This invention relates to novel textile fabrics and to processes for making the same. More particularly, this invention relates to a process whereby natural or artificial cellulose materials in the form of fibre, yarn, or woven fabric, are given novel and useful properties.

It is an object of this invention to produce on cotton and regenerated cellulose fabrics a permanent finish, for instance a stiff "organide" finish or a "parchmentized" finish. Other and further important objects of this invention will appear as the description proceeds.

We accomplish the objects of our invention by treating the said materials with caustic soda of at least 11% strength but preferably somewhat stronger, in the way usual in mercerizing, and afterwards with an alkylene oxide, such as ethylene oxide or propylene oxide, or a hydroxy derivative thereof, e.g. glycide in such a way that stoichiometrically small proportions, as compared to the number of free OH groups in the cotton material enter into combination. About 1½ molecular proportions or less reckoned on a CaH₂O₃ unit for cellulose appear to be quite suitable combining proportions, but the invention is not confined to these proportions, the most suitable proportion for use depending on the kind of fabric treated, the mode of treatment, and the result desired. For instance to obtain parchmentized materials the use of 1 to 1½ mols of ethylene oxide, propylene oxide, glycide or the like per CaH₂O₃ unit is preferable.

For the production of material resembling organide, cotton muslin or voile is preferably treated with one-third to one mol. of ethylene oxide, per CaH₂O₃ unit, the amount of reagent used depending on the nature of the fabric and on the required degree of stiffness in handle.

Where the ethylene oxide is dissolved in a solvent as described above, the amount used may run considerably higher than that indicated above, and may even exceed 10 mols of ethylene oxide per CaH₂O₃ unit. It is found, however, that when large proportions of ethylene oxide enter into combination, the fabric obtained is tender.

The treatment with ethylene oxide may be direct, with gaseous ethylene oxide, or may be carried out by using a solution of ethylene oxide in an inert solvent, for instance dioxane, acetone, benzene, tetrachloethane, or carbon tetrachloride.

Propylene oxide and glycide, being liquids at room temperature, are used as such, either at ordinary or elevated temperature, but preferably they are used as solutions in the solvents mentioned.

The products obtained according to this invention can then be regarded as consisting of cellulose fibres carrying a layer or skin of treated cellulose.

In some cases the product obtained may be further modified as to surface finish and dyeing qualities by treating the same with acylating agents according to the methods usually employed in acylating ordinary cellulosic material to produce a cellulose ester material. When the acylating agent is an acetylation agent it has been found that acetylation readily takes place, so that the process can be carried out under mild conditions.

The fabric, yarn, etc. may also be given a subsequent mercerizing treatment, whereby the finish is improved, particularly in respect of transparency.

The dyeing properties of the products of the invention differ from those of the starting materials in that they possess altered affinity for certain dyestuffs.

The invention is illustrated but not limited by the following examples, in which parts are parts by weight.

**Example 1**

Finely woven bleached cotton fabric (14 parts) is mercerized by immersing it under tension according to the customary procedure in 50° T.w. aqueous caustic soda. The mercerized fabric is then wrung out until there remains in the fabric 25 parts of mercerizing liquor. The moist fabric is then suspended in a chamber into which 3.8 parts (1 molecular proportion per 1 molecular proportion of cellulose reckoned as CaH₂O₃) of ethylene oxide are passed. The chamber is closed and left for 17 hours.

The fabric is then washed and dried. The product is a stiff "organide" fabric, but becomes limp when wet. It is readily dyed by direct cotton dyestuffs.

**Example 2**

The product of Example 1 is put into a bath, kept at 95° C., composed of a mixture of 20 parts of dry pyridine and 80 parts of acetic anhydride. The material is subjected to the action of the bath for two hours. It is then washed and dried. A stiff finish is given to the fabric and the stiffness is unaffected by moisture.

This product is not dyed by direct cotton dyestuffs. It is, however, readily dyed by basic dye-
Closely woven cotton fabric (162 parts) is mercerized in aqueous caustic soda of 50° T.W. remixed, pressed and treated with 44 parts of ethylene oxide in a closed vessel for 17 hours at room temperature. The fabric is washed and dried, being parchment-like, but pliable.

Example 4
Cotton muslin (52 parts) is treated with 50° T.W. caustic soda as described in previous examples, pressed and treated with 11 parts of ethylene oxide, (1/4 mol. per CH₂SO₃H unit) in a closed vessel for 17 hours at room temperature. The material is then washed in water and diluted acetic acid 1%, rinsed in water and dried. A fabric with an organdie type of finish and of good color is obtained.

Example 5
Cotton muslin (14 parts) is treated with alkali as described in Example 1, immersed in a solution of ethylene oxide (30 parts) in dioxan (500 parts) and left for 20 hours at ordinary temperature (20° C). The fabric is then washed and dried. A material so obtained which is slightly stiffened in handle, more transparent than the original material and of good color.}

Example 6
Cotton muslin (14 parts) is pretreated with alkali as previously described, immersed in a solution of ethylene oxide (10 parts) in benzene (500 parts) and left at room temperature for 20 hours. The fabric is washed and dried, a slightly stiffened gauze-like material being obtained. In the above Examples 5 and 6 propylene oxide may be used instead of ethylene oxide.

The subsequent mercerization, referred to above, is carried out according to the usual procedure for mercerizing under tension. When applied to the product of Example 6 there is an increase in transparency and the appearance is improved.

Example 7
Cotton muslin (15 parts) is placed in aqueous sodium hydroxide (50° T.W.) for 5 minutes and the excess alkali is removed by squeezing. The fabric is then immersed in a solution (50 parts) consisting of 9 parts of glyceid in 48 parts of acetone and left at room temperature for 15 hours. After washing and drying, the fabric is considerably stiffened and has an "organdie" finish.

Example 8
Cotton muslin (20 parts) is pretreated with alkali as described in the preceding example. It is then immersed in 100 parts of benzene containing 2 parts of glyceid and heated at 80° in a vessel fitted with a reflux condenser for 1 hour. The fabric is then removed, washed free from alkali and dried. It has a stiff organdie finish and is considerably more transparent than the original material. The procedures described in the above examples are applicable similarly to artificial cellulose fiber, for instance, regenerated cellulose. Similarly, although the main interest of this invention is in connection with fabric, woven or knit, the process is likewise applicable to cellulose yarn, thread or fiber. On the other hand, instead of ethylene oxide, its homologs or analogs may be employed. The details of procedure may be varied within wide limits. For instance, the mercerization step may be carried out according to any well known procedure for mercerizing cotton material, and need not be confined to the concentrations and details of procedure mentioned above for illustrative purpose. Likewise, the time of exposure to ethylene oxide may be varied within limits and depends further on the degree of finish desired in the fabric. The temperature at which the reaction between the alkylene oxide and mercerized cellulosic fabric is effected may also be varied, it being understood, of course, that higher temperatures result in increased speed of reaction and that the time of reaction must be decreased accordingly to obtain the same degree of reaction, and of finish in the fabric. The quantity of ethylene oxide, as has already been indicated, may vary considerably depending on the desired finish or on whether a solvent is employed. In the latter case, the large quantity of solvent reduces the concentration of the ethylene oxide at the zone of reaction, that is the surface of contact between the fabric and the ethylene oxide; therefore a larger total quantity of the latter is permissible.

We are aware that cellulose has been treated with ethylene oxide as before, but the object there was to plasticize or solubilize the cellulose. The operation was conducted on unmercerized cellulose; the proportion of ethylene oxide to cellulose was exceedingly high (about 10 parts by weight of ethylene oxide to each unit weight of the cellulose); and the treatment was effected at 100° C. Thus, neither the object of the aforementioned treatment nor the means employed were analogous to those of our invention herein described.

We claim:
1. A process for producing an organdie fabric, which comprises treating a cellulosic fabric in the presence of alkali with an ethylene oxide compound of the general formula

\[ \text{CH} \equiv \text{CH} \equiv \text{R} \]

wherein R stands for H, CH₃ or CH₂OH, in proportion of from 1/2 to 1 1/2 moles of the latter per part of CH₂SO₃H in the fabric, and under conditions equivalent to about room temperature and a time from about 17 to about 20 hours.

2. A process as in claim 1, the ethylene oxide compound being dissolved in an organic solvent.

3. A process as in claim 8, the ethylene oxide being dissolved in carbon tetrachloride.

4. Cellulose fabric containing mercerized fibers partially etherified under alkaline conditions by reaction with ethylene oxide in the ratio of one mole of cellulose to one from one-third to one and one-half moles of ethylene oxide dissolved in an inert organic solvent, said fabric having the finish and feel of an organade fabric and having an affinity for direct cotton dyestuffs.

5. Cotton fabric containing fibers which have been modified by treatment with aqueous caustic soda of not less than 11% strength and then by treatment under alkaline conditions with ethylene oxide in the ratio of one mole of cellulose to one from one-third to one and one-half moles of ethylene oxide, said fabric having the finish and feel of an organade fabric and having an affinity for direct cotton dyestuffs.

6. A process for modifying the surface qualities of textile cellulosic fabric which comprises sub
jecting the same to a treatment including as its first step treatment of the fabric with aqueous alkali of a strength comparable to those employed in mercerisation of cotton, and as a second step the further treatment of said fabric with an alkylene oxide of the general formula

\[ \text{CH}_2-\text{CH}-\text{R} \]

wherein \( R \) stands for \( H \), \( \text{CH}_3 \) or \( \text{CH}_2\text{OH} \), in low concentration in the zone of reaction and under reaction conditions equivalent to about room temperature at a time of about 17 to about 20 hours.

7. The process of producing a woven textile fabric which comprises treating a mercerized woven cellulose fabric with ethylene oxide in proportion not exceeding 1½ mols per unit of \( \text{C}_2\text{H}_4\text{O} \) in the fabric and under conditions equivalent to about room temperature and a time of from about 17 to about 20 hours.

8. A process of producing a woven textile fabric which comprises treating a mercerized woven cellulose fabric with ethylene oxide in proportion not exceeding 1½ mols per unit of \( \text{C}_2\text{H}_4\text{O} \) in the fabric, dissolved in an inert organic solvent, and under conditions equivalent to about room temperature and a time of from about 17 to about 20 hours.

9. The process of modifying the surface qualities of cotton fabric which comprises treating the same with aqueous caustic of not less than 11% strength, and then reacting the fabric so treated with ½ to 1½ mols of ethylene oxide per unit of \( \text{C}_2\text{H}_4\text{O} \) in the fabric, and under conditions equivalent to about room temperature for a time of from about 17 to about 20 hours.

LESLEY GORDON LAWRIE.
REGINALD JOHN WILLIAM REYNOLDS.
HENRY ALFRED PIGGOTT.