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COMPOSITE FABRIC AND METHOD OF MAKING SAME

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This invention relates to the preparation of stiffened fabrics and also to wearing apparel or other technical or commercial articles formed in whole or in part of such stiffened fabric, and more particularly to such articles of stiffened fabrics wherein the exposed layers of fabric comprise filaments or yarns containing organic derivatives of cellulose.

An object of my invention is to prepare fabrics of any desired degree of stiffness in a simple and expeditious manner. A further object of my invention is to prepare wearing apparel and other technical or industrial articles consisting of or containing an exposed fabric comprising filaments or yarns of on organic derivative of cellulose and a stiffening fabric, containing a plasticizer for the organic derivative of cellulose in the exposed layers. Other objects of the invention will appear from the following detailed description.

In the making of stiffened fabrics by causing cellulose acetate or other organic derivative of cellulose to melt or coalesce by operations involving the application of heat and pressure, it has previously been considered necessary to have present during this operation acetone or other volatile organic solvents or latent solvents for the derivative of cellulose. The use of such volatile organic solvents or latent solvents is objectionable when the exposed fabric or fabrics consist of or contain organic derivatives of cellulose, as the exposed fabric may be altered or marred by contact with the solvent or may even be entirely destroyed thereby.

I have found that composite fabrics may be formed, the outer or exposed layer or layers of which is made from a fabric consisting of or containing yarns formed from filaments containing an organic derivative of cellulose, by incorporating next to each layer of fabric containing yarns of an organic derivative of cellulose or between said layers a fabric that contains a plasticizer for the organic derivative of cellulose. The layer of fabric containing plasticizer may be made of yarns of an organic derivative of cellulose, of yarns of non-thermoplastic fibres and filaments, of yarns of non-thermoplastic fibres and filaments mixed with yarns containing an organic derivative of cellulose, or of yarns made by mixing thermoplastic and non-thermoplastic filaments, which fabrics are saturated, coated or otherwise have incorporated therewith a plasticizer for the organic derivative of cellulose of the assembly. By this method, there may be formed a stiffened fabric having good stiffening effects and firm adhesion between the various layers of the composite material by the mere application of heat and pressure. Water or moisture may, if desired, be present during the pressing. By this method, no solvent or other reagent that has a modifying action on the outer layers need be applied to or through the said outer layers.

Products formed by this invention may be used for any purpose where a stiffened and/or relatively more or less impermeable fabric is desired. An important application of such products is wearing apparel which may be formed wholly or in part of fabrics made or prepared in accordance with this invention. Thus, collars or cuffs may be formed entirely of the product of this invention. Alternatively, shirts may be made wherein attached collars, neckbands, cuffs, fronts or bosoms are made of such products. Hats or parts of hats may likewise be formed of such material, as may also be the inner or sweat bands of hats, visors for caps, cuffs or gauntlet gloves, inner lining of cravats, stiffening material used in the inner portions of garments, such as coats, to help retain the shape thereof, etc. The fabric of this invention may be used for a variety of other purposes and indeed may be used for any industrial or technical purpose where fabric of increased stiffness is required.

The finished article may consist of a front or exposed fabric and a backing fabric or a front or exposed fabric laminated to several layers of fabric. The backing fabric or at least one of the inner fabrics, where the assembly contains more than two layers of fabric, may be a fabric formed of yarns of an organic derivative of cellulose impregnated with a plasticizer. The backing fabric, or inner fabrics of the assemblies containing more than two layers of fabrics, may be made wholly of non-thermoplastic materials such as cotton, wool, linen, silk, etc. or they may be made of such materials interwoven or otherwise mixed with yarns and filaments of a thermoplastic material. Such fabrics are impregnated with a plasticizer for the organic derivative of cellulose present in the assembly.

A particular application of this invention is for sweat bands of hats. The bands may be formed by laminating and coalescing together two layers of fabric containing an organic derivative of cellulose with an intermediate layer of cotton fabric. The cotton fabric in this case will contain the plasticizer required for the union.

In order that the desired degree of stiffening and adhesion be attained upon the heat pressing either in the presence or absence of water, it is

of importance that there be present in the assembly being treated, a plasticizer, i. e. a relatively high-boiling or non-volatile solvent for the cellulose acetate or other organic derivative of cellulose employed in the assembly. The plasticizer may be present in any of the layers of fabric. However, if the exposed surfaces of the outer layers are not to be modified the plasticizer should be absent from those layers and be applied only to the inner layers. The plasticizer may be applied to the fabric in any suitable manner. Thus, the plasticizer or high-boiling solvent for the organic derivative of cellulose employed in the assembly may be applied to or incorporated in the desired fabric by passing the said fabric through a solution of plasticizer, by padding the plasticizer on the fabric or by spraying on to the fabric a solution of plasticizer in a volatile solvent. Or the plasticizer can be incorporated in the organic derivative of cellulose solution prior to or during the spinning operation. Any other suitable method may be employed for impregnating the backing or inner layers with a plasticizer.

Any suitable plasticizer may be employed, which plasticizer may or may not be soluble in water. The plasticizers may be any of the high-boiling solvents or softening agents as, for example, the aryl sulphonamids such as para ethyl toluol sulphonamid, the alkyl phthalates such as dimethyl phthalate, the dialkyl tartrates such as dibutyl tartrate, the alkoxy esters of polybasic organic acids such as diethoxy ethyl phthalate, the polybasic acid esters of the mono alkyl ethers of polyhydric alcohols such as diethylene glycol ethyl ether ester of phthalic acid the alkyl esters of phosphoric acid such as triethylglycol phosphate, the mixed alkyl and aryl phosphates, and camphor.

The amount of plasticizer present is preferably relatively large and on the order of from less than 40% to 150% or more of the weight of the organic derivative of cellulose present in the assembly of fabrics. Where the assembly is to consist of fabrics of an organic derivative of cellulose as the front and back layers and an inner layer of a cotton fabric, the amount of plasticizer applied to the cotton fabric may be as much as the cotton fabric will absorb and retain, i. e. the cotton fabric is saturated with the plasticizer.

In one form of this invention, the assembly of fabrics, comprising exposed or outer layers of a fabric containing an organic derivative of cellulose and an inner layer of a fabric containing a plasticizer for the organic derivative of cellulose in the outer layers, may be cut, sewn or otherwise shaped to articles and the assembly then pressed to lend stiffness and adhesion thereto. For instance, after the desired articles, such as sweat bands, collars, belts or other wearing apparel or parts thereof, are formed from an assembly comprising an inner layer of a non-thermoplastic material containing a plasticizer and outer layers of material containing organic derivatives of cellulose, the articles may then be treated with water and subjected to heat and pressure or subjected only to heat and pressure.

Products of this invention mave have any desired degree of stiffness which is relatively permanent so that they may be subjected to repeated launderings and may be dry cleaned without substantially losing their stiffness and/or the adhesion of each layer to the other. In this manner the use of starch or other extraneous stiffening materials during laundering may be avoided. As the composite material is preferably formed with the outer layers of fabric containing yarns or filaments containing an organic derivative of cellulose, there is a decided advantage in lending stiffness and coalescence to the article without the aid of extraneous material, as the use of such material results in a gloss on the laundered article, thus marring the uniform effect of color, texture and appearance of the organic derivative of cellulose fabric.

This invention may be carried out in a large number of ways, particularly as to the nature of the fabric or number of fabrics employed, provided that the fabrics containing yarns of organic derivatives of cellulose are employed in the composite material as the outer layers and also that in juxtaposition thereto is a fabric, of any suitable material, containing a plasticizer for the organic derivative of cellulose of the adjacent or outer layers. For instance, the composite material, such as a sweat band for a hat, may be formed by shaping the sweat band from a composite material having an outer fabric layer that contains filaments of organic derivatives of cellulose, and a liner of fabric, preferably a cotton duck, that has been padded with a substantial amount of plasticizer for the organic derivative of cellulose in the outer layers. In this method of forming articles the plasticizer acts only upon the inner side of the outer fabrics. This action is sufficient to cause a strong adhesion between the layers of the assembly yet does not mar or alter the textile appearance, soft hand or other properties of the outside of the outside layers.

This invention is not only applicable to laminated or composite articles wherein the outer layers of fabric contain only yarns or filaments of organic derivatives of cellulose. It is applicable also to composite articles that have an exposed or outer layer of fabric wherein yarns of other fibres are present together with the yarns or filaments of an organic derivative of cellulose. For instance, fabrics may be employed in which yarns of an organic derivative of cellulose alternate with non-thermoplastic yarns either in the warp or in the weft or both in any desired degree of alternation. This alternation may be, for instance, one. two, three or more cellulose acetate yarns with one, two, three or more yarns of cotton or other non-thermoplastic fibres. For convenience, the outer layers of fabric may be formed such that the warp may be made with such alternation of an organic derivative of cellulose yarn and the yarn of other fibres while the weft may consist wholly of such yarns of an organic derivative of cellulose or of yarns of other fibres, or fabric consisting of yarns made from mixed thermoplastic and non-thermoplastic fibres. If desired, a fabric may be used as the outer layer in which either the warp or weft consists wholly of cellulose acetate yarn; while the intermediate layers of fabric consist of any suitable material containing a sufficient amount of plasticizer for the cellulose acetate of the outer layer and the assembly of the fabrics caused to adhere to each other by heat pressing in the presence or absence of water. Adhesion effected under these conditions results in no alteration of the outer surface of the exposed layers since the plasticizer on the inner layers causes the organic derivative of cellulose, such as cellulose acetate, of only the inner side of the outer layers to soften, swell or become tacky or adhesive.

Any type of fabric formed from yarns containing organic derivatives of cellulose may be employed as the outer layers of fabric in the assem-

bly. This expedient gives rise to many novel effects that may be produced in stiffened fabrics. For instance, taffetas, satins, plushes, velvets or other types of fabric may be employed, which fabrics may be woven, knitted, netted or knotted. All exposed yarns, whether of organic derivatives of cellulose or other materials, are left unaltered in both appearance and hand.

The yarns or filaments which are employed to form the fabric may be made of any suitable organic derivative of cellulose, for instance, the organic esters of cellulose and the cellulose ethers. Examples of organic esters of cellulose are cellulose acetate, cellulose formate, cellulose propionate and cellulose butyrate, while examples of cellulose ethers are methyl cellulose, ethyl cellulose and benzyl cellulose.

In employing my invention, the composite material may be made of two or more layers of fabric, at least one layer of fabric, preferably the one that is exposed to view, having yarns of an organic derivative of cellulose. By this invention, any number of layers may be joined together to form stiffened articles. Thus, the stiffened article may contain a layer of cellulose acetate fabric, the exposed surface of which is unaltered, and bound thereto a layer of fabric containing cotton or other yarns such as yarns containing an organic derivative of cellulose. Furthermore, a composite article may be formed in which the inner fabric of non-thermoplastic material is surrounded by a fabric containing cellulose acetate. The composite material may be made of, for instance, six or seven layers of fabric provided that a layer of fabric containing a plasticizer is interposed between each two layers of fabric containing yarns or filaments of an organic derivative of cellulose. In the case of collars, cuffs, etc., where an exterior fabric containing cellulose acetate is desired, a layer of non-thermoplastic material containing a plasticizer may be interposed between two layers of fabric consisting of yarns or filaments of cellulose acetate and the same treated with water, after having been shaped and sewn, and the assembly pressed in the ordinary manner of pressing fabric materials or the assembly may be pressed without wetting with water.

In the forming of composite articles which are to be used in place of or to simulate to a certain extent, a leather product such as sweat bands for hats, belts, pocket-books, etc., the article after being formed with an exposed layer of cellulose acetate and a backing or inner layer of non-thermoplastic material containing a plasticizer for the cellulose acetate, may be dipped into an aqueous solution containing alcohols, with or without additional plasticizer, prior to pressing. The article thus formed, by regulating the constituents of the wetting solution, may be caused to have a slight or substantially complete coalescence of the yarns containing cellulose acetate on the exposed surface. This coalescence of the yarns on the outer surface produces an article having a slick leather-like feel and the textile appearance may or may not be obliterated.

To obtain good adhesion and stiffening properties, it is preferable to have water present during the application of heat and pressure, but it should be understood that this is not essential to the successful working of this invention. An aqueous liquid or steam may be applied to the assembly of fabrics in any suitable manner. Thus, water may be applied by spraying or brushing the fabric with water or by padding the material with water or by dipping the fabric in water. Where a slight or substantially complete loss of textile appearance and hand is desired in the outer fabrics, there may be employed an aqueous solution of alcohol, with or without a plasticizer, in place of the water. If steam is employed, it is preferable to employ a wet steam and the same may be injected into the material during the pressing operation in a manner similar to that of pressing woolen fabrics. Any suitable device may be used for pressing, for instance, hot irons, or the fabric may be pressed between pressure rolls, one or both of which are heated, or between a heated pressing iron or plate and a cold board or surface. The heating device may be heated to a desired temperature, for instance, 80° C. to 180° C. or more, and the pressure applied may be of any desired degree, for instance, from 10 to 600 pounds or more per square inch. By increasing the pressure to an extremely high degree a glazed surface may be imparted to the fabric.

Novel effects may be produced by pressing the composite material with a device wherein heat and pressure are applied only locally within the area of the composite material in such a manner as to make any desired design such as stripes, dots, rectangles or other geometrical, floral or other designs. By such a process, these designs are embossed into the composite material and the composite material is stiffened only at those points receiving the heat and pressure since only those portions that come in contact with the raised parts of the heating device become united, while the other portions retain the properties of the original fabrics. This local application of heat and pressure may be effected by manually operated means, if desired. By locally applying or having present a plasticizer on the backing the inner layers only in such localized places as are to be united, the union of other portions upon subsequent laundering is avoided.

By employing this invention, the layers of the composite fabric are joined together and the assembly stiffened without a visible alteration of the exposed layers of fabric that contain organic derivatives of cellulose. While the plasticizer on the backing or interior layers of fabric of the composited article is sufficient to cause a flow or softening of the organic derivatives of cellulose on the inner sides of the outer layers of the fabric, the action is not carried through the exposed layer of fabric to the outer surface thereof to alter the appearance or hand of the exposed part. Thus, the texture and hand of the exposed surface or surfaces of the composite fabric will be unaltered and may be the same as the unstiffened and/or unadhering surface layers.

In order further to illustrate my invention, but without being limited thereto, the following specific example is given:

Example.—A fabric consisting of a light weight cotton muslin is saturated with a plasticizer for cellulose acetate, for example, dimethyl phthalate. A fabric consisting of a woven taffeta comprising yarns of cellulose aceate is placed in juxtaposition to this fabric of cotton muslin. Alternatively, two pieces of cellulose acetate taffeta may have interposed between them a piece of the plasticized cotton muslin. This assembly may be cut into strips suitable for use as sweat bands for hats. The assembly of fabrics is then wetted on both sides with water. Thereupon the assembly is pressed with a hot iron or calender to form a stiffened material in which the fabrics are united. This results in a product of a stiffened composite ma-

terial in which the outer or exposed layers are of a fabric containing yarns of cellulose acetate having the same hand and appearance as though they were not stiffened or caused to adhere to the other layers of the assembly.

It is to be understood that the foregoing detailed description is merely given by way of illustration and many variations may be made therein without departing from the spirit of my invention.

Having described my invention, what I desire to secure by Letters Patent is:

1. The method of imparting stiffness or other properties to a fabric containing yarns of an organic derivative of cellulose, leaving the exposed surface of said fabric unaltered, which comprises joining the fabric containing the organic derivative of cellulose to a non-thermoplastic fabric having incorporated therewith a plasticizer for the organic derivative of cellulose by laminating the fabric and subjecting the laminated fabric to heat and pressure.

2. The method of imparting stiffness or other properties to a fabric containing yarns of cellulose acetate, leaving the exposed surface of said fabric unaltered, which comprises joining the fabric containing the cellulose acetate to a non-thermoplastic fabric having incorporated therewith a plasticizer for the cellulose acetate by laminating the fabric and subjecting the laminated fabric to heat and pressure in the presence of water.

3. The method of imparting stiffness or other properties to a fabric containing yarns of an organic derivative of cellulose, leaving the exposed surface of said fabric unaltered, which comprises joining the fabric containing the organic derivative of cellulose to a fabric consisting of cotton yarns having incorporated therewith a plasticizer for the organic derivative of cellulose by laminating the fabrics and subjecting the laminated fabrics to heat and pressure in the presence of water.

4. The method of imparting stiffness or other properties to a fabric containing yarns of cellulose acetate, leaving the exposed surface of said fabric unaltered, which comprises joining the fabric containing the cellulose acetate to a fabric consisting of cotton yarns having incorporated therewith a plasticizer for the cellulose acetate by laminating the fabrics and subjecting the laminated fabrics to heat and pressure.

5. The method of imparting stiffness or other properties to a fabric containing yarns of an organic derivative of cellulose, leaving the exposed surface of said fabric unaltered, which comprises joining the fabric containing the organic derivative of cellulose to a fabric consisting of cotton yarns impregnated with dimethyl phthalate by laminating the fabrics and subjecting the laminated fabrics to heat and pressure.

6. The method of imparting stiffness or other properties to a fabric containing yarns of cellulose acetate, leaving the exposed surface of said fabric unaltered, which comprises joining the fabric containing the cellulose acetate to a fabric consisting of cotton yarns impregnated with dimethyl phthalate by laminating the fabrics and subjecting the laminated fabrics to heat and pressure in the presence of water.

7. The method of imparting stiffness or other properties to a fabric containing yarns of an organic derivative of cellulose, leaving the exposed surface of said fabric unaltered, which comprises impregnating a non-thermoplastic fabric with a plasticizer for the organic derivative of cellulose, inserting said non-thermoplastic fabric between two layers of fabric containing yarns of an organic derivative of cellulose, applying water to the assembled fabrics and subjecting the assembly to heat and pressure.

8. The method of imparting stiffness or other properties to a fabric containing yarns of cellulose acetate, leaving the exposed surface of said fabric unaltered, which comprises impregnating a non-thermoplastic fabric with a plasticizer for the cellulose acetate, inserting said non-thermoplastic fabric between two layers of fabric containing yarns of cellulose acetate, applying water to the assembled fabrics and subjecting the assembly to heat and pressure.

9. Wearing apparel and other industrial and technical articles comprising an assembly of a plurality of layers of fabric adhering to each other, at least one of said fabrics containing yarns of an organic derivative of cellulose and at least one other fabric being non-thermoplastic and having incorporated therein a plasticizer for said organic derivative of cellulose, said fabrics being united to one another by the partial softening, under the influence of said plasticizer, of the inner side of said fabric containing yarns of organic derivative of cellulose, the said yarns being unaltered on the outer side of said fabric.

10. Wearing apparel and other industrial and technical articles comprising an assembly of a plurality of layers of fabric adhering to each other, at least one of said fabrics containing yarns of cellulose acetate and at least one other fabric being non-thermoplastic and having incorporated therein a plasticizer for said cellulose acetate, said fabrics being united to one another by the partial softening, under the influence of said plasticizers, of the inner side of said fabric containing yarns of cellulose acetate, the said yarns being unaltered on the outer side of said fabric.

11. Sweat bands, belts, collars, cuffs and similar articles comprising an assembly of a plurality of layers of fabric adhering to each other, at least one of said fabrics containing yarns of an organic derivative of cellulose and at least one other fabric being non-thermoplastic and having incorporated therein a plasticizer for said organic derivative of cellulose, said fabrics being united to one another by the partial softening, under the influence of said plasticizer, of the inner side of said fabric containing yarns of organic derivative of cellulose, the said yarns being unaltered on the outer side of said fabric and the said articles having an increased stiffness.

12. Sweat bands, belts, collars, cuffs and similar articles comprising an assembly of a plurality of layers of fabric adhering to each other, at least one of said fabrics containing yarns of cellulose acetate and at least one other fabric being non-thermoplastic and having incorporated therein a plasticizer for said cellulose acetate, said fabrics being united to one another by the partial softening, under the influence of said plasticizer, of the inner side of said fabric containing yarns of cellulose acetate, the said yarns being unaltered on the outer side of said fabric and the said articles having an increased stiffness.

GEORGE SCHNEIDER.