

# UNITED STATES PATENT OFFICE

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## NONINFLAMMABLE FABRIC AND PROCESS OF MAKING THE SAME

No Drawing.

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This invention relates to non-inflammable fabrics, both the article and the process of making the same. Particularly it relates to treated fabrics of the type that contains in the interstices of the fabric body or the pile, or both, a material which, on being treated with a suitable solvent, will cause the treated fabric to become flaccid, and which, on removal of the solvent, will cause the fabric (which in the meantime has been given a desired shape) to retain a desired shape.

In accordance with the present invention any suitable fabric, either woven or structureless, as cloth or felt, is first thoroughly impregnated with a dope containing the desired stiffening material, and fire-retardants; then, without drying, the goods are passed through a bath of a character to precipitate in the goods the stiffening material, carrying with it the fire-retardant or retardants, after which the goods are dried. In use, the goods are quickly treated with a solvent for the stiffening material, sufficiently to render the goods flaccid but not sufficiently to remove the material. The goods are then shaped, and the solvent then dried out. It will be understood that the precipitating bath, and the colloiding bath are preferably such as not to remove the fire-retarding agent or agents.

In preferable accordance with the invention, the primary material of the impregnating dope is a cellulose ester, as pyroxylin or cellulose acetate; the fire-retardant is a substance which, on heating, will evolve a fire-smothering gas, for example gypsum,  $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$ ; the volatile solvent in the dope may be denatured alcohol and acetone, and a fixable solvent or plasticizer may be camphor or an aromatic phosphate, such as tricresyl phosphate, such a phosphate being particularly desirable since it itself is a fire-retardant. The precipitating bath may be water. And the solvent for rendering the material flaccid may be denatured alcohol and acetone, or, in order to ensure that the goods will not stiffen too rapidly, due to prompt evaporation of the solvent, a mixture of alcohol and a high boiling solvent, such as diacetone alcohol may be used.

Without restricting the invention thereto, a suitable formula for the impregnating mixture may be (parts by weight):—

|                     | Range    | Preferred |    |
|---------------------|----------|-----------|----|
| Pyroxylin           | 100-100  | 100       | 55 |
| Camphor             | 0-35     | 30        |    |
| Tricresyl phosphate | 0-60     | 33        |    |
| Gypsum              | 100-250  | 200       |    |
| Volatile solvent    | 500-1000 | 650       | 60 |

It will be understood, of course, that although the ranges for camphor and tricresyl phosphate start at zero, both are not at the same time omitted from a mixture. The volatile solvent may be a mixture (parts by weight) of denatured alcohol 90, acetone 10. (This may also be the solvent used for rendering the fabric flaccid but, preferably a mixture (parts by weight) of alcohol 70 and diacetone alcohol 30 is used.) The amount of aromatic phosphate advisable to use depends on the degree of impairment of stiffness of the fabric permissible in any particular case; and similarly the amount of gypsum or the like is limited by the degree of brittleness and friability permissible. The gypsum is illustrative of a variety of other substances, such as calcium tartrate, ammonium phosphate, etc., etc. The pyroxylin may, of course, be replaced, in whole or in part, by other cellulosic derivatives as cellulose acetate.

While more particular mention has been made above of cellulosic dopes, it will be understood that other materials may be used for impregnating the goods; for example, there may be used various gums and resins, or rosin. As is evident, when such materials are used they should be dissolved in suitable solvents for making a proper dope. The precipitating bath should be suitable for the particular case in hand and the fire-retarding constituent should be one that is properly consistent with the dope and the precipitating bath. Also, the solvent used for making the goods flaccid should be properly consistent with the primary material used for impregnating the goods and also with the fire-retarding substance. To illustrate, when using gum copal, the impregnating dope, the

precipitating liquid and the solvent for making the goods flaccid may be as follows:—

|                  | Parts by weight |
|------------------|-----------------|
| 5 Gum copal----- | 100             |
| Gypsum-----      | 100             |
| Acetone-----     | 25-50           |

In this case the precipitating liquid may be water, and the solvent used for making the goods flaccid may be acetone with or without partial replacement by a high boiling solvent.

The practical making of goods in accordance with the invention will be understood by those skilled in the art, the presence of the fire-retarding agent introducing no complications into the general procedure of applying the dope, precipitating the stiffening material, e. g. pyroxylin, making the goods flaccid, shaping them, and permitting the solvents to dry out. However, in brief, the goods to be treated, say woven fabric, are passed through the impregnating bath (e. g. pyroxylin) until thoroughly impregnated, the goods being preferably distorted or kneaded during passage by any suitable mechanical means, or by hand, to facilitate the penetration of the dope. The goods are then passed into the precipitating bath (e. g. water) and immersed therein, desirably with kneading, until precipitation is completed, which will be indicated by the fact that squeezing of the goods does not bring to the surface particles or drops of the colloid solution or dope, easily identified by its gelatinous character. The fabric is now withdrawn from the water bath and dried; and the impregnating material proper, e. g. pyroxylin, and the fire-retarding agent will be found in or on the fabric and entangled and interlocked with the fibres thereof. In due course the goods are quickly dipped in the solvent bath, merely sufficiently to render them flaccid and without substantial removal of the deposited substances, are shaped and then the solvents evaporated, giving the finished shaped goods. The goods may be formed into blanks of the final shape at such time as desired, as prior to the beginning of the process.

As to the character of the fire-retardant, it is not important whether or not the fire-retardant is soluble or insoluble in the solvents used in making up the impregnating dope. Even though it be insoluble difficulty with settling out is not likely to be experienced in the time which would ordinarily elapse between the making up and the use of the impregnating dope. The fire-retardant is, of course, used in a very finely divided condition, and is easily supported by the impregnating dope.

It is desirable to use a fire-retardant insoluble in the precipitating bath and in the flaccidity-imparting bath. If, however, it

be desired to use a soluble retardant the technique of the precipitating-bath treatment may be modified to minimize the kneading action and to allow the surface to become sealed by the precipitate promptly. The precipitating liquid would then penetrate to the centre of the fabric relatively slowly. Under such conditions there would be relatively little loss of the fire-retardant substance even though it were definitely soluble in the precipitating path. As to the flaccidity-imparting bath, even though the fire-retardant be soluble in it, the immersion in this bath is very brief and substantial amounts of the fire-retardant would remain in the fabric. Thus, such a substance as urea would be soluble in acetone-alcohol, also in water, and also in the recolloiding or flaccidity-imparting bath, yet, with the precipitating treatment properly carried out a large percentage of the urea originally introduced would survive in the finished goods, as a result of entrainment with the precipitate and occlusion by it.

The fire-retardant particularly mentioned above, gypsum, is, of course, substantially insoluble in the liquids ordinarily used, i. e. acetone and alcohol in the impregnating bath, water in the precipitating liquid, and alcohol and diacetone alcohol in the recolloiding solvent.

Returning to the treatment of the fabric in the precipitating bath, an immersion of the goods for about one-half hour therein should generally be ample. If desired, the goods may be passed over idler rolls in the tank, or rolled up and unrolled occasionally, to facilitate the precipitation.

I claim:

1. As an article of manufacture, a porous fabric having in and through the interstices thereof, and carried within the same as a filling therefor, a powdered colloidal material in precipitated form, forming a porous deposit capable of ready penetration by solvents therefor, together with a fire-retardant, such retardant being deposited within, entangled in and distributed through the deposit of colloidal material.

2. As an article of manufacture, a porous fabric having in and through the interstices thereof, and carried within the same as a filling therefor, a powdered cellulose ester in precipitated form, forming a porous deposit capable of ready penetration by solvents therefor, together with a fire-retardant capable of evolving a fire-smothering gas upon heating, such retardant being deposited within, entangled in and distributed through the cellulose ester deposit.

3. As an article of manufacture, a porous fabric having in and through the interstices thereof, and carried within the same as a filling therefor, powdered pyroxylin in precipitated form, forming a porous deposit ca-

pable of ready penetration by solvents therefor, together with gypsum as a fire-retardant, such gypsum being deposited within and distributed through the pyroxylin deposit.

5 4. The method of producing a fabric capable of being made flaccid, shaped and stiffened by virtue of a deposited and carried colloidal material, and embodying a fire-retarding agent deposited within, entangled in, and  
10 distributed through the colloidal material, which method comprises: preparing a bath of a colloidal material, insoluble in the hereafter named precipitating bath, and containing a normally solid fire-retarding agent,  
15 immersing a porous fabric in said bath, and thereafter immersing the fabric in a precipitating bath thus to simultaneously deposit the colloidal material in powdered precipitated form in and through the interstices of the  
20 fabric together with the fire-retarding agent entangled with and distributed through the colloidal material.

5 5. The method of producing a fabric capable of being made flaccid, shaped and stiffened by virtue of a deposited and carried colloidal material, and embodying a gas-evolving, fire-retarding agent deposited within,  
25 entangled in, and distributed through the colloidal material, which method comprises: preparing a bath of a colloidal material, insoluble in the hereafter named precipitating bath, and containing a normally solid fire-retarding agent capable of evolving a fire-smothering gas upon heating, immersing a  
30 porous fabric in said bath, and thereafter immersing the fabric in a precipitating bath thus to simultaneously deposit the colloidal material in powdered precipitated form in and through the interstices of the fabric together  
40 with the gas-evolving, fire-retarding agent entangled with and distributed through the colloidal material.

In testimony whereof I affix my signature.

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