

## UNITED STATES PATENT OFFICE

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COMPOSITE FABRIC AND METHOD OF MAK-  
ING SAMEGeorge Schneider, Montclair, N. J., assignor to  
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6 Claims. (Cl. 154—2)

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 contain filaments or yarns containing an organic derivative of cellulose.

10 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 containing an organic derivative of cellulose and a stiffening fabric containing an organic derivative of cellulose and a plasticizer. Other objects of the invention will appear from the following detailed description.

20 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 for the derivative of cellulose. The use of such volatile organic solvents is objectionable when the exposed fabric or fabrics consist of or contain organic derivatives of cellulose, as the exposed fabric may be altered in either appearance or hand or both by contact with the solvent or may even be entirely destroyed thereby.

30 I have found that composite fabrics may be formed, the outer layer or exposed layers of which is a fabric or fabrics 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 such fabrics, a fabric that contains both an organic derivative of cellulose and a plasticizer. The inner or adhesive layer of fabric may be a fabric made of yarns of an organic derivative of cellulose or a fabric of other material, such as cotton, 45 that contains a coating or is impregnated with an organic derivative of cellulose, which fabrics are saturated, coated or otherwise contain a plasticizer for the organic derivative of cellulose. By this method, a stiffened fabric may be formed having good stiffening effects and firm adhesion between the various layers of the composite material by the mere application of heat and pressure alone or when water or moisture is also 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 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. 5 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 10 Alternatively, shirts may be made wherein attached collars, neck bands, 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 15 caps, cuffs of gauntlets, inner linings 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 20 may be used for any industrial or technical purpose where fabric of increased stiffness and/or more or less impermeability is required and it is desired to have the exposed layers of fabric containing the properties of fabrics formed of an 25 organic derivative of cellulose.

The adhesive or inner layer or layers of fabric may be a fabric formed of yarns of an organic derivative of cellulose or substantially of an organic derivative of cellulose. Further, the adhesive or inner layer or layers of fabric may be a fabric formed of non-thermoplastic yarns, which fabric has been coated or impregnated with an organic derivative of cellulose, for instance, by coating the fabric with an aqueous slurry of a 35 finely divided powder comprising an organic derivative of cellulose. Any suitable amount of an organic derivative of cellulose may be present in the inner layers, it being important, however, that a sufficient amount be present to furnish the 40 adhesive to cause the layers of fabric in the assembly to adhere to each other.

In order that the desired degree of stiffening and adhesion be attained upon the heat pressing in the presence of water, it is of importance that 45 there be present in the assembly being treated a plasticizer of relatively high boiling or non-volatile solvent for the cellulose acetate or other organic derivative of cellulose employed in the inner layers or adhesive layers of the composite material. This plasticizer may be caused to be present in any manner. Thus, the plasticizer or high boiling solvent for the organic derivative of cellulose employed in the fabric of the inner layer may be applied to or incorporated in the fabric of 55

the inner layer preferably by passing the fabric containing the organic derivative of cellulose through a solution of plasticizer, by padding the plasticizer on such a fabric or by spraying onto the fabric a solution of such a plasticizer in a volatile solvent. However, the plasticizer may be incorporated in the inner or adhesive fabric by adding the plasticizer to the spinning solution from which the yarns are formed, when employing fabrics formed of yarns containing an organic derivative of cellulose, or by incorporating the plasticizer with the organic derivative of cellulose powder or other form of coating material when employing a non-thermoplastic fabric that has been coated with an organic derivative of cellulose.

Any suitable plasticizer may be employed, which plasticizer may or may not be soluble in water. Examples of suitable plasticizers for cellulose acetate are dimethyl phthalate, dibutyl phthalate, diethyl tartrate, dibutyl tartrate, triacetin, etc. The amount of plasticizer present is preferably relatively large and on the order of from less than 40 per cent to 150 per cent or more of the weight of the organic derivative of cellulose present in the inner layers of fabric that are to bind together the outer layer or layers of fabric containing an organic derivative of cellulose.

In one form of this invention the assembly of fabrics, with an intermediate layer of a fabric containing non-thermoplastic fibres, for instance, cotton, wool, silk, etc., that contains padded or impregnated thereon or therein a substantial amount of an organic derivative of cellulose and plasticizer, may first be cut, sewn or otherwise shaped and the assembly then pressed to lend stiffness and adhesion to said assembly. For instance, after the desired articles such as collars, cuffs or other wearing apparel or parts thereof comprising an inner fabric that is in touching relation to the fabrics containing an organic derivative of cellulose are formed, a plasticizer and a substantial amount of an organic derivative of cellulose being present on the inner fabric, the articles may then be treated with water and subjected to heat and pressure to impart the desired stiffness and/or impermeability. In this manner the sewing of stiffened material is avoided.

In another form of this invention the assembly of fabrics that contain exposed or outer layers of a fabric containing an organic derivative of cellulose and an intermediate layer of a fabric containing yarns of an organic derivative of cellulose and a plasticizer incorporated therewith or thereupon, may be cut, sewn or otherwise shaped and the assembly then pressed to lend stiffness and adhesion to said assembly. For instance, after the desired articles, such as collars, cuffs, or other wearing apparel or parts thereof are formed, an inner layer that contains a plasticizer and yarns of an organic derivative of cellulose being present, the articles may be treated with water and then subjected to heat and pressure.

Products of this invention have any desired degree of stiffness which is relatively permanent so that they may be subjected to repeated laundering without substantially losing their stiffness and/or their adhesion or lamination of each layer to the other. In this manner the use of starch or other extraneous stiffening material during laundering may be avoided. As the composite material is preferably formed with the outer layers of fabric being of yarns or filaments con-

taining 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 such material could show as a gloss on the laundered article which might mar the unique 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 fabrics containing yarns of organic derivatives of cellulose are contained in the composite material as the outer layers and also that in juxtaposition thereto is a fabric containing yarns of organic derivatives of cellulose and a plasticizer or a non-thermoplastic material containing a coating or impregnation of an organic derivative of cellulose and a plasticizer for the thermoplastic material of the inner or adhesive layers. For instance, the composite material such as a collar for a shirt may be formed by shaping the collar of a material made of yarns or filaments of organic derivatives of cellulose containing a liner of fabric formed of organic derivatives of cellulose that have been padded with a substantial amount of a plasticizer for the said organic derivative of cellulose.

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 fabric wherein the yarns or filaments of an organic derivative of cellulose predominate. 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, 1, 2, 3 or more cellulose acetate yarns with 1, 2, 3 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 yarn of other fibres, while the weft may consist wholly of such organic derivative of cellulose yarn or wholly of yarn of other 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 fabric containing sufficient organic derivatives of cellulose and plasticizer to cause an adhesion of the layers of fabric to each other upon heat pressing in the presence of water. Adhesion effected under these conditions results in no alteration of the layers since the plasticizer on the inner layers causes the organic derivative of cellulose of only the inner layers to soften, swell or otherwise cause the adhesion of the various layers.

Any type of fabric woven from yarns containing organic derivatives of cellulose may be employed as the outer layers, which expedient gives rise to many novel effects that may be produced in stiffened fabrics. For instance, taffetas, satins, plushes, velvets or any other type of fabric may be employed, which fabrics may be woven, knitted or netted. All exposed yarns, whether of organic derivative 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. For example, the organic esters of cellulose may be cellulose acetate, cellulose formate, cellulose propionate and cellulose butyrate, while examples of cellulose ethers are methyl cellulose, ethyl cellulose and benzyl cellulose. Further, the same or different organic derivatives of cellulose may be employed with the plasticizer to form the adhesive material of the inner or non-exposed adhesive layers.

In employing my invention a composite material may be made consisting of two or more layers of fabric, at least one, preferably the one that is exposed to view, layer of fabric having yarns of organic derivatives of cellulose. By this invention, any number of layers may be joined together to form a stiffened article. Thus, the stiffened article may contain a layer of unaltered fabric containing cellulose acetate and a layer of fabric bound thereto containing cotton or other yarns such as yarns containing organic derivatives of cellulose, or a composite material may be formed in which an adhesive fabric is surrounded by a fabric containing cellulose acetate. Further, a composite material may be made of, for instance, six or seven layers provided that a layer of adhesive material containing an organic derivative of cellulose and plasticizer is interposed between each two layers of fabric containing yarns or filaments of organic derivatives of cellulose. In the case of collars, cuffs, etc. where an exterior of fabric containing cellulose acetate is desired, a layer of adhesive fabric consisting of yarns containing an organic derivative of cellulose and 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.

To obtain good adhesion and stiffening properties water should be present during the application of heat and pressure in accordance with 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. 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 passed 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 per square inch.

Novel effects may be produced by pressing the composite material with a device wherein heat and pressure are applied only to local spots of the area of the composite material in such a manner to make any desired designs 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 same is stiffened only at those points receiving the heat and pressure since only those portions that come in contact with the embossed portions of the heated device become united, while the other portions retain the properties of the origi-

nal fabrics. This local application of heat and pressure may be done by manually operated means if desired. By locally applying or having present the plasticizer on the adhesive layer or layers only in localized places which 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 the organic derivative of cellulose. While the plasticizer on or in the interior layers or adhesive layers of fabric is sufficient to cause a flow or softening of the organic derivative of cellulose of the interior layers of fabric, the action is not carried through the exposed layers of fabric to alter the appearance or hand of the exposed part. Thus, the texture and hand of the part 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 woven taffeta of cellulose acetate is padded with substantially its own weight of a plasticizer for the cellulose acetate, for example, dibutyl tartrate, is covered on both sides with a fabric consisting wholly of acetone soluble cellulose acetate. This composite material is cut to shape and sewn in any suitable manner such as into a cuff or collar. The same 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 material in which the outer layers or exposed layers of same are of a fabric containing yarns of cellulose acetate, which yarns have the same hand and appearance as though they were not stiffened or caused to adhere to the other layers of fabric.

It is to be understood that the foregoing detailed description is given merely 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 to collars, cuffs and the like containing yarns or filaments of an organic derivative of cellulose while leaving the exposed surface of said collars or cuffs unaltered, which comprises assembling a fabric containing yarns or filaments of an organic derivative of cellulose, said fabric comprising the outer surface of said collars or cuffs, with a fabric containing organic derivatives of cellulose and a plasticizer therefor, applying water to the assembled fabrics and subjecting the assembly to heat and pressure in the presence of said water whereby the assembly is laminated and stiffened.

2. The method of imparting stiffness to collars, cuffs and the like containing yarns or filaments of cellulose acetate while leaving the exposed surface of said collars or cuffs unaltered, which comprises assembling a fabric containing yarns or filaments of cellulose acetate, said fabric comprising the outer surface of said collars or cuffs, with a fabric containing cellulose acetate and a plasticizer therefor, applying water to the

assembled fabrics and subjecting the assembly to heat and pressure in the presence of said water, whereby the assembly is laminated and stiffened.

3. The method of imparting stiffness to collars, cuffs and the like containing yarns or filaments of an organic derivative of cellulose while leaving the exposed surface of said collars and cuffs unaltered, which comprises interposing between layers of fabric forming the outer layers of said collars or cuffs a layer of fabric comprising yarns or filaments of an organic derivative of cellulose and a plasticizer therefor, applying water to the assembled fabrics and subjecting the assembly to heat and pressure in the presence of said water, whereby the assembly is laminated and stiffened.

4. The method of imparting stiffness to collars, cuffs and the like containing yarns or filaments of cellulose acetate while leaving the exposed surface of said collars and cuffs unaltered, which comprises interposing between layers of fabric forming the outer layers of said collars or cuffs a layer of fabric comprising yarns or filaments of cellulose acetate and a plasticizer therefor, applying water to the assembled fabrics and subjecting the assembly to heat and pressure in the presence of said water, whereby the assembly is laminated and stiffened.

5. The method of imparting stiffness to collars, cuffs and the like containing yarns or fila-

ments of an organic derivative of cellulose while leaving the exposed surface of said collars or cuffs unaltered, which comprises treating a non-thermoplastic fabric comprising the unexposed layer of said collars or cuffs with a mixture of an organic derivative of cellulose and a plasticizer therefor, inserting the so-treated non-thermoplastic fabric between two layers of fabric containing yarns or filaments of an organic derivative of cellulose and comprising the outer layers of said collars or cuffs, applying water to the assembled fabrics and subjecting the assembly to heat and pressure in the presence of said water, whereby the assembly is laminated and stiffened.

6. The method of imparting stiffness to collars, cuffs and the like containing yarns or filaments of cellulose acetate while leaving the exposed surface of said collars or cuffs unaltered, which comprises treating a non-thermoplastic fabric comprising the unexposed layer of said collars or cuffs with a mixture of cellulose acetate and a plasticizer therefor, inserting the so-treated non-thermoplastic fabric between two layers of fabric containing yarns or filaments of cellulose acetate and comprising the outer layers of said collars or cuffs, applying water to the assembled fabrics and subjecting the assembly to heat and pressure in the presence of said water, whereby the assembly is laminated and stiffened.

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