Patented Aug. 16, 1938

2,126,754

UNITED STATES PATENT OFFICE

2,126,754

FABRIC AND METHOD OF PREPARING SAME

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No Drawing. Application August 9, 1934, Serial No. 739,108

8 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 fabrics.

An object of our invention is to prepare fabrics of any desired degree of increased stiffness and in a simple and expeditious manner. A further object of our invention is to prepare wearing apparel and other technical or industrial articles consisting of or containing such stiffened fabric. Other objects of the invention will appear from the following detailed description.

In making stiffened fabrics by causing cellulose acetate or other derivative of cellulose material to melt or coalesce at least partially by operation involving the application of heat and pressure in the presence of non-thermoplastic fibres, we have found that the resulting layer or film of derivative of cellulose decreases the opacity of the final product, due probably to the fact that such derivative of cellulose material "wets" or makes optical contact with the non-thermoplastic fibres. As a result of this, the resulting product does not often have the desired appearance. Thus for instance if white collars are to be formed by interposing a layer of cellulose acetate fabric between two layers of white cotton or linen fabrics and heat and pressure applied in the presence of a liquid that causes stiffening, the resulting collars are not pure white but have a grayish cast.

We have found that this difficulty may be overcome and other advantages achieved, if there is present in the derivative of cellulose material a finely divided pigment-like material. If such pigment is white or of light color, the composite fabric will retain the color or appearance of the outer layers of fabric whereas the color or appearance thereof may be altered by the employment of colored pigments.

We prefer to have present volatile liquids that are not active solvents for cellulose acetate at ordinary temperatures but which cause the same to stiffen at elevated temperatures during the application of heat and pressure. Since these liquids are not active solvents at ordinary temperatures, action on the cellulose acetate takes place only upon application of heat and pressure, and therefore by applying heat and pressure only locally, ornamental or other special effects may be produced. The use of such non-solvents is preferred, since the use of liquids that are active solvents at ordinary temperature is often disadvantageous since they act too quickly and produce defects in the finished article for various reasons, while with the use of non-solvents, such defects are avoided.

The products formed by this invention may be used for any purpose where a stiffened and/or relatively impermeable fabric is desired. An important application of such products is wearing apparel which may be formed in whole 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 the 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 the inner or sweat bands of hats, visors for caps, cuffs of gauntlets, inner linings for cravats, stiffening material used in the inner portions of garments such as coats to help retain the shape thereof, etc. The fabrics 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 and/or impermeability is required.

In one form of this invention the assembly of fabrics with an intermediate layer comprising cellulose acetate and finely divided pigment-like material employed as starting material may first be cut, sewn or otherwise shaped. After the desired articles, such as collars, cuffs or other wearing apparel or parts thereof are formed, they may then be treated with a liquid that is either a solvent for the cellulose acetate or causes the cellulose acetate to stiffen at elevated temperatures and then subjected to heat and pressure to impart the desired stiffness and/or impermeability. In this manner the sewing of stiff material is avoided.

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. In this manner the use of starch or other extraneous stiffening materials during laundering may be avoided.

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 cellulose acetate in any form, such as powder, film or yarns or filaments, and the finely divided pigment are present in the fabric if a single fabric is used, or in or near at least one of the fabrics if a plurality of fabrics are used.

If the cellulose acetate is present in the form

of yarns or filaments, there should be present in the product treated at least one layer of fabric, which either consists wholly of cellulose acetate yarn containing finely divided pigment, or which is a mixed fabric containing yarn of cellulose acetate containing finely divided pigment alternating either in the warp or in the weft or both, in any desired degree of alternation, with yarns of other non-thermoplastic fibres such as cotton, regenerated cellulose, linen, wool or natural silk. 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 warp may be made with such alternation of cellulose acetate yarn containing finely divided pigment and yarn of other fibres, while the weft may consist wholly of such cellulose acetate yarn or wholly of yarn of other fibres. However the weft may consist of an alternation of such cellulose acetate yarns and non-thermoplastic yarns of other fibres, in which case, if the fabric is made in ordinary looms, the alternations will be preferably in two's or multiples of two's. If desired a fabric may be used in which either the warp or the weft consists wholly of cellulose acetate yarn containing finely divided pigment while the other component consists of non-thermoplastic yarn.

Instead of employing a woven fabric, a knitted or netted fabric may be employed. Also a fabric containing mixed yarn containing both filaments of cellulose acetate containing finely divided pigment and fibres of cotton or other non-thermoplastic material may be employed.

Only a single layer of fabric consisting wholly of pigmented cellulose acetate yarn or a single layer of any of the fabrics above described containing both pigmented cellulose acetate yarn or filaments and non-thermoplastic fibres may be treated by this invention, whereby relatively thin fabric having the desired degree of stiffness or impermeability throughout or only locally may be produced. Alternatively 2, 3, 4 or more of such fabrics may be treated with the volatile liquid that causes stiffening at elevated temperatures, and heat and pressure applied to the whole surface to form a composite fabric that is united throughout, or only in local areas by application of heat and pressure only at the desired local areas.

In another, and in some cases preferred method of carrying out the invention, one or more fabrics consisting wholly of non-thermoplastic yarns, such as cotton, linen, reconstituted cellulose, wool or silk, is assembled with one or more fabrics consisting wholly of pigmented cellulose acetate yarn or of a mixture of pigmented cellulose acetate yarn and filaments and yarn of nonthermoplastic fibres, as above described, may be treated by this invention, whereby a composite fabric made up of a plurality of layers may be made. If a product is to be produced wherein all the layers thereof are united, it is of importance where two or more layers of fabric consisting wholly of non-thermoplastic material is used, that at least one layer of fabric consisting of or containing pigmented cellulose acetate yarn be interposed between such layers of fabric.

Instead of employing the cellulose acetate in the form of yarns or filaments, it may be present in other forms. Thus it may be in the form of sheet-like material such as foil having a thickness of 0.0005 to 0.003" or more which may be prepared by casting or flowing a solution of cellulose acetate containing finely divided pigment in a volatile solvent, which solution may or may not contain plasticizers onto polished surfaces of bands, drums, film wheels, etc. and permitting the volatile solvent to evaporate.

Alternately fabrics of any desired construction and made of yarns of cotton, reconstituted cellulose, linen, natural silk, wool or other non-thermoplastic fibres may be impregnated with or coated with a solution of cellulose acetate containing finely divided pigment with or without plasticizer in a volatile solvent. If this volatile solvent is permitted to evaporate substantially completely, the coated or impregnated fabric may be stored until it is used, in which case it is necessary that a suitable liquid be present during the application of heat and pressure if a well stuck laminated product is desired. However if the volatile solvent of the coating or impregnated pigmented cellulose acetate solution is not permitted to evaporate to too large an extent, no extraneous volatile liquid need be used.

The layer of cellulose acetate that is interposed between the fabrics may be in the form of finely divided powder in intimate admixture with finely divided pigment, with which a plasticizer may or may not be in intimate admixture. This powder may be blown or sprayed onto one or more layers of the frabics to be laminated and if desired gums or other appropriate binders may be employed to cause such powder to adhere to the fabrics.

In still another form of this invention a fabric made of or containing non-thermoplastic fibres may be coated or impregnated with an intimate mixture of finely divided cellulose acetate and pigment with or without plasticizers, and binders or agglutinants such as gum tragacanth, gum arabic, and this fabric is then interposed between two or more layers of fabric which consist wholly of non-thermoplastic fibres, such as cotton, linen, regenerated cellulose, wool, or natural silk.

As instances of the manner that the various fabrics may be assembled, the following are given. In the case of collars, cuffs, etc. where an exterior of cotton or linen is desired, a layer of fabric consisting wholly of or containing pigmented cellulose acetate yarn, as above described may be interposed between two layers of fabric consisting of cotton, linen or other non-thermoplastic fibres. An assembly that is also useful for such purposes comprises three layers of fabric consisting wholly of such non-thermoplastic yarns, with a layer of fabric consisting of or containing pigmented cellulose acetate yarn between each of such fabrics.

Any suitable pigment may be employed in practicing this invention. Examples of white inorganic pigments are titanium dioxide, stannic oxide, antimony oxide, barium sulfate, lead sulfate, aluminum oxide, barium borate, while examples of white pigments of organic nature are diacetyl benzidine, diacetyl toluidine, dibenzoyl benzidine and naphthyl urea.

The following are examples of colored pigments that may be employed—For yellow, ochre, sienna, chrome yellow, tin bronze, etc. may be used. For red, Venetian red, red lead, vermillion, etc. may be employed. For blue, ultramarine, Prussian blue, Milori blue. etc.: for green, Guignet's green, verdigris, chrome green, etc.; for brown, raw umber, burnt umber or Vandyke brown; for black, lamp black, graphite, etc., may be used. To obtain other colors, the pigments may be mixed in accordance with the colorist's art.

The amount of finely divided pigment employed

will vary with the particular requirements and the nature of the pigment employed and generally will be from 1 to 10% of the weight of the cellulose acetate present. The pigment is preferably in very fine form, the particles having a diameter of less than 0.1 to 5 microns for increasing the covering power. This fine size may be obtained by grinding the pigment with water, an oil, or a solution of cellulose acetate in a ball or pebble mill. The pigment may be incorporated in the cellulose acetate yarns, filaments, foils, etc. by admixture in the dopes or solutions from which they are formed.

To obtain good adhesion, an appropriate liquid should be present during the application of heat and pressure to the assembly. Examples of such liquids are active solvents for the cellulose acetate, such as acetone, ethyllactate, formal glycerol, etc. which may be diluted with water or other liquids to restrict their solvent power. Solutions of plasticizers in volatile liquids that may or may not be active solvents may also be used for this purpose.

A preferred liquid to be used is a volatile liquid that acts on the cellulose acetate at elevated temperatures so as to cause the same to stiffen, but which is preferably not an active solvent at ordinary temperatures. We prefer to use for this purpose ethyl alcohol (denatured or undenatured) or methyl alcohol containing water or mixtures of these, since they are relatively inexpensive. Ethyl alcohol containing about 20% of water is particularly desirable as its vapors are not toxic or disagreeable. Less advantageously, more or less water may be added to the alcohol. Aqueous solutions of ethyl alcohol or of methyl alcohol of 55 to 90%, particularly of about 80%, concentration are very useful for this purpose. Another example of a suitable liquid that may be used in an aqueous solution of the monomethyl ether of ethylene glycol containing say about 20% of water. These liquids are not active solvents for cellulose acetate at ordinary temperatures.

The liquid may be applied to the assembly of fabrics having an intermediate layer containing pigmented cellulose acetate in any suitable manner, such as by dipping, spraying or brushing. A convenient manner of wetting the assembly is by padding the same with the liquid. If an assembly of two or more fabrics is treated, both sides of the assembly should be wetted with the liquid, as it is desirable that all of the layers of the fabric present be wetted therewith when heat and pressure is applied.

The so wetted fabric or assembly of fabrics is then subjected to heat and pressure. This may be done by any suitable device, for instance by hot ironing or by passing between pressure rolls, one or both of which are heated, or between a heated roller and a heated or cold plate or surface, or between a heated pressing iron or plate and a cold board or surface. The heating device may be heated to the desired temperatures for instance 80 to 180° C. or more and the pressure applied may be any desired pressures, for instance from 10 to 600 pounds per square inch.

If heated devices that have desired designs, such as stripes, dots, rectangles or other geometric, floral or other designs, embossed thereon are employed, novel effects are obtained, 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 original fabrics. This local application of heat and pressure may be done by manually operated means if desired.

In order further to illustrate our invention, but without being limited thereto, the following example is given.

Example

For making fabrics to be used for making a desired article, there is employed an assembly of two layers of cotton or linen fabric with an interposed layer of fabric consisting wholly of acetone soluble cellulose acetate filaments containing an amount of titanium dioxide of 2 to 5% of the weight of the cellulose acetate present. Instead of employing as the intermediate layer a fabric consisting wholly of pigmented cellulose acetate yarn, there may be employed a fabric containing both pigmented cellulose acetate yarn and cotton yarn in any of the desired constructions as has been described.

The assembly is then wetted on both sides with an aqueous solution of ethyl alcohol (denatured or not) of 80% concentration. Thereupon the assembly is pressed with a hot iron or calender to form a stiffened material in which the fabrics are united. Preferably the heating and pressing is done on both sides of the assembly. By controlling the degree of heat and pressure and/or selection of the type of fabrics employed and the amount of cellulose acetate present, the degree of stiffness may be controlled. Generally a semi-stiff fabric is formed, which retains its stiffness after repeated laundering so that the use of starch or like material is not required.

If collars or cuffs or bosoms or other articles which are to be sewn onto shirts or other articles of apparel are to be formed, it is advantageous to cut the assembly of fabrics to the desired shape or form and sew it to the shirt or other article prior to the application of the aqueous alcohol and the heat and pressure so that the assembly is stiffened and united by wetting with the aqueous alcohol and application of heat and pressure only after the shirt or other article is completed.

The fabrics and articles obtained by this invention may be made more or less stiff as desired by controlling the amount of cellulose acetate present in the layer in the assembly of fabrics being treated; the more cellulose acetate present, the stiffer the resultant products. The fabrics or other articles may be rendered softer by the incorporation of plasticizers, such as diethyl phthalate, dimethyl phthalate, dibutyl tartrate, etc., in the aqueous alcohol or onto or in the layer containing the cellulose acetate.

While this invention has been described particularly in connection with cellulose acetate, such cellulose acetate may be replaced in whole or in part by other derivatives of cellulose such as cellulose nitrate, or cellulose formate, cellulose propionate, cellulose butyrate, or other organic esters of cellulose, or methyl cellulose, ethyl cellulose and benzyl cellulose or other cellulose ethers, in which case suitable liquids having the required properties for aiding union under heat and pressure will tbe selected.

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 our invention.

Having described our invention, what we desire to secure by Letters Patent is:

1. Stiffened fabrics and fabric articles, comprising layers of textile fabric composed substantially of non-thermoplastic material united to

one another by means of an intermediate layer of textile fabric containing thermoplastic cellulose derivative yarns which contain a finely divided pigment.

2. Stiffened fabrics and fabric articles, comprising layers of textile fabric composed substantially of non-thermoplastic material united to one another by means of an intermediate layer of textile fabric containing cellulose acetate yarns which contain a finely divided white pigment.

3. Stiffened fabrics and fabric articles, comprising layers of textile fabric composed substantially of non-thermoplastic material united to one another by means of an intermediate layer of textile fabric containing cellulose acetate yarns which contain finely divided titanium dioxide.

4. Stiffened fabrics and fabric articles, comprising layers of cotton fabric united to one another by means of an intermediate layer of textile fabric containing cellulose acetate yarns which contain finely divided titanium dioxide.

5. Process for the production of stiffened fabrics and fabric articles, which comprises uniting layers of textile fabric, composed substantially of non-thermoplastic material, to one another with the aid of heat and pressure by means of an intermediate layer of textile fabric containing thermoplastic cellulose derivative yarns which contain a finely divided pigment-like material.

6. Process for the production of stiffened fabrics and fabric articles, which comprises uniting layers of textile fabric, composed substantially of non-thermoplastic material, to one another with the aid of heat and pressure by means of an intermediate layer of textile fabric containing cellulose acetate yarns which containing a finely divided pigment-like material.

7. Process for the production of stiffened fabrics and fabric articles, which comprises uniting layers of textile fabric, composed substantially of non-thermoplastic material, to one another with the aid of heat and pressure by means of an intermediate layer of fabric containing cellulose acetate yarns which contain a finely divided pigment-like material, the uniting of the fabrics being facilitated by the presence of aqueous alcohol.

8. Process for the production of stiffened fabrics and fabric articles, which comprises uniting layers of textile fabric, composed substantially of non-thermoplastic material, to one another with the aid of heat and pressure by means of an intermediate layer of fabric containing cellulose acetate yarns which contain finely divided titanium dioxide, the uniting of the fabrics being facilitated by the presence of a mixture of 80% ethyl alcohol and 20% water.

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