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H. I. HUEY ET AL

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METHOD OF PRODUCING PATTERNED CELLULOSIC FABRIC

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Fig. 1

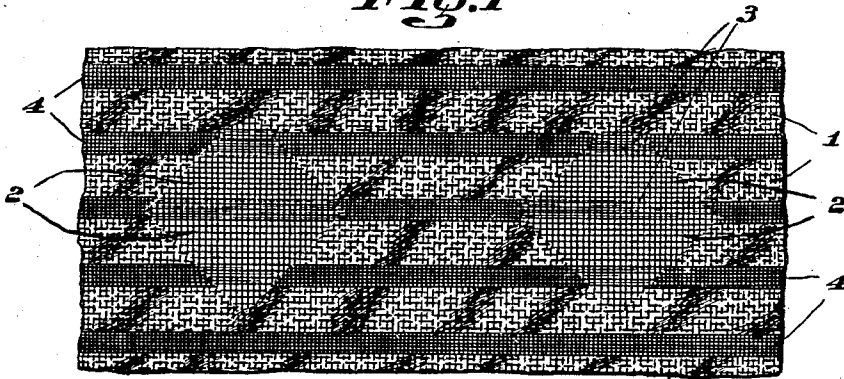
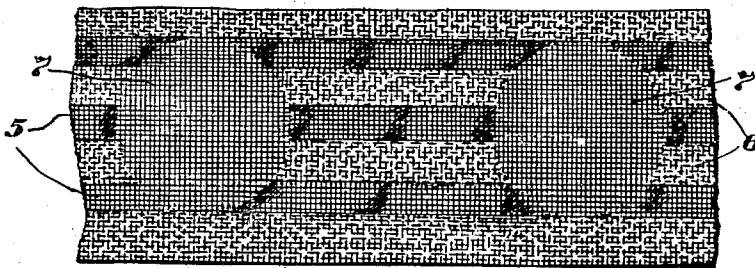


Fig. 2



INVENTORS
HAROLD I. HUEY
WILLIAM W. RUSSELL
BY
Edgar H. Hunt
ATTORNEY

UNITED STATES PATENT OFFICE

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METHOD OF PRODUCING PATTERNED
CELLULOSIC FABRIC

Harold I. Huey, Saylesville, and William W. Russell, East Providence, R. I., assignors to Sayles Finishing Plants, Inc., Saylesville, R. I., a corporation of Rhode Island

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4 Claims. (Cl. 8—18)

The present invention relates to the treatment of cellulosic fabric, woven or unwoven, composed of or containing yarns or filaments of cotton, ramie, linen, rayon and the like, and is particularly applicable to cotton cloth. More particularly, the invention relates to such fabrics wherein a pattern formed by the presence therein of areas of differing sheerness and stiffness is emphasized and brought into relief by a crinkling or puckering of the fabric in certain selected areas only, and to methods of producing the same.

The object of the invention is to provide such relief-patterned cellulosic fabrics possessing novel advantageous qualities and also to provide novel methods by which such relief patterning may be accomplished more simply, economically and efficiently than with previously known methods.

In the accompanying drawing, Fig. 1 is a plan view of a portion of a fabric having a relief pattern effect produced by one method of the present invention, and Fig. 2 is a plan view of a fabric portion having a relief pattern produced by another process of the invention.

Our invention is based on the discovery that by coating the yarns or filaments in an area of a cellulosic fabric with the precipitate from a solution of one of a class of water insoluble cellulose derivatives, not only does the fabric take on a sheerness or transparency and added luster in the area so coated, but also, when the fabric is subjected without tension to the action of a strong caustic, the yarns or filaments of said area do not shrink and the effect of such caustic treatment is not to detract from the sheerness and luster of said area but rather to accentuate those qualities. These results were surprising because it was known that when a fabric area is coated with cellulose itself, such as regenerated cellulose, such treatment with a caustic causes the yarns to shrink substantially and also reduces materially the sheerness and luster imparted by the cellulose coating.

The class of cellulose derivatives which we have found to operate in this manner comprises those water-insoluble derivatives of cellulose which are soluble or at least strongly swelled by aqueous solutions of caustic alkalis. They may be employed singly or in admixture. We prefer to employ cellulose ethers because of their inertness and stability toward the chemicals used in laundering. Examples of such ethers are the hydroxy ethers of cellulose. As is well known, such hydroxy ethers can be made by the interaction of alkali cellulose with alkene oxides such as ethylene ox-

ide, propylene oxide, etc., or with chlorohydrins such as ethylene chlorohydrin, glyceryl monochlorohydrin, etc. Other suitable alkali-soluble compounds of cellulose may also be used.

By virtue of this discovery, we are enabled to produce new and improved relief pattern effects by novel methods which are simple and inexpensive compared with prior processes intended to produce more or less similar effects.

Heretofore, so far as we are aware, the only known method for producing a relief pattern effect in a cellulosic fabric was to parchmentize selected areas of the fabric to form a pattern of areas, then to apply a caustic at narrowly spaced intervals over the fabric, thus shrinking narrowly spaced portions of the unparchmentized areas and causing the intervening unparchmentized areas to crinkle. This method, while entirely practical, is subject to a number of disadvantages which have tended to limit its use.

The production of a pattern by parchmentizing is a difficult, expensive operation, requiring first a resist printing of the fabric because the parchmentizing acids are not adapted to local application as by printing, then subsection of the fabric to a bath of parchmentizing acid under rigid control of such variables as time, temperature, concentration and the like to avoid damage to the cellulose yarns by the strong, rapidly acting acids which it is necessary to use. Moreover, the sheer effect produced by parchmentizing is due to a chemical attack on the yarns by the acids, which may weaken the fabric, also the parchmentized areas of a fabric have a harsher feel than is desirable for many uses. In addition, it is not feasible with this process to color transparent parchmentized areas with a different dye from that applied to the rest of the fabric or to other transparent areas, as dye pastes resist the action of the parchmentizing acids.

Because of these difficulties there has been a demand for a less difficult and expensive process not involving the use of acids and for an unparchmentized smoother feeling relief patterned fabric. However, so far as we are aware, no such method or fabric was known prior to the present invention, and it was believed that production of the sheer areas of the pattern by treatment with parchmentizing acids was essential in order to prevent shrinking of the yarns and loss of sheerness in those portions of the sheer areas to which the caustic is applied.

By reason of our surprising discovery that cellulosic yarns of a fabric which are coated with cellulose derivatives of the class above referred

to remain unshrunk and not only have their sheerness and luster unimpaired but rather increased after treatment in slack condition with a caustic, we are enabled to employ these cellulose derivatives in the production of relief patterned fabrics to great advantage both in simplification of the process and improvement of the product. Cellulose derivatives of the type above set forth may be applied in paste or solution form directly onto the desired areas by printing, stenciling, and the like, and may be precipitated on the yarns by drying, steaming, or treatment with solutions of acids, strong alkali, or salts. These cellulose derivatives do not attack and weaken the yarns but produce the sheer effect by gathering the projecting filaments of the yarn into a smooth contracted strengthening sheath which stiffens the yarns but makes them smooth and not harsh to the touch and which imparts to the yarns an added luster not present in parchmentized yarns. Dye pastes may be mixed with the cellulose derivatives and thus applied to the sheer areas only of the fabric, without interfering with the desired action of the cellulose derivatives.

An example of the novel methods made possible by the present invention is the following: A cellulose derivative paste containing about five per cent. of a cellulose hydroxy alkyl ether is prepared by dissolving a sufficient quantity of the ether in a five to ten per cent. solution of sodium hydroxide at a temperature of 0° to 15° centigrade, the resultant solution forming a workable paste at room temperatures. If desired, a direct dyestuff may be added to the paste. The paste, with or without an added dyestuff, is printed on the fabric in a design. The fabric is dried to precipitate the cellulose ether upon the fibres. Upon drying, the printed areas are sheer, smooth, lustrous and stiffened without being harsh.

Numerous variations may be made in the steps of the process thus far described. That is, various cellulose derivatives, other than cellulose hydroxy alkyl ether, or combinations of cellulose derivatives, may be used as above indicated. Suitable solutions or pastes may be prepared and applied in various ways. For example, multiple print-roll machines may be used to apply successively cellulose derivative pastes containing different dyestuffs. The fabric, after printing, may be soured by passing through an acid bath, such as dilute sulfuric acid.

After drying, the printed fabric is treated with a caustic to produce the relief or crinkling effects. This may be done by spacial application of a caustic. One way is by printing on the caustic at narrowly spaced intervals, as in stripes about $\frac{1}{8}$ inch wide spaced apart about $\frac{1}{2}$ inch. Or the fabric may be printed with a resist to caustic, such as British gum resist, as in stripes about $\frac{1}{8}$ inch wide spaced apart about $\frac{1}{2}$ inch, and passed through a bath of caustic. After standing for about three minutes, the caustic impregnated fabric is washed with hot water, then in very dilute sulfuric acid, then very thoroughly in cold water, extracting the caustic and the resist if one was used. The fabric is untensioned during the caustic treatment and washing operations. The washed fabric is dried without tension, then moistened and framed to desired width.

The caustic shrinks the uncoated yarns which it contacts but not the coated yarns, so that the uncoated fabric areas between the caustic treated

portions crinkle, but the coated areas and the caustic treated areas are left smooth.

A relief patterned fabric resulting from this process is shown in Fig. 1. As shown in said figure, the patterned fabric has four sorts of areas, namely, areas 1 not treated either by the cellulose derivative or by the caustic, areas 2 treated by the cellulose derivative and not by the caustic, areas 3 treated by the cellulose derivative and by the caustic, and areas 4 not treated by the cellulose derivative but by the caustic only.

Areas 4 are very substantially shrunken but smooth. The other areas are not shrunken, but, due to the shrinking of areas 4, areas 1 are crinkled or puckered. Areas 2 and 3 which have been treated by the cellulose derivative, are sheer, lustrous, and crisp without being harsh. In these areas the yarns are sheathed with a cellulose derivative. Due to the action of the caustic, areas 3 are somewhat more sheer and lustrous than areas 2 and form shadow lines. Areas 2 and 3 are smooth because the caustic does not shrink the yarns in these areas, and also because these areas are stiffened. The crinkle produced by the contraction of areas 4 appears in the softer, more easily distorted areas 1. Areas 4 are relatively soft, dense and opaque, having been treated only by the caustic.

A different procedure, now to be described, produces more simply and economically a crinkled relief patterned fabric, which is equal and in some respects superior to that produced by the methods just described. In this procedure we apply the cellulose derivative paste or solution in areas of substantial size to constitute smooth, sheer portions of the pattern and, in addition, in narrowly spaced relatively small areas over the fabric, such as in parallel stripes about $\frac{1}{8}$ inch wide spaced apart about $\frac{1}{2}$ inch. After treatment to precipitate the cellulose derivative as above described, the fabric, without further printing, is subjected in its entirety, without tension, to a bath of caustic, such as sodium hydroxide, of mercerizing strength, and allowed to stand in slack condition for a short time. The fabric is then washed, dried, moistened and framed as above described.

As a result of this procedure, the fabric areas between the spaced narrow areas or stripes treated with cellulose derivative shrink and cause those cellulose derivative treated areas, which are immunized to shrinking by the caustic, to crinkle or pucker. The larger cellulose derivative treated areas of the pattern are not affected by this shrinking because of their size but remain substantially smooth and have an added sheerness and luster due to the caustic treatment.

A relief patterned fabric produced by this process just described is shown in Fig. 2. As shown in this figure, the fabric comprises three sorts of areas, namely, areas 5 consisting of the narrow stripes which have been treated by both the cellulose derivative and the caustic, areas 6, alternating with areas 5, that have been treated by the caustic only, and areas 7 of comparatively large extent which have been treated by both the cellulose derivative and by the caustic. Areas 6 shrink and thereby pucker areas 5, but do not pucker areas 7 because of their large extent. Areas 5 are sheer, lustrous and crisp, but not harsh, and are puckered. Areas 7 are sheer, lustrous, crisp and smooth. Areas 6 are soft, dense, opaque and smooth.

The relief effect produced by this method is entirely satisfactory and the method is consid-

erably simpler and less costly than the previously described methods. The fabric is in some respects superior to that produced by the previously described methods, in that all areas of the fabric are either cellulose derivative sheathed or caustic treated and the crinkle is in crisp, stiffened areas and not in areas of untreated fabric and is therefore more enduring.

When cellulose derivative treated areas of a fabric are subjected to the action of a caustic in accordance with the methods above described, care should be taken to avoid applying heavy pressure to the fabric until the caustic has been washed out and the fabric dried, as the caustic swells and softens the cellulose derivative sheaths to such an extent that heavy pressure, such as is exerted by normally set squeeze rolls, may damage them. After removal of the caustic and drying, the sheaths become more firmly fixed so that heavy pressure thereafter need not be avoided.

The caustics which may be employed in producing relief pattern effects according to the invention include sodium hydroxide, potassium hydroxide, lithium hydroxide, strong quaternary bases and like reagents which exert a strong swelling and shrinking action upon cellulose and a solvent or swelling action upon cellulose derivatives. The concentration of the caustic is sufficient to produce considerable shrinkage in the previously untreated cellulose yarns to which it is applied, ordinarily between 30° and 70° Twaddell. The temperature and concentration conditions are controlled to avoid redissolving the cellulose derivative. For example, where cellulose hydroxy alkyl ether is employed and sodium hydroxide solution is the caustic, the temperature should be kept well above 15° C. and the caustic concentration substantially above 10 per cent.

The procedures hereinabove described are merely illustrative and various changes may be made therein without departing from the spirit and scope of the invention.

In the appended claims, by the terms "cellulosic fabric" we intend to designate woven or unwoven cloth composed of, or containing to a substantial extent, cellulose filaments, and by the term "yarns" we intend to refer to the fibrous elements which are woven or otherwise secured together to form the cloth.

This application is a continuation-in-part of application Serial No. 166,886, filed October 1, 1937.

We claim:

1. A process for patterning in relief a cellulosic fabric which comprises treating narrow, narrowly spaced areas only of the fabric with a water insoluble hydroxy ether of cellulose to render said areas relatively stiff and sheer and resistant to shrinkage under the action of a caustic, and shrinking other areas of the fabric with a caustic to produce a permanent crinkle in at least some of the unshrunk fabric portions between said shrunken areas.

2. A process for patterning in relief a cellulosic fabric which comprises treating narrow, narrowly spaced areas only of the fabric with a mixture of a water insoluble hydroxy ether of cellulose and a compatible dyestuff to render said areas colored, stiff and resistant to shrinkage under the action of a caustic, and shrinking other areas of the fabric with a caustic to produce a permanent crinkle in at least some of the unshrunk fabric portions between said shrunken areas.

3. A process for patterning in relief a cellulosic fabric which comprises treating selected areas only of the fabric with a water insoluble hydroxy ether of cellulose to render said areas relatively sheer and resistant to shrinkage under the action of a caustic, and applying a caustic to said fabric at least at narrowly spaced intervals to shrink portions of the fabric free from hydroxy ethers of cellulose, thereby obtaining a puckering of portions of the fabric.

4. A process for patterning in relief a cellulosic fabric which comprises treating selected areas only of the fabric with a water insoluble hydroxy ether of cellulose to render said areas relatively stiff, sheer and resistant to shrinkage under the action of a caustic, said selected areas including a plurality of narrow, narrowly spaced fabric portions, and subjecting the fabric to treatment with a caustic whereby to produce a permanent crinkling of said narrow, narrowly spaced, sheer, stiffened portions by shrinking the fabric between said portions.

HAROLD I. HUEY.
WILLIAM W. RUSSELL.