

# UNITED STATES PATENT OFFICE.

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## PROCESS OF TREATING FIBER WARE.

SPECIFICATION forming part of Letters Patent No. 395,951, dated January 8, 1889.

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*To all whom it may concern:*

Be it known that I, HENRY CARMICHAEL, a citizen of the United States, residing at Malden, in the county of Middlesex and State of Massachusetts, have invented certain new and useful Improvements in the Process of Treating Fiber Ware; and I do declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to a novel process for treating or indurating fibrous materials, and is especially adapted, among other things, for the treatment of articles made of wood pulp or other analogous fiber.

Prior to this my present invention articles made from pulp fiber have been indurated, as disclosed in former patents granted to me, by subjecting them to the action of liquid baths of hot linseed-oil, colophony, asphalt, &c., and subsequently subjecting them to a substantially high temperature for a considerable length of time, by which the oil, colophony, &c., in the mass is oxidized or hardened.

It has been found in practice when articles of pulp fiber have been treated as above described that the linseed-oil or other indurating substance either did not penetrate sufficiently into the interior of the article or if it did it penetrated in such quantities that the porous spaces of the article would be filled or plugged up with the said indurating substance, so that the subsequent ingress of oxygen—namely, heated air—would be prevented or retarded, thus preventing or retarding the oxidation of the indurating substance. This is especially true if the oil or other indurating substance be forced into the fibrous article under pressure. Fibrous articles treated as above described are hard, resilient, and impenetrable; but when broken or cut they show uneven structures, decreasing in density from the surface inward, the centers being usually spongy and unaffected by the process which has hardened the exterior portion.

This invention has for one of its objects to effect a uniform distribution of the linseed-oil or other indurating substance throughout the fibrous mass or article, whereby the whole body or substance of the article is uniformly

supplied with the indurating material; and, further, the invention is designed to leave the mass of fibrous material which has been thus uniformly saturated with the indurating substance in such porous condition that it is acted upon throughout by the heat, and the oil or other indurating substance is thoroughly oxidized uniformly throughout the mass. I accomplish this feature of my invention by dissolving the indurating substance in a suitable solvent, which acts as a vehicle or carrier to convey the indurating substance into the interior of the fibrous mass or article, the said solvent, when a volatile solvent is used, being subsequently expelled from the fibrous mass or article, leaving the indurating substance in condition to be easily and quickly acted upon by the oxidizing agent.

The oil or other indurating substance, being dissolved in naphtha or other suitable solvent, will, as is well known, be carried more readily and will be uniformly diffused through the mass; but the uniform diffusion in this case is not so important a feature as the uniform oxidation. The removal of the solvent by evaporation leaves the oil adhering to the fibers with minute passages and cells or spaces which were occupied by the solvent open to the access of air, so that when heat is applied the mass is thoroughly oxidized by heat and the presence of oxygen throughout the mass, and by this step in the process, in connection with the heating, as herein described, there is secured not only a uniform diffusion of the indurating material, but a uniform oxidation of the same, which could not be accomplished were the pores clogged with oil or other undissolved material.

In practice the hygroscopic moisture is preferably first removed from the article to be treated, which is then immersed in a bath composed of an indurating substance, which may be linseed or other oil, colophony, or other resin, asphalt, or analogous substance, or a mixture of these dissolved in a suitable solvent—such, for instance, as naphtha, turpentine, benzine, bisulphide of carbon, or other suitable solvent.

To enable my invention to be clearly understood, I will describe the process with the indurating substance preferred by me—



namely, a mixture of equal parts of linseed-oil and colophony or other resin.

A mixture of equal parts, by weight, of linseed-oil and colophony is dissolved in an equal volume of naphtha, and the article to be treated is immersed in the solution or bath thus formed, it being left therein, preferably, until bubbles cease to escape, usually about five minutes, the article being at such time thoroughly saturated.

When naphtha is used, the operation should be conducted in a covered vessel on account of the volatile nature of the naphtha. When the article is dense, pressure may be employed to facilitate the introduction of the indurating solution; or the air may be exhausted from the article before treating it with the indurating solution. The naphtha or solvent, being thin, readily penetrates the fibrous mass and carries with it the linseed-oil or colophony or other indurating substance, so that the fibers in the center of the article become saturated or impregnated with the linseed-oil and colophony to substantially the same degree as the fibers at the surface of the article. The article saturated with indurating substance and naphtha or other solvent is removed from the bath, and the naphtha or other solvent is expelled from the article by spontaneous evaporations or by artificial heat, it being preferred to heat the saturated article in a closed vessel, from which the naphtha is distilled and condensed in the usual manner, it being thus recovered to be used again.

The naphtha or other solvent merely acts mechanically as a carrier or vehicle for the indurating substance to conduct the latter in a finely-divided state to the center or interior of the article.

After freeing the article of solvent and leaving the fibers of the article impregnated with linseed-oil, the said article is subjected to a baking process, which consists in subjecting the article to a heat preferably approximating 270° Fahrenheit in a ventilated oven for about three hours, more or less, or until the irritating fumes of oxidizing oil cease to be given off. By this baking process the oil in the fiber, both at the center and surface of the article, is oxidized, thus rendering the fiber impervious to liquids. The article, after being baked, as described, possesses a vesicular structure like cork. It is light and porous, yet practically water-proof. It has a smooth and even structure and resembles somewhat the best qualities of box-wood, though without any decided grain, while it is very flexible and elastic and possesses in a remarkable degree the property of resisting blows and fracture.

I have described the bath as composed of

equal parts of linseed-oil and resin and naphtha; but I do not desire to confine myself to these proportions, as the same may be varied according to the nature of the article to be treated and the uses to which it is to be put.

I have herein described the indurating substances as a mixture of equal parts of linseed-oil and resins; but I do not desire to limit myself to this mixture of linseed or other oil alone, as colophony or other resinous substance alone may be used with good results.

By the process above described the fiber of the article is indurated, while the article or mass as a whole is porous.

If now it is desired to render the article or mass as a whole, as well as the individual fibers thereof, inaccessible or impenetrable to liquids, the said article or mass is immersed or treated with hot linseed-oil or a mixture thereof with other substances—such as colophony, &c.—and subjected to a second baking, the pores of the article or mass being thus stopped up or closed, thus preventing liquids from penetrating into the interior of the article or mass.

In practice the naphtha or other solvent will preferably be distilled off from or out of the fibrous material in a separate or distinct apparatus from that in which the baking step of the process is carried on; but it is evident that both steps may be carried on in one apparatus—as, for instance, the baking-oven.

I claim—

1. The art or method of treating articles of pulp or other fiber, which consists, first, in saturating the article with a solution of indurating substance; second, freeing the article from the solvent, and, lastly, subjecting the article freed from solvent, but containing the indurating substance, to a baking process, whereby the indurating substance in the fiber is oxidized or hardened, substantially as and for the purpose specified.

2. The art or method of treating articles of pulp or other fiber, which consists, first, in saturating the article with a solution of indurating substance; second, freeing the article from the solvent; third, subjecting the article freed from solvent, but containing the indurating substance, to a baking process; fourth, subjecting the baked article to a bath of linseed-oil or a mixture thereof, and, lastly, subjecting the article to a second baking, substantially as described.

In testimony whereof I affix my signature in presence of two witnesses.

HENRY CARMICHAEL.

Witnesses:

HENRY F. QUINT,  
CHAS. STEERE.