

UNITED STATES PATENT OFFICE

2,010,635

METHOD OF MANUFACTURING WETPROOF
CELLULOSE PRODUCTS

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No Drawing. Application September 4, 1931,
Serial No. 561,311. In Germany September 20,
1930.

8 Claims. (Cl. 92—3)

I have filed application in Germany Sept. 20, 1930.

This invention has reference to improvements in the manufacture of cellulose products having high wet strength which will resist even rough usage in the moist condition, as for instance in the manufacture of paper towels and the like, and it is intended to devise means of manufacturing a better product than generally obtainable heretofore and to also simplify the process of manufacture of such products. In the various methods suggested by the prior art of manufacturing water-proof or moisture-proof cellulose products their water-resisting or water repelling properties were ordinarily produced by treating the raw material or the products themselves during or at the end of the manufacturing process with water repelling substances with which they were impregnated, or with certain chemical agents, such as acids for instance, and preferably at an increased temperature.

Now, with these previous methods there is the difficulty that the fibers of the water-proof cellulose products have lost their imbibing or water-absorbing qualities, and in view thereof it is one of the important objects of this invention to obtain moisture proof articles which, while being adapted to absorb moisture and being free from water-repelling qualities will not become disintegrated and will not become flabby or soft or collapse and lose their stiffness, when they are exposed to moisture during usage. These and similar requirements are of importance for instance in the case of paper handkerchiefs, paper towels and of similar paper articles which would otherwise be unsuitable for use. It has been ascertained that it is not possible to so adjust the moisture resisting qualities of marketable paper or of other finished cellulose products, as for instance by treatment with formaline and acid, as to prevent such products from becoming at the same time brittle and liable to rupture.

In accordance with this invention however it has become possible to manufacture cellulose products which have both flexibility and high wet strength, by employing a treatment which, instead of converting the finished cellulose products into moisture-proof compounds, makes use of moisture-proof raw material, a mixture of moisture-proof crude cellulose with cellulose material of other suitable substances and possessing none or only limited moisture-proof qualities being used for instance for the manufacture of the desired cellulose products. The moisture-proof condition of the crude cel-

lulose may be produced according to any suitable method, as for instance by treating the crude cellulose with formaldehyde and acid with or without other additions, simultaneously or successively and by exposing it to the action of high temperatures.

In accordance with this invention and by way of exemplification I may for instance make use of a mixture of four parts moisture-proof cellulose and one part elastic, but not moisture-proof cellulose and by this means a kind of paper may be obtained which is adapted to absorb or suck-up moisture, and which is not brittle and liable to rupture, and which is still sufficiently moisture-proof to resist disintegration and falling apart and flowing away of the fibers when in the moist condition, so that it is well adapted for the manufacture of handkerchiefs and towels from cellulose. In this manner it is also possible to obtain moisture-proof card-board by the employment of moisture-proof and of non-moisture-proof or only slightly moisture-proof crude cellulose. By this means thick, bulky articles, such as cellulose artificial wood which are otherwise only superficially and unsatisfactorily treated, may be submitted to the method of this invention and may have a highly efficient degree of moisture-proof qualities imparted to them, inasmuch as the crude cellulose becomes intimately mixed with the chemical agents on which the moisture-proof quality depends, so that a final product is obtained of uniform moisture-proof condition throughout.

By a suitable selection of the proportions of the mixture of moisture-proof and of non-moisture-proof cellulose in the crude condition the degree of resistance against moisture of the final products may be suitably adjusted. Instead of non-moisture-proof crude cellulose the moisture-proof crude cellulose used may also be mixed with substances which facilitate the further treatment thereof or which are such as not to withstand the chemical agents and high temperatures employed in the moisture-proof-making of the final product, such as dyes, colors, glue or the like. A further important advantage of the process according to this invention is presented by the fact that the procedures dealing with the subsequent treatment of the finished cellulose are not interfered with by the necessity of effecting the moisture-proof treatment which may be carried out in a much simpler and less expensive manner in the works dealing with the manufacture of crude cellulose.

The method according to this invention may

for instance be carried out as follows:—A suitable kind of cellulose in the crude condition and obtained by the ordinary methods is impregnated with a mixture of 100 parts formaldehyde of 40 percent and 2 parts concentrated nitric acid and intimately mixed therewith. It is then squeezed out and is dried at 120 degrees centigrade upon a heated support. The crude cellulose thus obtained which is proof against moisture is mixed with untreated crude cellulose in the proportion of 4:1, so that a uniform mixture is obtained which is then worked into paper, card-board, artificial wood and other cellulose products in the usual manner.

It should also be pointed out that the scope of the invention is not limited to the particular exemplification herein described as an illustration of its principles, and modifications and changes are possible within the ambit of the claims hereinafter appended.

I claim:—

1. The method of manufacturing cellulose products having high wet strength, which comprises treating crude cellulose with about 40 percent formaldehyde with a limited percentage of concentrated nitric acid, removing the excess of treating liquid, drying the treated cellulose at about 120 degrees C., mixing an excess thereof with untreated crude cellulose and obtaining cellulose articles from said mixture.

2. A process for the production of wet-proof cellulose products which are capable of being wetted and which are absorbent but which do not disintegrate or fray when they become wet, said process comprising providing as initial material about four parts of raw cellulose which has been rendered perfectly wet-proof by treatment with formaldehyde, acid and heat and mixing therewith one part of substantially non-wet-proof cellulose material.

3. That process of preparing cellulose for the manufacture of paper towels and other wet-proof products and which consists in treating raw cel-

lulose with a mixture of formaldehyde and nitric acid exposing said mass to the action of heat at substantially 120° C., and mixing with the treated cellulose a quantity of raw untreated cellulose.

4. That process of preparing cellulose for the manufacture of paper towels and other wet-proof products and which consists in treating raw cellulose with a mixture of formaldehyde and nitric acid exposing said mass to the action of heat at substantially 120° C., and mixing with the treated cellulose a quantity of raw untreated cellulose in the proportion of four parts treated and one part of untreated cellulose.

5. That step in the process of preparing a wet-proof cellulose product which consists in treating raw cellulose with a mixture of formaldehyde and concentrated nitric acid exposing said mass to the action of heat at substantially 120° C.

6. That step in the process of preparing a wet-proof cellulose product which consists in mixing with raw cellulose an excess of a mixture of substantially one hundred parts of forty percent formaldehyde and two parts of concentrated nitric acid, expressing the excess formaldehyde and acid to partially dry the mass, and exposing the mass to heat at temperature of substantially 120° C.

7. A process for the production of cellulose products having high wet strength comprising rendering raw cellulose capable of high wet strength by treating said raw cellulose with formaldehyde and acid in the presence of heat and admixing therewith a cellulose material having substantially no wet strength.

8. A process for the production of cellulose products having high wet strength comprising rendering raw cellulose capable of high wet strength by treating said raw cellulose with formaldehyde and acid at a temperature of substantially 120° C. and admixing therewith a cellulose material having substantially no wet strength.

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