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ANTISTATIC TEXTILE MATERIALS

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The present invention relates to the treatment of textile materials such as fibers, yarns, filaments, threads, and the like to render such materials anti-static so that they will not generate or accumulate electrical charges during the performance of textile operations thereon, such as, twisting, winding, warping, carding, combing, drawing, spinning, weaving, knitting, and the like.

The invention also relates, in particular, to the treatment of cellulose organic derivative textile materials as, for instance, fibers, yarns, threads, filaments, fabrics and the like of cellulose acetate, to reduce or eliminate their tendency to generate or accumulate charges of electricity due to frictional forces that they may encounter during the performance of textile operations, or in use as wearing apparel.

In the performance of textile operations on textile materials in the form of filaments, yarns, threads or staple fibers, considerable difficulty is experienced because the yarns acquire an electrical charge due to the frictional and other influences encountered in the textile operations. The electrical charge causes the yarns and fibers to fly around in an unmanageable manner so that the formation of the yarn or of the fabric is rendered quite difficult. Particularly, in the utilization of staple fibers, the static electrical charges produced are often so great as to prevent the fibers from adhering to each other and thereby cause considerable difficulty in the spinning operation. In the case of knitting or weaving, the accumulation of static charges interferes with the smooth formation of the web or textile fabric.

The accumulation of electrical charges is particularly a problem in the case of carrying out textile operations on cellulose derivative fibers, filaments or yarns. Being smoothlike in their structure and also of the low moisture content compared to natural fibers, such as, cotton and wool, cellulose derivative yarns are inherently more susceptible to accumulation of static. Often the charges accumulated are so great as to cause considerable separation of the individual fibers with the result that it is difficult to form compact yarns or slivers.

Considerable effort has been devoted by workers in the textile field to develop suitable antistatic agents that would prevent or eliminate the accumulation of electrical charges on textile materials. Various agents and compositions for this purpose have already been proposed.

I have discovered that by treating or incorporating into textile materials lauryl ethyl acid

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o-phosphate, that such treated textile materials are free from the tendency to accumulate electrical charges and may be subjected to textile operations without encountering this difficulty. The employment of lauryl ethyl acid o-phosphate involves many advantages. The textile materials treated with this agent, in addition to readily dissipating any electrical charges that may tend to form, remain non-tacky, non-gummy, and can be readily manipulated during the textile operations. In addition, lauryl ethyl acid o-phosphate is non-corrosive to the machinery upon which the textile operations are performed, is highly stable to oxidizing influences, does not age, and may be readily removed, when desired, from the textile material by simple scouring operations after the textile operations have been performed. Furthermore, this compound is highly compatible with emulsifying, softening, or lubricating agents and may be readily applied to the textile yarns with or without such agents. Another particular advantage of this compound is that it readily wets the textile materials, and thus spreads over the materials quickly and thoroughly.

Instead of applying the lauryl ethyl acid o-phoshate to fibers, yarns, or filaments, this compound may be applied to already formed fabrics. In this case, and in the case of fabrics which have been made from yarns treated with this antistatic agent, the fabric does not retain charges of static electricity. As is well known, women's wearing apparel prepared from artificial silk, such as cellulose acetate, particularly when worn as an outer garment over a silk or wool under garment, accumulates charges of electricity during use and tends to adhere or cling to the wearer's body, thus affecting adversely the lines and designs of the garment. Fabrics treated according to my invention or prepared from yarns so treated do not accumulate electrical charges and accordingly do not tend to cling to the wearer's body but hang freely thereon.

In addition, the fabric so treated with the anti-static agent of my invention is not off odor and is free from any tacky or gummy feeling. Since they are not tacky and do not become charged with electricity, another advantage of such treated fabrics is that dust particles which normally are attracted by static charges do not cling readily to such materials and may be readily removed by brushing or shaking.

From the above considerations, it will be seen that the use of lauryl ethyl acid o-phosphate

when applied to or incorporated into textile materials and particularly into cellulose derivative textile materials, results in many advantageous effects.

It is a principal object of my invention to render textile materials free from the tendency to accumulate static electrical charges.

It is a further object of my invention to treat cellulose derivative yarns, fibers, or filaments to reduce or eliminate the tendency of such textile materials to generate or accumulate static electrical charges due to frictional influences.

Another object of my invention is to provide a method of overcoming the difficulties attendant the handling and manipulation of textile fibers and yarns involved in the conversion of such materials into textile fabrics.

A further object of the invention is to provide textile materials which are free from the tendency to accumulate or generate electrical charges.

A still further object is to provide a composition which when applied to textile yarns, filaments, or fibers eliminates the tendency of such materials to accumulate static charges.

The above and other objects of my invention are accomplished by treating or incorporating into fibers, yarns, threads, filaments, or fabrics, a small amount of lauryl ethyl acid o-phosphate. The textile materials treated according to my invention may be composed of any of the well-known textile materials, such as, cotton, wool, silk, flax, artificial yarns, as for example, yarns prepared from regenerated cellulose of the viscose or cuprammonium type, nylon, or from proteins as casein. However, my invention finds its greatest effectiveness and most effective application in the treatment of yarns, filaments, fibers or threads, formed from organic derivatives of cellulose which are normally either non-conductors or weak conductors of electricity, as for example, cellulose esters and ethers of cellulose. More specifically, as examples of such organic esters of cellulose, there may be mentioned cellulose acetate, cellulose formate, cellulose propionate, cellulose butyrate. As examples of organic ethers of cellulose, there may be mentioned the ethyl-, methyl-, or butyl-cellulose.

While the lauryl ethyl acid o-phosphate is preferably applied to the yarns, filaments, fibers or threads and the like, after they have been formed, it is to be understood that this anti-static agent may be incorporated in the solution of the organic derivative of cellulose from which such artificial products are spun. I have found that it is necessary to use only small amounts of the lauryl ethyl acid o-phosphate in order to render the textile materials completely effective to prevent the generation or accumulation of static electricity, for example, as little as 0.3%, based on the weight of the treated material will render the material completely effective in anti-static properties. However, if it is desired, larger amounts of the lauryl ethyl acid o-phosphate may be applied. On the other hand, even smaller amounts, such as, 0.1% of the lauryl ethyl acid o-phosphate is effective when it is applied to the textile materials together with a lubricant such as mineral, vegetable or animal oil as, for instance, a light mineral oil, olive oil, sperm oil, blown olive oil or blown sperm oil, or other suitable lubricating oils, such as, for example, sulfonated castor oil.

According to the preferred embodiment of the invention, the lauryl ethyl acid o-phosphate or similar anti-static agent according to the invention, is applied in conjunction with a textile lubricating oil of the type exemplified above, in an amount such that about 99 to about 90 parts of the textile lubricating oil are mixed with from about 1 to about 10 parts of the lauryl ethyl acid o-phosphate or similar agent. The amount of lauryl ethyl acid o-phosphate or similar agent, should be such that when the mixture is applied to the textile material, from about 0.1% to about 10%, based on the weight of the treated material, is applied thereto, such quantity being sufficient to prevent the accumulation of electrical charges in the textile material. Somewhat larger quantities of the anti-static agent according to the invention could be applied but are usually unnecessary because of the ease of spreading of the anti-static agent, particularly in admixture with the textile lubricating oil, and the high anti-static properties of the agents according to the present invention.

The lauryl ethyl acid o-phosphate alone or with a lubricant may be applied in any suitable manner as by immersion, spraying, roller, wick or felt. Thus, in the case of yarns, the anti-static agent may be applied by passing the yarns over wicks or felt bodies dipping into the anti-static material. In the treatment of fabrics prepared from yarns not treated with the anti-static material, the anti-static material is preferably applied after dyeing. This may readily be carried out by passing the fabric over rollers dipping into a trough containing the lauryl ethyl acid o-phosphate or a solution or suspension thereof.

Since the lauryl ethyl acid o-phosphate is readily soluble in animal, vegetable, or mineral oils as, for example, blown and unblown vegetable oils as olive, teaseed, castor, soy bean etc., the anti-static agent may be applied in compositions containing such lubricants. If desired, the anti-static agent may also be applied in the form of emulsions with such oils.

The following examples will serve to set forth several of the preferred embodiments of my invention but it is to be understood that the examples are merely by way of illustration and are not to be considered as limiting the invention.

Example 1

Cellulose acetate yarns, as they leave the spinning cabinet, are made to pass over wicks or rollers to which there is supplied lauryl ethyl acid o-phosphate. The rate of application is such that about 0.3% of lauryl ethyl acid o-phosphate, based on the weight of the treated material, is applied to the yarn.

Example 2

A yarn of cellulose acetate, as it is drawn from the spinning cabinet is caused to pass across a wick which dips into a solution containing 1 to 10 parts of lauryl ethyl acid o-phosphate and 90–99 parts of a light mineral oil. The wick is submerged in the solution so that the rate of speed at which the yarn is spun and the area of contact of the yarn with the wick is such as will apply about 2% of the solution, based on the weight of the yarn.

Example 3

Yarns prepared from cellulose acetate are treated with an emulsion containing 100 parts of lauryl ethyl acid o-phosphate, 900 parts of olive oil and 10,000 parts of water so that the amount of emulsion applied is about 4%, based on the weight of the treated yarns. The yarns may then

be readily converted into staple fibers, and the resulting fibers spun into yarn without encountering any difficulties due to accumulation of electrical charges, since such treated fibers "bleed off" any charges formed during the yarn forming operation.

Example 4

To cotton yarns, there is applied a solution comprising 30 parts of mineral oil, 65 parts of olive oil and 5 parts of lauryl ethyl acid o-phosphate. The solution is applied to the yarn at such a rate that about 0.5% of the anti-static agent, based on the weight of the finished yarn, is incorporated therein. In the weaving of such a treated yarn, static electrical charges are completely eliminated.

Example 5

To a solution of cellulose acetate in acetone such as is conventionally utilized in the spinning of textile fibers, there is added about 2½% of lauryl ethyl acid o-phosphate, based on the weight of the cellulose acetate. This solution is then extruded into an atmosphere wherein the acetone is evaporated from the solution. The filaments thus produced are readily wound or twisted without the formation of any static electrical charges. The filaments so prepared may be readily cut to form staple fibers and such fibers may be readily formed into yarns without encountering any difficulties due to the generation of static.

Example 6

To a 25% solution of cellulose acetate in acetone, there is added 5% of lauryl ethyl acid o-phosphate based on the weight of cellulose acetate. The resulting solution may then be spun into filaments by any suitable method of spinning such as the wet or dry method. The filaments thus obtained may be twisted into yarn or cut into staple fibers which may then be spun into yarns without encountering any accumulation of electrical charges.

It is to be understood that the lauryl ethyl acid o-phosphate may be employed alone or with a textile treating agent as an oil, as pointed out above. However, in addition to oils, other agents may be applied to the textile material simultaneously with the anti-static agent, such as, emulsifying agents, blending agents, dyes or other coloring matter where it is desired to color the material while it is undergoing the anti-static treatment. It is further to be understood that while the specific examples pertain to specific percentages of the various ingredients of the compositions, that the proportions may be varied within relatively wide limits depending upon the nature of the textile fiber treated.

It will be seen that my method of preventing and eliminating static charges and the anti-static agent utilized possesses many outstanding advantages. In the first place, the lauryl ethyl acid o-phosphate possesses outstanding antistatic activity, and particularly in connection with textile materials comprising organic derivatives of cellulose. It is easily applied and because of its ready spreading action, and solubility in oils, it also renders the textile materials amenable to the various textile operations. Its properties, chemical stability, and stability against oxidation and the ease with which it may be readily removed from the textile materials when it is no longer required add to its outstanding characteristics as an anti-static agent.

While the greatest advantages are obtained with

lauryl ethyl acid o-phosphate, and this is the preferred embodiment of my invention, other compounds of a similar nature in which the lauryl group is replaced by an alkyl group of from 6 to and including 18 carbon atoms may be employed. Also, the ethyl group may be replaced by a methyl, propyl, isopropyl or butyl group. In general, dialkyl acid o-phosphates may be employed in which one of the alkyl groups contains from 6 to 18 carbon atoms and the other from 1 to 4 carbon atoms. As examples of such compounds may be mentioned, lauryl methyl acid o-phosphate, lauryl propyl acid o-phosphate, lauryl isopropyl acid o-phosphate, lauryl butyl acid o-phosphate, hexyl ethyl acid o-phosphate, stearyl ethyl acid o-phosphate, undecyl propyl acid o-phosphate, octyl butyl acid o-phosphate, and other combinations of the long chain and short chain alkyl groups. As illustrative of the application of these compounds for rendering textile materials anti-static they may be employed in the same manner as the lauryl ethyl acid o-phosphate as illustrated in the hereinabove described examples. However, because of its outstanding anti-static activity and other highly advantageous properties hereinbefore mentioned, lauryl ethyl acid o-phosphate constitutes the preferred embodiment of my invention.

I claim:

1. Textile material containing from about 99 to about 90 parts of a textile lubricating oil and from about 1 to about 10 parts of a dialkyl acid o-phosphate wherein one of the alkyl groups has from 6 to 18 carbon atoms and the other from 1 to 4 carbon atoms, the quantity of dialkyl acid o-phosphate present ranging from about 0.1% to about 10%, based on the weight of the treated material, so as to be sufficient to prevent the accumulation of electrical charges in said textile material.

2. Textile material containing from about 99 to about 90 parts of a textile lubricating oil and from about 1 to about 10 parts of lauryl ethyl acid o-phosphate, the quantity of lauryl ethyl acid o-phosphate present ranging from about 0.1% to about 10%, based on the weight of the treated material, so as to be sufficient to prevent the accumulation of electrical charges in said textile material.

3. Textile material containing from about 99 to about 90 parts of a textile lubricating oil and from about 1 to about 10 parts of hexyl ethyl acid o-phosphate, the quantity of hexyl ethyl acid o-phosphate present ranging from about 0.1% to about 10%, based on the weight of the treated material, so as to be sufficient to prevent the accumulation of electrical charges in said textile material.

4. Textile material containing from about 99 to about 90 parts of a textile lubricating oil and from about 1 to about 10 parts of stearyl ethyl acid o-phosphate, the quantity of stearyl ethyl acid o-phosphate present ranging from about 0.1% to about 10%, based on the weight of the treated material, so as to be sufficient to prevent the accumulation of electrical charges in said textile material.

5. Textile material containing in amount sufficient to prevent the accumulation of electrical charges in said textile materials a dialkyl acid o-phosphate wherein one of the alkyl groups has from 6 to 18 carbon atoms and the other from 1 to 4 carbon atoms.

6. Textile material containing a textile lubricating oil and a dialkyl acid o-phosphate wherein

one of the alkyl groups has from 6 to 18 carbon atoms and the other from 1 to 4 carbon atoms, said phosphate being present in amount sufficient to prevent the accumulation of electrical charges in said textile material.

7. A cellulose ester textile material containing in amount sufficient to prevent the accumulation of electrical charges in said textile materials a dialkyl acid o-phosphate wherein one of the alkyl groups has from 6 to 18 carbon atoms and the other from 1 to 4 carbon atoms.

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