

# UNITED STATES PATENT OFFICE.

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## WATERPROOF MATERIAL AND METHOD OF PREPARING SAME.

SPECIFICATION forming part of Letters Patent No. 721,558, dated February 24, 1903.

Application filed August 16, 1900. Serial No. 27,086. (No specimens.)

*To all whom it may concern:*

Be it known that I, CHARLES I. GOESSMANN, a citizen of the United States of America, and a resident of Amherst, in the county of Hampshire and State of Massachusetts, have invented new and useful Improvements in the Art of Waterproofing Materials and an Improved Product Created Thereby, of which the following is a specification.

10 My invention relates more particularly to the art of manufacturing paper, which may be practiced either during the process of manufacture or after the paper has been manufactured, although my process or method may  
15 also be employed in connection with the production of fabrics other than paper, but of a similar nature.

My invention also relates to the strengthening of the texture of paper or other similar  
20 fabrics and to the rendering of the same impervious to water, moisture, grease, acid, &c.

The objects of my invention are, first, to produce a paper or other fabric which will be stronger than when subjected to any treatment heretofore practiced; second, to produce a paper or other fabric which will be non-absorbent of water or moisture, or, in other words, waterproof; third, to produce a paper or other fabric which will be non-absorbent of grease, or, in other words, grease-proof; fourth, to produce a paper or other fabric which will not be affected by acids, or, in other words, will be acid-proof; fifth, to provide a process or method by which said  
25 objects or results may be obtained, and, sixth, to provide methods or processes by which said results may be expeditiously and economically attained.

My invention consists in the methods, steps,  
30 or processes by which I attain the objects of my invention, both singly and collectively, as hereinafter set forth, and in the product resulting from such treatment.

In carrying out my invention any convenient and appropriate machinery or apparatus  
35 may be employed.

As this invention has more particular reference to the manufacture of paper and treatment of the same and only general reference

to other fabrics, I herein set forth in detail 50 the best methods and processes of carrying out my invention as applied to paper fabrics.

The treatment may be applied while the pulp is being formed into paper or the finished paper may be treated. If the material is to  
55 be treated while being formed into paper, then the better method is to begin the treatment when the web of pulpy material leaves the Fourdrinier wire or the cylinders, it then being in a damp condition, but with the larger percentage of moisture removed. From this point the treatment of the fabric is the same whether it be pulp in a sheet, as above stated, or finished paper.

The treatment consists first in saturating 65 the paper with glutinous material, preferably animal glue, and by preference the bath of glutinous material should be hot to effect the more rapid absorption and more perfect permeation, impregnation, and deposit of the  
70 glutinous material within all the microscopic interstices throughout the body of the fabric being treated.

By preference a suitable tank is provided, in which the glutinous material is deposited 75 and in which it may be kept heated to a constant temperature, the fabric being passed through the tank and saturated during its passage. I prefer that the material being treated be kept in motion and pass in a continuous sheet—that is, be fed from a roll—  
80 and the finished product be wound in a roll after final treatment. This saves time, and I find that the requisite permeation or incorporation of glutinous matter in the fiber will  
85 with some papers—for instance, lightly-sized Manila hemp—require but a few seconds. As the fabric passes from the glutin-tank the surplus of glutinous matter is removed from the surfaces by mechanical means as contrasted  
90 distinguished from simply allowing it to pass off by gravity, and in most instances I prefer to pass the fabric between suitable pressure-rolls to remove such surplus.

The strength and consistency of the glutinous bath may be varied, depending upon the material being treated and the uses for which such material is designed. It may, however

be stated that in a majority of cases a hot solution of about one part of animal glue to about ten parts of water, by weight, gives the best results.

5 After leaving the bath of glutinous material and having the surplus adhering to the surfaces removed the fabric before drying is passed into or through a solution of formaldehyde and water. The strength of this so-  
10 lution may also be variable, depending, as heretofore stated, upon the fabric and uses for which it is designed. In the majority of cases, however, a solution of one part of formaldehyde, thirty-five per cent. solution, to  
15 five parts of water, by weight, gives the best results, and the best result is attained if this bath is cold instead of hot, though any particular temperature is not essentially necessary.

20 The effect of the formaldehyde solution upon the glutin-saturated fabric is to precipitate the glutinous matter and render it insoluble.

As the material comes from the formaldehyde-bath I prefer that the surplus adhering to the surfaces be removed by mechanical means, pressure-rolls being probably most convenient. The fabric is then dried in any convenient manner. The best result in drying,  
30 ing, so far as I am at present advised, is attained by the air-blast—i. e., projecting blasts of air against both surfaces of the fabric. This drying removes all the watery constituents and leaves the fabric in a toughened or  
35 greatly-strengthened condition, but not in practical condition for commercial uses, as it is brittle, horny, and stiff and has an objectionable odor and taste on account of the presence of the aldehydes, paraldehydes, formic  
40 acid, and other products, the result of oxidation. Now while the glutinous material is rendered insoluble—that is, it is so acted upon by the formaldehyde and the chemical action which takes place while the united so-  
45 lutions are giving off their watery constituents that it will not fully dissolve. It is, however, in a condition to be acted on by moisture, as it will swell and absorb or take up permanently by either chemical or me-  
50 chanical action a percentage of water and will also become improved in many respects, so that to temper and render the fabric soft and pliable and adapt it for most commercial uses I subject it to moisture, which penetrates the  
55 fabric, causing a swelling in all directions, filling the interstices perfectly, and resulting in “hydration” throughout the entire cellular structure. Two actions—mechanical and chemical—appear to take place, the mechanical action being the temporary absorption of  
60 water, analogous to the absorption of water by a dry sponge, the chemical action being the permanent union of water with the treated fabric, analogous to the union of water and tapioca, causing swelling, or like the chemical combination of water with lime or cement. For  
65 this purpose I prefer to pass the fabric into

a bath of hot water, saturated steam, or equivalent heat and moisture medium, thus causing the fibers and the non-soluble glutinous  
70 material filling the interstices to expand in all directions and forcing the glutinous material into all the microscopic pores or openings and into the masses of fiber, causing a  
75 commingling or thorough incorporation of the fibers and the glutinous compound, and at the same time, as heretofore indicated, a change (hydration) takes place, whereby the  
80 hardened mass of fiber, glutinous material, and formaldehyde becomes tempered and softened and the strength imparted by the previous treatment increased.

To heighten the tempering and softening effect, I may in some instances introduce glycerin in the tempering-bath, and in most cases  
85 one two-hundredths, in volume, of glycerin gives the best results.

The fabric may be dried in any convenient manner and is in condition for most commercial uses, it being greatly strengthened, more  
90 flexible, more impervious to moisture, acids, grease, or alkalies, and is suitable for the manufacture of binding-twine, carpets, dry wrappings, for lining packing-cases, and many  
95 novelties, &c., but is liable to still have a disagreeable taste and may carry traces of acids, rendering it impracticable for some uses—for instance, wrapping butter, meats, cheese, &c. For the purpose, therefore, of rendering  
100 the material absolutely free from all traces of acidity and all taste and odors and, in fact, to render it absolutely hygienic I pass it through a bath of water and a volatile alkali—ammonium hydrate—the proportion by preference in a majority of cases being one one-  
105 hundredth of ammonium hydrate to ninety-nine one-hundredths of water, by volume, and I may add a small percentage of wood-alcohol. This bath is preferably cool; but a variation in its temperature will not to a serious extent interfere with the results. The  
110 effect of this bath followed by drying is to complete the chemical reaction and destroy all taste or odor, removing all traces of acids, and rendering the fabric hygienic in all re-  
115 spects. The material may be calendered or cut and used for any of the purposes desired.

If the material is to be subjected to the volatile-alkali bath, it is not necessary to dry it between the tempering and volatile-alkali  
120 baths.

The fabric thus made will be found to be greatly strengthened, some materials being increased in strength from one hundred to seven hundred per cent. It will be non-ab-  
125 sorbent to acids, greases, alkalies, and substantially waterproof, and owing to its component integrate structure will be practically non-conductive to electricity, adapting it as a superior insulating material and may with  
130 perfect safety be employed for wrapping butter, meats, spices, groceries, and all materials, whether unctuous or otherwise.

By the term “hydration” as used herein I

mean the subjecting of the material (after treatment with glutinous material and formaldehyde and drying) to moisture, whereby the action herein described takes place.

5 With my methods or processes the sheet of material—as paper, for instance—can be treated as rapidly as it is manufactured, as the time for exposure to the action of the glutinous material need not be longer than  
10 the time required for it to become saturated, this of course varying with different thicknesses and densities, and the length of time of exposure may be fixed without checking the speed by making the tank of such length  
15 that the requisite time will elapse while the sheet is passing through it and the guides so arranged as to maintain the sheet in position to be acted on by such solution the requisite length of time. I find four seconds exposure  
20 to the action of formaldehyde sufficient in most cases.

Having therefore described my invention, what I claim, and desire to secure by Letters Patent, is—

25 1. The improvement in the art of treating paper or other like material, consisting in saturating the material with a glutinous substance, then subjecting the saturated material before it is dry to the action of formaldehyde, then drying the material, then hydrating the same and then drying it.

30 2. The improvement in the art of treating paper, &c., consisting in first treating the paper with a fluid glutinous compound, then removing the surplus from the surfaces, then subjecting it before it is dry to the action of formaldehyde, then drying the same, then hydrating the material, and then drying it.

3. The improvement in the art of treating  
40 paper or other like material, consisting in saturating it with a glutinous material, then mechanically removing the surplus from the surfaces, then subjecting it while in its watery condition to the action of formaldehyde, then drying it, then hydrating the material  
45 with a solution of water and glycerin, and then drying it.

4. The improvement in the art of treating paper or other like material, consisting in  
50 first treating it with a glutinous substance, then subjecting it to the action of formaldehyde, then drying, then hydrating, and then subjecting it to the action of a volatile alkali.

5. The improvement in the art of treating  
55 paper or other like material, consisting in first saturating the paper with a glutinous material, then mechanically removing the surplus from the surfaces, then immersing it while in its watery condition in a bath of dilute formaldehyde, then drying it, then hydrating it  
60 by immersion in a bath of dilute glycerin, and then drying it.

6. The improvement in the art of treating paper or other like material, consisting in first  
65 treating it with a glutinous compound, then subjecting it before it is dry to the action of

formaldehyde, then drying it, and then hydrating it by subjection to the action of hot water.

7. The improvement in the art of treating  
70 paper or other material, consisting in first subjecting it to a glutinous compound, then to the action of formaldehyde, then drying it, then hydrating it, and then subjecting it to the action of ammonium hydrate.

8. The improvement in the art of treating paper or other like material, consisting in first saturating it in a bath of glutinous material, then passing it through a bath of dilute formaldehyde, then drying it, then immersing  
80 it in hot water to hydrate it and remove impurities, and then neutralizing with a volatile alkali.

9. The improvement in the art of treating paper or other like material consisting in pass-  
85 ing the material in one continuous motion, first into a vat wherein it is saturated with a glutinous material, then removing the surplus from the surfaces, then passing it through a formaldehyde-bath, then removing the sur-  
90 plus from the surfaces, then passing it into hot water, and then into a solution of a volatile alkali and calendering.

10. The improvement in the art of treating paper herein described, consisting in subject-  
95 ing a continuously-moving sheet consecutively to the following treatments: first, impregnating the sheet with a heated fluid glutinous solution; second, passing the paper before it is dry through a formaldehyde solu-  
100 tion; third, subjecting the paper to a drying agency; fourth, subjecting the paper to a heated immersion to hydrate it, and fifth, drying the treated paper.

11. The herein-described method of pre-  
105 paring a waterproof material, which consists in first applying a solution of glue; then subjecting the material thus treated to the action of a weak solution of formaldehyde; then drying and treating with boiling water and  
110 glycerin, and subsequently with dilute ammonia hydrate and wood-alcohol.

12. The improvement in the art of treating paper herein described, consisting in subject-  
115 ing a continuously-moving sheet consecutively to the following treatments: first, impregnating the sheet with a fluid glutinous solution; second, passing the paper through a formaldehyde solution; third, subjecting the paper to a drying agency; fourth, subjecting  
120 the paper to a heated immersion to hydrate it; fifth, passing the paper through a bath of ammonium hydrate, substantially as described, and, sixth, drying the treated paper.

In testimony that I claim the foregoing as  
125 my invention, I have signed my name, in presence of two witnesses, this 6th day of August, 1900.

CHARLES I. GOESSMANN.

Witnesses:

ALLEN WEBSTER,  
L. H. HORNER.