

## TREATMENT &amp; CHEMICAL MODIFICATION OF TEXTILES &amp; FIBERS,

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JOHN MARSDEN, OF NORTH DIGHTON, MASSACHUSETTS, ASSIGNOR TO MOUNT HOPE FINISHING COMPANY, OF NORTH DIGHTON, MASSACHUSETTS, A CORPORATION OF MASSACHUSETTS.

## PROCESS OF PURIFYING TEXTILE FABRICATIONS.

No Drawing.

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*To all whom it may concern:*

Be it known that I, JOHN MARSDEN, a subject of the King of Great Britain, residing at North Dighton, in the county of Bristol and State of Massachusetts, have invented certain new and useful Improvements in Processes of Purifying Textile Fabrications, of which the following is a specification.

This invention relates to the purification of textile fabrications, a term herein employed to include fibers or fabrics whether in the form of yarn or cloth, and comprises a process whereby this may be accomplished in a much shorter time than that heretofore required, and likewise with an improved result as regards the texture and luster of the finished fibres, the effectiveness, uniformity and permanence of the bleach, and avoidance of that species of injury to the fibers known as "tendering" and due to the employment of oxidizing conditions of undue severity. The process is chiefly applicable to cotton goods, including not only raw cotton, but artificial silk and mixtures thereof with cotton, as well as mercerized cotton.

It is well known to those skilled in this art that raw cotton, in common with all fibers of vegetable origin, is a highly complex substance, having a basis of pure cellulose but containing also a variety of complex organic bodies of undetermined constitution and imperfectly understood chemical relations, these bodies comprising waxes, proteid bodies, pectic matters, coloring materials, and perhaps others, collectively known as the non-cellulose constituents. The essential problem involved in the purifying operation is the isolation of the cellulose without injury to itself, and this problem has been approached in the past in a great variety of ways, all of which have necessarily been largely empirical in character, since many of the fundamental constants of the chemical reactions involved have been and still are unknown.

It is known, however, that the organic non-cellulose constituents of the fiber are, as a whole, less resistive to, or more readily attacked by oxidizing agents, than cellulose; and the present methods of isolating cellulose are based on the fundamental idea that the non-cellulose constituents, or most of them, can be selectively oxidized in pres-

ence of the cellulose, leaving the latter in a pure or comparatively pure state. It is well recognized however that the differences between cellulose and its associated non-cellulose bodies, as respects reactivity toward such powerful oxidizing agents as the hypochlorites for example, are not very great; and accordingly it is a matter of extreme practical difficulty to accomplish and industrially complete removal of the non-cellulose without injury to the cellulose.

As will more fully appear hereinafter, I have discovered that by a suitable preliminary or conditioning treatment carried out at normal or only slightly higher temperatures, which temperatures should in no event attain the boiling point of water at atmospheric pressures, I am enabled to increase very greatly the reactivity toward the hypochlorites of the non-cellulose constituents of the fiber, with the result that these non-cellulose constituents may in a subsequent oxidizing operation be quickly and readily destroyed or removed, leaving the cellulose unimpaired.

In order that the principles involved in my novel process may be clearly understood, I will explain that the process of purifying cotton goods, as now commonly practiced, involves the following steps:

- (1) Singeing to produce a clear face;
- (2) Boiling from 8 to 10 hours at 10-40 lbs. pressure, in an alkaline liquor, for the purpose of dissolving and eliminating the natural impurities of the raw cotton as well as the sizing materials used in the fabrication of the cloth, (the so-called kier-boiling);
- (3) A repetition of the above pressure boiling;
- (4) Washing;
- (5) Bleaching with sodium hypochlorite solution etc., (chemicking);
- (6) Washing;
- (7) Souring;
- (8) Washing;
- (9) Drying, preparatory to the final dyeing and finishing operations.

According to my improved process I omit altogether the expensive kier-boiling or any high-temperature treatments, as well as the usual chemicking or bleaching operations; and I subject the gray product direct from the singeing frames to a cold conditioning



operation, followed by a brief and carefully controlled subjection to gaseous chlorin, acting in the presence of an alkaline solution. Thereby I am enabled to shorten the total  
5 process from several days to a few hours, and furthermore to secure in full the dyeing qualities, and in part the lustrous appearance, now obtained only by the expensive step of mercerizing. If desired I may, by a  
10 slight modification of my process, attain the full mercerizing effect.

I have found that the reactivity of the organic non-cellulose components of the fiber is a function of the surface exposed to the  
15 oxidizing agent, which in the process about to be described is a hypochlorite at the instant of its formation. Accordingly I subject the raw fibers to a conditioning treatment having for its purpose the extending  
20 to the maximum attainable degree of the exposed surfaces of the non-cellulose matters. This maximum extension of the exposed surfaces is preferably brought about by a treatment with cold dilute alkali or alkaline-  
25 reacting salt (carbonate, hydroxid, phosphate, etc.) which has two functions, to wit, (1) to remove by solution a certain portion of the non-cellulose, thereby permitting freer access of the solution to the remainder,  
30 which is not capable of being dissolved under the operating conditions; and (2) swelling or distending the undissolved non-cellulose residue to increase its surface exposure and hence its reactivity. Following this conditioning treatment the fabrication is caused to  
35 take up a controlled proportion of alkali or alkaline-reacting salt and is at once subjected in swift movement to an atmosphere containing chlorin gas, either undiluted, or  
40 in case it is difficult or impracticable sufficiently to limit the time of exposure to the gas, diluted by air, carbon dioxid or other relatively inert gas.

Following is an illustrative and preferred  
45 embodiment of my process as applied to the treatment of cotton cloth in open widths, it being understood that the invention is not limited to woven fabrics, nor to the precise conditions set forth by way of example, since  
50 in this as in most similar cases time, temperature and concentration are co-related factors in the sense that any one may be varied somewhat in conjunction with a corresponding variation of the others; moreover,  
55 over, the exact conditions to be used will depend somewhat upon the permeability of the material treated; for example in case of tightly woven fabrics with tightly twisted yarns, the alkali solution should preferably  
60 be of somewhat higher concentration, and the exposure to chlorin gas should be somewhat lengthened:

The cloth is thoroughly wetted out with a caustic solution of about 3° Tw, and the  
65 excess of solution squeezed out. After about

four hours standing in the cold the cloth is washed free of alkali and soluble impurities. It is then again wetted with a solution of caustic soda of 3° Tw and is passed  
70 through an atmosphere of gaseous chlorin at a speed of about 6000-8000 yards per hour, the total time of exposure to the chlorin of any given area of the cloth being approximately 15-30 seconds. The preferred  
75 dimensions of the chlorin chamber are such that only about 40 yards of the cloth are exposed to the gas at any given instant, and chlorin is admitted to the chamber at a rate sufficient to maintain a constant concentration (pressure) therein. Immediately upon  
80 leaving the chamber the cloth is passed through a solution of soda ash of 4° Tw, this concentration being sufficient to neutralize the residual chlorin in the cloth, with a decided excess of the alkali. The cloth is  
85 then permitted to lie for a sufficient time, usually from 20 minutes to one hour, to accomplish a thorough by-bleach, after which it is washed out and finished in the usual way. 90

In case it is desired to mercerize the cloth, the mercerization is preferably carried out in known manner in connection with the first alkali treatment; or, alternatively, after the cloth has been subjected to our hypo- 95 chlorite treatment.

It will be observed that my process does not involve at any point the kier-boiling or pressure digestion of the stock; and such boiling or digestion would defeat the objects 100 which I seek to attain. By the omission of this boiling I not only secure an improved result as regards color and texture of the fabrication, but I save a considerable element of cost in fuel, and a very large 105 element of cost in time.

I am aware that it has been proposed to subject cotton stock to the direct action of chlorin, either in presence or absence of alkali; but so far as I am aware such treat- 110 ment has not before my invention been applied to a fabrication which has been properly conditioned to increase the reactivity of the non-cellulose constituents. In the absence of such proper conditioning the 115 chlorin treatment will necessarily be ineffective, being either too mild to destroy or remove the non-cellulose bodies, or, if intense enough to accomplish this result it will act injuriously upon the cellulose. It 120 is only by establishing a new differential between the reactivities toward the hypochlorite of the cellulose and the non-cellulose respectively, that the desired isolation of the former can be accomplished. 125

My invention is not limited to any particular type of apparatus, but it lends itself well to a continuous operation and is carried out continuously in practice. The preferred apparatus comprises a gas-chamber pro- 130



vided with means for effecting the traverse  
of the cloth or yarn at the necessary rate, as  
by means of driven and idle rolls, and means  
for the controlled admission of the chlorin,  
5 in conjunction with deep seals at the inlet  
and outlet respectively. These seals may  
advantageously contain the alkali solutions  
employed as described above for the pre-  
treatment and the after-treatment of the  
10 cloth.

I claim:

1. In a fiber-purifying operation, the steps  
comprising subjecting an unbleached fabri-  
cation to a cold conditioning operation serv-  
15 ing to increase the reactivity of the non-cel-  
lulose components, and thereafter selectively  
oxidizing said non-cellulose components by

means of a hypochlorite formed in presence  
of the fiber.

2. In a fiber-purifying operation, the steps 20  
comprising subjecting an unbleached fabri-  
cation to the action of an alkali at a tem-  
perature below the atmospheric boiling  
point, thereby increasing the reactivity of  
the non-cellulose components; washing to re- 25  
move dissolved matters and again moisten-  
ing with alkali; and then exposing the  
fabrication for a limited and controlled  
period to an atmosphere containing chlorin,  
whereby the non-cellulose components are 30  
selectively oxidized by means of a hypo-  
chlorite formed in presence of the fiber.

In testimony whereof I affix my signature.

JOHN MARSDEN.