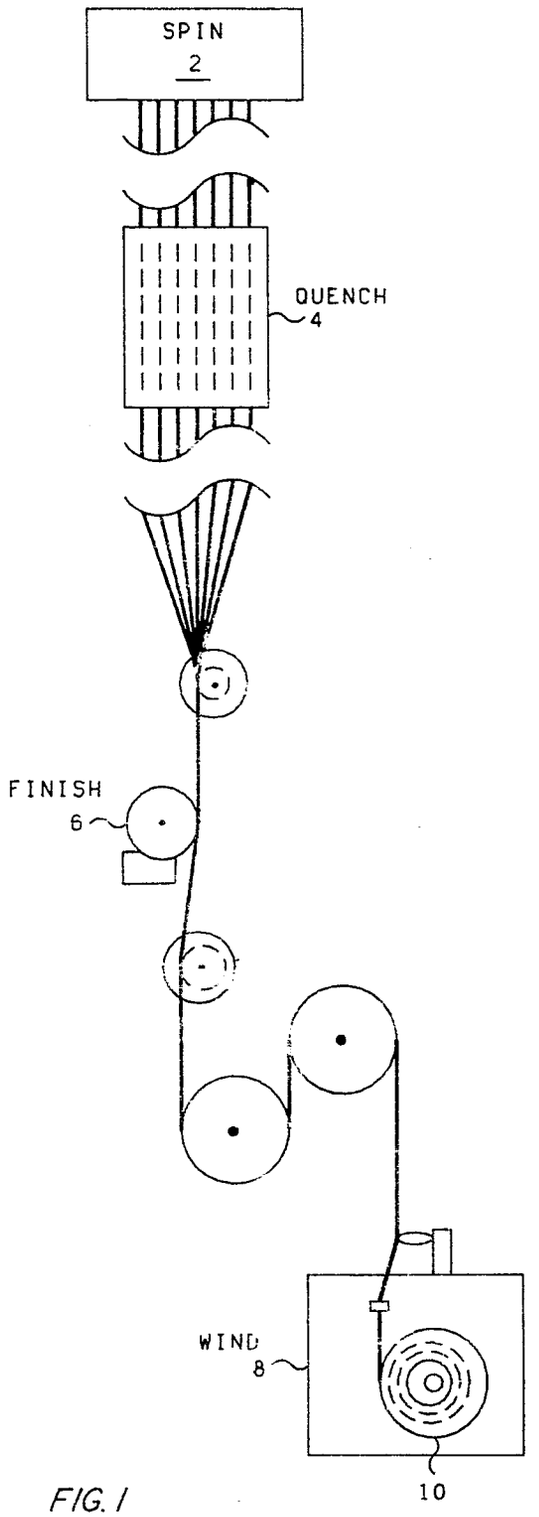


FIG. 1

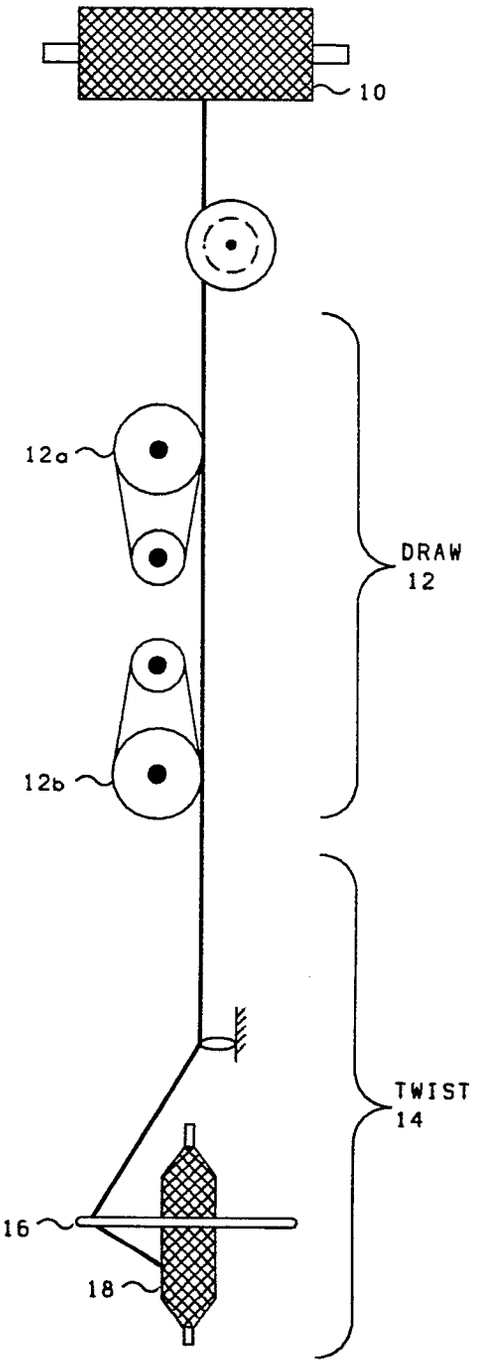


FIG. 2