

(19)



Europäisches Patentamt

European Patent Office

Office européen des brevets



(11)

EP 0 740 007 A2

(12)

EUROPEAN PATENT APPLICATION

(43) Date of publication:
30.10.1996 Bulletin 1996/44

(51) Int. Cl.⁶: **D06B 23/20**

(21) Application number: **95117738.5**

(22) Date of filing: **10.11.1995**

(84) Designated Contracting States:
**AT BE CH DE DK ES FR GB GR IE IT LI LU MC NL
PT SE**

(30) Priority: **18.04.1995 US 423188**

(71) Applicant: **HENKEL CORPORATION
Plymouth Meeting, PA 19462 (US)**

(72) Inventor: **Anderson, Jack L.
Charlotte NC 28210 (US)**

(74) Representative: **von Kreisler, Alek, Dipl.-Chem. et
al
Patentanwälte,
von Kreisler-Selting-Werner,
Bahnhofsvorplatz 1 (Deichmannhaus)
50667 Köln (DE)**

(54) Process for treating a textile substrate

(57) A process for treating a textile substrate by (a) providing a mixing apparatus located in-line with a textile substrate contacting system, the apparatus having at least two inlet ports for receiving a predetermined amount of water and at least one raw textile finish component, a fluid port for combining the water and textile finish component into a single fluid stream, an interfacial surface generator in operative connection with the fluid port for statically mixing the water and raw textile finish component, and an outlet port connected to the interfacial surface generator for discharging a formulated textile finish composition, and (b) contacting a textile substrate with the textile finish composition.

EP 0 740 007 A2

DescriptionBackground of the Invention5 Field of the Invention

The present invention generally relates to an in-line process for continuously preparing textile finish compositions and treating textiles therewith. More particularly, a process is provided whereby a predetermined amount of a textile finish composition having a specific formulation can be prepared on an as-needed basis for treatment of textile materials.

10 Finishing compositions are generally applied to textile fibers to improve their subsequent handling and processing. Fiber finishes play an important role in assisting the fiber producer to manufacture the product, and enable the fiber producer's customers to carry out the required yarn and fabric manufacturing processes to obtain the finished textile product. The composition and amount of fiber finish applied depend in large measure upon the nature, i.e., the chemical composition of the fiber, the particular stage in the processing of the fiber, and the end use under consideration.

15 For example, compositions referred to as "spin finishes" are usually applied to textile fibers after extrusion. These or other finishes may be applied to yarn prior to knitting or winding, and to fiber tows prior to or at the time of crimping, drying, cutting, drawing, roving, and spinning, or to staple fibers prior to carding. The application of lubricants onto fibers prior to carding and subsequent textile operations such as yarn manufacture, preparation of nonwoven webs or processing of continuous filament yarns after the fiber spinning process are commonly called secondary or over-finishes. Such finishes provide lubrication, prevent static build-up, and afford sufficient cohesion between adjacent fibers.

20 The application of such finishes is generally accomplished by contacting a fiber tow or yarn with a solution or an emulsion comprising at least one component having antistatic and/or lubricating properties. In addition to a lubricant and anti-static agent, additives such as wetting agents, antioxidants, biocides, anti-corrosion agents, pH control agents, as well as emulsifiers are also commonly found in such finish mixtures. Finish compositions can also be applied to tow, yarn, or cut staple by spraying.

25 Satisfactory finish compositions must fulfill a number of requirements in addition to providing desired lubricating and antistatic effects. For example, they should be easy to apply (and to remove if desired), they should have good thermal and chemical stability, they should not adversely affect the physical or chemical properties of the fibers to which they are applied, and they should aid the subsequent processes to which the treated fibers are subjected, they should not leave residues on surfaces or cause toxic fumes or undesirable odors, they should provide for rapid wetting of fiber surfaces, they should be water-soluble or emulsifiable or solvent-soluble, they should have good storage stability, they should be compatible with sizes, nonwoven binders and other fiber treatments, they should not attract soil or cause color changes to the fibers, they should not interact with frictional elements used in texturizing and they should not be corrosive to machine parts.

35 Discussion of Related Art

Of the numerous compositions which have been proposed as fiber finishes, some of the more noteworthy may be found in the following prior art. For example, U.S. Patent 4,027,617 discloses a finish for acrylic fiber consisting of an alkyl phenol ethoxylated with 40 to 200 moles of ethylene oxide, an amine salt of hydrogenated tallow-alcohol phosphate, and a mixture of mineral oil, an ethoxylated aliphatic monohydric alcohol, and the amine-neutralized reaction product of an ethoxylated aliphatic monohydric alcohol phosphate. In addition, U.S. Patent 3,997,450 relates to a finish composition for synthetic fibers such as polyamides and polyesters, consisting essentially of a lubricant selected from a mono- or diester of an aliphatic carboxylic acid with a monohydric aliphatic alcohol, or a refined mineral, animal or vegetable oil; an emulsifier containing up to 50 moles of alkylene oxide per mole of ester, alcohol, or amide wherein the reactive hydroxyl sites of the emulsifiers contain deactivating and cap groups; and an alkali salt of a dialkyl sulfosuccinic acid. Likewise, U.S. Patent 4,725,371 is directed to a finish for the texturing of partially oriented polyester yarn wherein the composition has a pH of at least 10, and comprises an oil-in-water emulsion wherein the oil phase constitutes 2 to 25 weight percent of the emulsion. The oil phase comprises a lubricant selected from mineral oils, alkyl esters, glycerides, silicone oils, waxes, paraffins, naphthenic and polyolefinic lubricants, glycols, glycol esters, and alkoxyated glycol esters. The emulsifiers employed include soaps, glycerol fatty acid esters, sorbitan and polyoxyethylene sorbitan esters, polyglycerol esters, polyoxyethylene esters or ethers, polyoxyethylene polyol ether esters, polyoxyethylene amines and amides, partial polyol ester ethoxylates, sulfated vegetable oils, sulfonated hydrocarbons, and the like.

50 The purpose of a fiber finish is to provide fiber to metal lubrication and fiber to fiber cohesion, as well as reduce static electricity. Although much of the basic work to elucidate the mechanisms of lubrication was done in the distant past, results of this work continue to be used to understand and apply results of frictional testing to current problems and the development of new finishes.

55 The contribution of frictional and antistatic properties can be observed throughout fiber manufacturing and processing. An example is the case of a low denier polypropylene staple fiber which is to be carded into a web and thermally

bonded for some disposable nonwoven application. This requires a formulation which in conjunction with the fiber crimp, contributes a relatively high fiber to fiber friction which is important in insuring a carded web with good cohesion, uniformity, and integrity, and which compensates for the low stiffness of the fibers. Low fiber to metal friction is also a key factor in the processing of these staple fibers which have diameters on the order of only 15 to 20 micrometers.

Another example involves a slit film or ribbon type yarn intended for woven carpet backing for tufted carpets. During its manufacture, good wetting of the fiber surface by the finish and moderate frictional coefficients are required. For tufting, however, relatively low fiber to metal friction is a very important feature because of the action of tufting needles on the backing fabric.

Finally, low fiber to fiber friction is a highly desirable feature of continuous filament yarns used in cordage applications which involve twisting and plying to form compact structures which have a large amount of fiber to fiber contact. Low friction is desirable since it is generally associated with high flex resistance, high energy absorption and therefore, long life.

A different area of fiber-to-fiber friction is concerned with continuous filament yarns. This may be illustrated by some examples within the fiber manufacturing plant, i.e., package building in spinning and filament drawing or tow drawing are the major steps where the fiber-to-fiber friction is of critical importance. In yarn processing, yarn delivery in coning, stitch formation in knitting, filament damage in braiding, strength and elongation in cordage, slippage of weave in fabric, yarn-to-fabric friction in sewing, are some of the areas where yarn-to-yarn friction is important.

Unfortunately, prior art finish compositions fail to provide adequate friction coefficients with respect to the bundle cohesion and scroop of synthetic fiber filaments. This lack of adequate bundle cohesion results in the following problems: migration of filaments from bundles in tri-color yarns resulting in color streaking; difficulty in handling yarns in a direct tuft carpet process in which yarns are not twisted prior to tufting resulting in stray filaments being snagged; the filament twisting process is hindered due to the filaments separating from the main body of the fiber bundle; during fiber manufacture multiple wraps of the multifilament bundles are taken on various rolls wherein the bundles have a tendency to wander resulting in individual filaments from one bundle becoming trapped in an adjacent bundle causing a breakdown in the process. Finally, there is also a need in the industry to improve the seam slippage in synthetic fabrics; and particularly those made of polypropylene fibers.

Textile finish compositions such as those described above are typically formulated by the end-user. Suppliers and manufacturers provide the end-user with the raw textile finish components needed to formulate the finish composition. Prior to their application onto textile substrates, the raw textiles finish components must first be formulated and/or diluted to a specific concentration for a particular application and/or mixed with auxiliary components such as emulsifiers, anti-static agents, etc.. A batchwise process is most commonly employed to formulate the textile finish compositions. This process involves introducing the raw textile finish components into a large vessel, and then mixing them with water along with any additional auxiliary components which may be required. The contents of the vessel and mixed by mechanical means such as by the use of a propeller-type mixing device or an auger. The disadvantages associated with the use of this type of batchwise process for formulating textile finish compositions are as follows.

First, a significant amount of manpower must be expended in order to formulate the textile finish composition which involves weighing the amount of raw textile finish components, as well as any auxiliaries, to be employed in the particular textile finish being formulated, physically introducing the various components into a mixing container, inserting, supervising and subsequently cleaning the mechanical mixer employed, as well as other tasks involving the application of human effort.

It is therefore an object of the present invention to provide a process which requires the expenditure of minimal manpower when emulsifying textile finish compositions prior to their application onto textile substrates.

Secondly, due to the significant amount of manpower needed to prepare the textile finish composition prior to its application onto textile substrates, a particular textile finish composition must oftentimes be prepared in large quantities for future applications. Consequently, emulsifiers and biocides must be added to the textile finish composition to ensure that the emulsified finish neither separates nor becomes contaminated during storage. The addition of these preservative components adds significantly to the cost of making and using the textile finish compositions.

It is therefore another object of the present invention to provide a process for preparing textile finish compositions which requires the addition of little, if any, preservative components.

Further, even with the addition of emulsifiers and biocides to prolong shelf-life, these formulated textile finish emulsions have finite storage times so that if the formulated textile finish emulsion is not completely exhausted prior to the expiration of its shelf-life, any remainder must be disposed of, which in turn requires the additional expenditure of both manpower, the financial loss associated with any waste, as well as waste treatment and environmental concerns.

It is therefore another object of the present invention to provide a process for preparing textile finish compositions on an as-needed basis and only in the particular amount needed for an application.

Finally, an inordinate amounts of floor space is required to accommodate the storage of both the raw textile finish components and any formulated textile finish composition which has not been completely exhausted.

It is therefore a main object of the present invention to provide a process for formulating textile finish compositions which can be prepared in-line with a particular textile substrate application process, and treating textile substrates therewith.

5 Summary of the Invention

The present invention is generally directed to a process for treating textile substrates. The present invention eliminates the need for the batchwise formulation of textile finish compositions prior to their application onto textile substrates.

10 In particular, the present invention is directed to a process for treating a textile substrate comprising:

- (a) providing a mixing apparatus located in-line with a textile substrate contacting system, the mixing apparatus having at least two inlet ports for receiving a predetermined amount of water and at least one raw textile finish component, a fluid port for combining the water and the raw textile finish component into a single fluid stream, an interfacial surface generator in operative connection with the fluid port for statically mixing the water and the raw textile finish component, and an outlet port connected to the interfacial surface generator for discharging a formulated textile finish composition;
- (b) introducing predetermined amounts of water and raw textile finish component into the mixing apparatus through the inlet ports;
- 20 (c) combining the water and the raw textile finish component into a single fluid stream;
- (d) mixing the single fluid stream in the interfacial surface generator until a predetermined degree of mixing is obtained to provide a formulated, textile finish composition;
- (e) discharging the textile finish composition through the outlet port; and
- (f) contacting a textile substrate with the textile finish composition.

25

Brief Description of the Drawing

The following drawing is illustrative of an embodiment of an apparatus which may be employed in the invention and is not intended to limit the inventions as encompassed by the claims forming part of the application.

30 The sole figure is a schematic view of one embodiment of an apparatus which may be employed in the invention for the in-line formulation of textile finish compositions in which multiple raw textile finish components and water are introduced into an interfacial surface generator, through multiple inlet ports, where they are subsequently statically mixed and discharged as a newly formulated textile finish composition through the outlet conduit.

35 Detailed Description of the Invention

Other than in the operating examples, or where otherwise indicated, all numbers expressing quantities of ingredients or reaction conditions used herein are to be understood as modified in all instances by the term "about".

40 The present invention provides for the in-line formulation of a textile finish composition on an as-needed basis, and its subsequent application onto a textile substrate. In accordance with the invention, water along with multiple raw textile finish components are fed into a mixing apparatus comprising an interfacial surface generator wherein the components are intimately mixed in order to produce a formulated finish composition of predetermined quantity, concentration and characteristics prior to contact with a textile substrate.

Referring to the sole drawing, the principal components of the mixing apparatus 1 employed to carry out the present invention include a water inlet port 2a and raw textile finish component inlet ports 2b and 2c for introducing water and raw textile finish components to be formulated into a textile finish composition, an interfacial surface generator 6 for statically mixing the water and raw textile finish components, an outlet port 9 for dispensing the formulated textile finish composition and a control unit 7 for controlling the operation of the apparatus 1.

50 In operation, water is introduced to the apparatus from a source, not shown, through inlet port 2a. Raw textile finish components are similarly fed from individual sources, not shown, through inlet ports 2b and 2c. Valves 3a, 3b and 3c, are used to open and close inlet ports 2a, 2b and 2c so that water and the various raw textile finish components may be introduced into the interfacial surface generator 6 through fluid port 5. Due to the viscous state of the raw textile finish components employed, pumps 4a and 4b are used to meter the raw textile finish components through inlet ports 2b and 2c and they are combined, along with the water, into a single fluid stream and fed through fluid port 5 into the interfacial surface generator 6.

55

The interfacial surface generator 6 employed in the present invention is well known in the art. For example, U.S. Patent 3,583,678, hereby incorporated by reference, discloses a typical interfacial surface generator used for static mixing of fluids wherein a fluid stream is divided into a plurality of substreams which are then recombined, divided, repositioned, and recombined again until a desired degree of mixing is obtained. These types of interfacial surface generators

are capable of providing a degree of mixing that is a function of the number of static mixing elements (n) employed. Each element individually divides and mixes the liquid stream four times. Consequently, each additional element (n) employed increases the degree of mixing on the order of 4ⁿ. Other examples of interfacial surface generators known in the art, and also incorporated herein by reference, are disclosed in U.S. Patent 3,358,749, 3,404,869 and 3,652,061.

Once the water and raw textile finish components are sufficiently mixed to formulate a particular textile finish composition, valve 8 is opened so that the textile finish composition may be discharged through outlet port 9. The freshly formulated textile finish composition is then ready for contact with a textile substrate.

While the apparatus 1 can be operated manually with the use of a minimal amount of manpower with respect to the opening and closing of valves 3a, 3b, 3c and 8, as well as the actuation of pumps 4a and 4b, along with the interfacial surface generator 6, it is preferred that a control unit 7 be employed in operative connection with the apparatus to perform all of these functions. The type of control unit 7 employed by the present invention is well known in the art. The control unit 7 is capable of being programmed so that predetermined amounts of water and various raw textile finish components may be measured and subsequently introduced into the interfacial surface generator 6. Similarly, the control unit 7 can also be programmed to provide varying degrees of mixing for numerous types of textile finish compositions. Thus, according to the preferred embodiment of the present invention, all of the operating components of the apparatus 1 are electronically controlled, with variables such as amounts of water and raw textile finish components to be admixed and degrees of mixing being programmed into and controlled by control unit 7.

The primary components of most textile finish compositions include a lubricant, emulsifiers known in the art such as ethoxylated C₁₂₋₁₈ fatty alcohols, an anti-jelling agent and an anti-static agent. It is oftentimes highly desirable to also include a wetting agent to aid in the penetration, spread and adherence of the textile finish composition onto the textile substrate. The textile composition is typically applied onto the textile substrate as an aqueous emulsion.

The lubricant component of the fiber finish composition is preferably selected from the group consisting of ethoxylated fatty acids such as the reaction product of ethylene oxide with pelargonic acid to form PEG 300 monopelargonate (Emerest[®] 2634) and PEG 400 monopelargonate (Emerest[®] 2654), the reaction product of ethylene oxide with coconut fatty acids to form PEG 400 monolaurate (cocoate) (Emerest[®] 2650) and PEG 600 monolaurate (Emerest[®] 2661), and the like. The lubricant component can also be selected from non-water-soluble materials such as synthetic hydrocarbon oils, alkyl esters such as tridecyl stearate (Emerest[®] 2308) which is the reaction product of tridecyl alcohol and stearic acid, and polyol esters such as trimethylol propane tripelargonate (Emery[®] 6701) and pentaerythritol tetrapelargonate (Emery[®] 2484), as well as oxa-acid esters, may also be employed. In general, however, any lubricant based on synthetic, mineral, animal or vegetable oil typically known in the art for use as a lubricant in textile finish compositions may be employed in the present invention.

The textile finish of this invention is emulsifiable and capable of forming a stable emulsion with water. By the term "stable emulsion" it is meant that the emulsion is stable at the time of application of the textile finish composition to a textile substrate. This is meant to include both oil-in-water and water-in-oil finishes which, typically, are mixed well prior to their application and then applied via various applicators from a storage tank or the like and thus the textile finish composition in the form of an emulsion must traditionally be stable for extended time periods. However, by employing the present process, textile finish compositions in the form of a highly dispersed emulsion can be prepared in the exact amount needed for a particular application, in-line with the application process, and on an as-needed basis. The present process reduces the concentration of emulsifier required to maintain a stable emulsion. Hence, since less emulsifier is needed, this translates into a significant savings in production costs.

Anti-static agents function by either reducing the charge generation or by increasing the rate of charge dissipation. Most antistats operate by increasing the rate of dissipation and rely on atmospheric moisture for their effectiveness. A hydrophobic fiber such as polypropylene depends on an antistat coating to impart high surface conductivity for charge dissipation.

The antistatic agent may comprise any suitable anionic, cationic, amphoteric or nonionic antistatic agent. Anionic antistatic agents are generally sulfates or phosphates such as the phosphate esters of alcohols or ethoxylated alcohols. Cationic antistatic agents are typified by the quaternary ammonium compounds and imidazolines which possess a positive charge. Examples of nonionics include the polyoxyalkylene derivatives. The anionic and cationic materials tend to be more effective antistats. Preferred anionic antistatic agents for use herein include an alkali metal salt, e.g., potassium, of a phosphate ester such as commercially available from Henkel Corporation, Mauldin, South Carolina, under the tradenames Tryfac[®] 5559 or Tryfac[®] 5576. Preferred nonionic antistatic agents include ethoxylated fatty acids (Emerest[®] 2650, an ethoxylated fatty acid), ethoxylated fatty alcohols (Trycol[®] 5964, an ethoxylated lauryl alcohol), ethoxylated fatty amines (Trymeen[®] 6606, an ethoxylated tallow amine), and alkanolamides (Emid[®] 6545, an oleic diethanolamine). Such products are commercially available from Henkel Corporation, Mauldin, South Carolina.

The amount of antistatic agent present in the finish composition is generally from about 5 to about 30 weight percent when there is a possibility that static electricity may be a problem. In some cases less might be required, for example, for continuous filament yarns which are interlaced or for a winding operation. In other cases such as for staple fiber processing, larger amounts of antistatic agent may be required.

The satisfactory application of the various textile finish compositions oftentimes requires that a surfactant and/or a solvent be used as a wetting agent in the composition. The surfactant and/or solvent acts to ensure that the particular textile finish composition to which it is added is evenly and effectively distributed throughout the textile substrate. While the use of wetting agents in textile finish compositions is well known in the art, a particularly preferred wetting agent is an alkylpolyglycoside of formula I



wherein R^1 is a monovalent organic radical having from about 6 to about 30 carbon atoms; Z is a saccharide residue having 5 or 6 carbon atoms; and a is a number having a value from 1 to about 6.

The textile finish composition may be applied onto a textile substrate according to a variety of known procedures. For example, in the melt spinning process used for polypropylene manufacture, the polymer is melted and extruded through spinnerette holes into filaments which are cooled and solidified in an air stream or water bath. Shortly after, the filaments contact a textile finish composition applicator which can be in the form of a kiss roll rotating in a trough. The amount of active finish composition applied to the filaments can be controlled by the concentration of textile finish composition in the solution or emulsion and the total wet pick-up. Alternatively, positive metering systems may be used which pump the finish composition to a ceramic slot which allows the finish composition to contact the moving filaments. Textile finish compositions can also be applied onto textile substrates by spraying.

From this point, the textile substrate which now has a coating of textile finish composition moves forward into any of several processes. The amount of finish composition to be applied onto a synthetic filament is also dependent on the end product of the filament yarn. If staple fiber is the desired product, the filament bundles are combined into large tows, oriented by stretching, crimped, and cut into short lengths for processing on textile equipment to ultimately make yarn or nonwoven webs.

In a preferred embodiment of the present invention, the present process is employed to formulate spin finish emulsions, in-line with a textile substrate application process, on an as-needed basis. The primary components of a spin finish are a lubricant, an emulsifier, an anti-static agent and water which, when combined, form an emulsion. Predetermined amounts of these components are combined and mixed so as to formulate a spin finish composition having a specific concentration required for an end-user's particular application process. Varying concentrations of spin finishes in turn require varying degrees of mixing so that a desired degree of dispersion of the raw textile finish components and water is obtained.

Thus, referring again to the sole drawing, specific parameters relating to both the amounts of water and raw textile finish components to be mixed, along with the degree of mixing to be performed, are programmed into the control unit 7. It should be noted that in this particular embodiment, a wetting agent is also being employed. Valves 3a, 3b and 3c are opened, and pumps 4a and 4b actuated, so that predetermined amounts of water via inlet port 2a, lubricant component via conduit 2b and wetting agent via conduit 2c are introduced into the interfacial surface generator 6 in a single stream through fluid port 5. The interfacial surface generator then statically mixes the programmed amounts of water and raw textile finish components to a predetermined degree of dispersion, thus formulating the spin finish. Once the spin finish composition is formulated, valve 8 is opened and the newly formulated spin finish composition is discharged through outlet port 9. The spin finish composition is then contacted with a textile substrate.

It is thus clear that by employing the process of the present invention, thoroughly mixed and precise formulations of textile finish compositions can be formulated in-line with a textile substrate treating process, on an as-needed basis. The apparatus 1 employed in the process is capable of being employed in-line with any textile treating process. Moreover, since only the precise amount of textile finish composition that is required for any one textile application process is formulated at any one time, the need for employing auxiliaries such as emulsifying agents to maintain the emulsion or biocides to preserve the formulated textile finish composition are reduced or eliminated. Also, waste associated with both the space required to store textile finish compositions when an excess amount is formulated and the expiration of the composition's shelf-life is similarly avoided by employing the present process. Similarly, the amount of manpower required by the present process is substantially less than that of conventional formulating processes.

The newly formulated textile finish compositions may be applied to virtually any textile substrate including glass, cellulosics such as acetate, triacetate, rayon, non-cellulosics such as acrylics, modacrylic, nylon, aramid, olefins such as polyethylene and polypropylene, polybenzimidazole, polyesters such as polyethylene terephthalate and polybutylene terephthalate or copolyesters thereof, saran, spandex and vinylon.

It should be noted that although only two textile finish components are shown as being combined and mixed with water to formulate a textile finish composition, any number of raw textile finish components or auxiliaries such as surfactant blends/dispersions of waxy lubricants, for example fatty amides, fatty esters, oxidized polyethylene, and the like, needed for a particular textile finish composition may be employed.

The present invention will be better understood from the examples which follow, all of which are intended to be illustrative only and not meant to unduly limit the scope of the invention. Unless otherwise indicated, percentages are on a weight-by-weight basis.

Example I

A spin finish composition for fiber and textile applications was prepared having the following formulation.

Component	% by weight
(a) STANTEX [®] 1910-G	10
(b) water	90

(a) STANTEX[®] 1910-G, a nonionic fiber finish available from Henkel Corporation, Textiles Group, Charlotte, North Carolina, is a blend of sulfated glycerides, mineral oil, esters and ethoxylated fatty alcohols.

The components listed above were introduced, in a single stream, into an interfacial surface generator, at ambient temperature, and then mixed to form an aqueous spin finish emulsion.

Comparative Example I

A spin finish composition for fiber and textile applications was prepared having the following formulation.

Component	% by weight
(a) STANTEX [®] 1910-G	10
(b) water	90

The components listed above were mixed, at a temperature of 50°C, using conventional agitation to form a spin finish. The textile spin finish compositions of Example 1 and Comparative Example 1 were then analyzed to determine their aesthetic appearance and degree of mixing. A photoelectric colorimeter, clinical model, catalog number 76-500-000, available from MANOSTAT[®] Inc., 519 Eighth Ave., New York, NY was used to measure the degree of mixing achieved by the present process versus a conventional mixing process. Table 1 summarizes the results obtained.

	Appearance	Photoelectric Colorimeter Value
Example 1	Translucent	60
Comparative Example 1	Opaque	870

The data in Table 1 shows that by employing the present process of mixing textile and spin finishes, a significantly increased degree of mixing is obtained, as compared to conventional mixing techniques. Moreover, due to the significantly enhanced degree of mixing obtained with limited expenditure of manpower, as compared to conventional mixing processes, the present process allows for the in-line mixing of textile and spin finishes on an as-needed basis.

Claims

1. A process for treating a textile substrate comprising:

(a) providing a mixing apparatus located in-line with a textile substrate contacting system, said mixing apparatus having at least two inlet ports for receiving a predetermined amount of water and at least one raw textile finish component, a fluid port for combining said water and said raw textile finish component into a single fluid

stream, an interfacial surface generator in operative connection with said fluid port for statically mixing said water and said raw textile finish component, and an outlet port connected to said interfacial surface generator for discharging a formulated textile finish composition;

(b) introducing predetermined amounts of said water and said raw textile finish component into said mixing apparatus through said inlet ports;

(c) combining said water and said raw textile finish component into a single fluid stream;

(d) mixing said single fluid stream in said interfacial surface generator until a predetermined degree of mixing is obtained to provide a formulated textile finish composition;

(e) discharging said textile finish composition through said outlet port; and

(f) contacting a textile substrate with said textile finish composition.

2. The process of claim 1 wherein said raw textile finish component is selected from the group consisting of a lubricant, an anti-static agent, a wetting agent, an emulsifier, an anti-jelling agent and mixtures thereof.

3. The process of claim 2 wherein said raw textile finish component is selected from the group consisting of a lubricant, an anti-static agent and mixtures thereof.

4. The process of claim 1 wherein said predetermined degree of mixing is on an order of 4^n , wherein n represents a number of mixing elements contained in said interfacial surface generator.

5. The process of claim 1 wherein said textile finish component is free of an emulsifier.

6. The process of claim 1 wherein said textile finish component is free of a preservative.

7. The process of claim 2 wherein said lubricant is selected from the group consisting of ethoxylated fatty acids having a chain length ranging from about 9 to 18 carbon atoms, butyl stearate, tridecyl stearate, polyol esters, synthetic hydrocarbon oils, mineral oils, animal oils, vegetable oils, oxa-acid esters and mixtures thereof.

8. The process of claim 2 wherein said anti-static agent is selected from the group consisting of an amine neutralized phosphate ester, quaternary ammonium salts, alkali neutralized phosphate ester, imidazolines, alkali sulfates, ethoxylated fatty acids, ethoxylated fatty amines, ethoxylated fatty alcohols, alkanolamides, and mixtures thereof.

9. The process of claim 1 wherein said apparatus is operated by a control unit.

10. The process of claim 9 wherein said control unit is programmed to both introduce predetermined amounts of said water and said raw textile finish component and provide a predetermined degree of mixing.

11. A process for formulating a textile finish composition comprising:

(a) providing a mixing apparatus located in-line with a textile substrate contacting system, said mixing apparatus having at least two inlet ports for receiving a predetermined amount of water and at least one raw textile finish component, a fluid port for combining said water and said raw textile finish component into a single fluid stream, an interfacial surface generator in operative connection with said fluid port for statically mixing said water and said raw textile finish component, and an outlet port connected to said interfacial surface generator for discharging a formulated textile finish composition;

(b) introducing predetermined amounts of said water and said raw textile finish component into said mixing apparatus through said inlet ports;

(c) combining said water and said raw textile finish component into a single fluid stream;

(d) mixing said single fluid stream in said interfacial surface generator until a predetermined degree of mixing is obtained to provide a formulated textile finish composition; and

(e) discharging said textile finish composition through said outlet port.

12. The process of claim 11 wherein said raw textile finish component is selected from the group consisting of a lubricant, an anti-static agent, a wetting agent, an emulsifier, an anti-jelling agent and mixtures thereof.

13. The process of claim 12 wherein said raw textile finish component is selected from the group consisting of a lubricant, an anti-static agent and mixtures thereof.

14. The process of claim 11 wherein said predetermined degree of mixing is on an order of 4^n , wherein n represents a number of mixing elements contained in said interfacial surface generator.

15. The process of claim 11 wherein said textile finish composition is free of an emulsifier.

16. The process of claim 11 wherein said textile finish composition is free of a preservative.

17. The process of claim 12 wherein said lubricant is selected from the group consisting of ethoxylated fatty acids having a chain length ranging from about 9 to 18 carbon atoms, butyl stearate, tridecyl stearate, polyol esters, synthetic hydrocarbon oils, mineral oils, animal oils, vegetable oils, oxa-acid esters and mixtures thereof.

18. The process of claim 12 wherein said anti-static agent is selected from the group consisting of an amine neutralized phosphate ester, quaternary ammonium salts, alkali neutralized phosphate ester, imidazolines, alkali sulfates, ethoxylated fatty acids, ethoxylated fatty amines, ethoxylated fatty alcohols, alkanolamides, and mixtures thereof.

19. The process of claim 11 wherein said apparatus is operated by a control unit.

20. The process of claim 19 wherein said control unit is programmed to both introduce predetermined amounts of said water and said raw textile finish component and provide a predetermined degree of mixing.

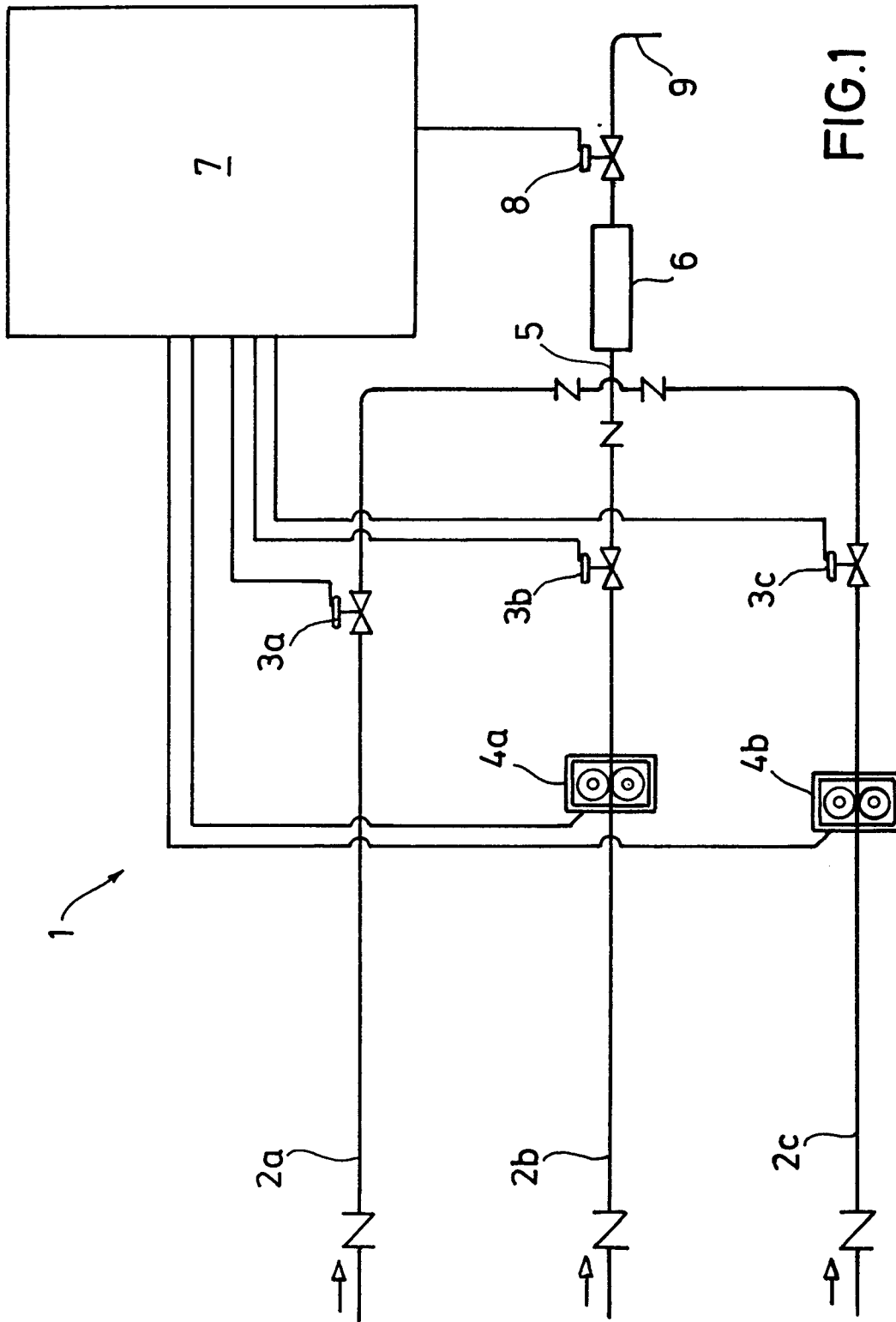


FIG.1