UNITED STATES PATENT OFFICE.

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HYDRATED CELLULOSE OR LIGNOCELLULOSE MATERIAL.

1,140,799. Specification of Letters Patent. Patented May 25, 1915.

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To all whom it may concern:

Be it known that I, JUDSON A. DE CEW, of the city of Montreal, in the Province of Quebec and Dominion of Canada, have invented certain new and useful Improvements in Hydrated Cellulose or Lignocellulose Material, of which the following is a full, clear, and exact description.

This invention relates to a process of hydrating cellulose or lignocellulose material, the particular application of the invention being the treatment of pulp material used in the manufacture of paper.

Every cellulose material contains a certain amount of water of hydration unless it has been artificially removed. These materials also have a tendency to absorb a certain quantity of this water of hydration in proportion as the OH group is more or less suppressed by combination with the negative radicals in the molecule. Cellulose materials have a weakly acid character, and more weakly basic character, therefore they will absorb or combine with a very small amount of acid, and with a larger amount of alkali. For instance, the amount of sulfuric acid that will react with a cellulose material is about .5%, while the amount of caustic soda that will combine with it is about 2%.

I find that the hygroscopic character of any cellulose material is greater when it is combined with alkali, than when it is combined with acid, and that when it is in the basic condition, it has a constant tendency toward greater hydration. I also find that this tendency toward hydration can be still further increased by the addition of other materials in very small quantity, such as carbon bisulfid.

Carbon bisulfid is soluble in water to about .2%, and combines with the alkali Na_2S, forming the soluble compound Na_2CS_3 (sodium thiocarbonate), and in this way it may in either form be brought into reaction with the cellulose.

The main object of this invention is to provide a process of treating a cellulose or lignocellulose material with a dilute alkali, an alkaline thiocarbonate or an alkali and carbon bisulfid or one of its compounds, whereby the material will absorb water and become hydrated, so that it can be ground by mechanical processes into strongly fibrous material.

In carrying out my invention, it must be understood that only a small percentage of alkali is actually absorbed by the cellulose, and the resultant product is quite distinct from the alkali-cellulose formed by the combination of strong caustic soda with cellulose in viscose and mercerizing processes. In forming alkali-cellulose, it is necessary to use about fifty parts of caustic soda to one hundred parts of cellulose, and this treated with about fifty parts carbon bisulfid becomes soluble, forming viscose. The object of the viscose process is the destruction of the fiber structure, whereas in my process the object is to maintain in full the structure of the fiber, the only change being due to hydration.

In the mercerizing process, there is also an alteration in the structural character of the fiber, but this takes place only when the cellulose is treated with caustic soda of a strength exceeding 13% of NaOH.

In my process, plastic or soluble cellulose is not formed nor is this the object desired. What is aimed at in my process is the weakest possible alkaline condition of the fiber, which means that a certain small percentage of alkali has been taken up by the acid radicals in the cellulose molecule. The advantages of the slightly basic condition of cellulose material for special purposes are not generally known, and the disadvantage of the acid condition is not known. For example, in the manufacture of sulfite cellulose, the product is made by an acid process and will naturally contain a small percentage of acid which cannot be removed by washing, this acid being either sulfurous or sulfuric acid. If sulfurous, it will be finally oxidized to sulfuric acid, and the constant tendency (which is increased by heat or drying) is to form hydrocellulose and make the product brittle or tender.

This is a great disadvantage in the making of strong fiber paper from sulfite pulp, for owing to the acid character of this fiber it does not become hydrated in the beating engine with the same facility as if it were alkaline, and the acid in its composition is constantly destroying the strength, especially when it is heated or dried during or after manufacture. On this account sulfite papers are generally weaker than those made from fiber isolated by an alkaline process.

My process not only prevents the tendering action going on in a cellulose material which is acid, but places it in a chemical condition for the rapid absorption of water, and

this hydration has much to do with the strength that can be obtained from the fiber when it is made into paper. Papers made from fiber isolated by the sulfite process will be, when using my process of treatment, as strong as any paper made from fiber prepared by any other method. This, however, is but a special application of the process, for any fibrous material, which in its natural condition offers resistance to the absorption of water, can be made more hygroscopic by treating it with a very small amount of alkali or alkali and carbon bisulfid.

Any woody material in the form of chips, blocks, sawdust, etc., if treated by a purely mechanical process of crushing or grinding will be reduced to a more or less pulverulent non-fibrous pulp, because without hydration the cells are so strongly cemented together that they will break before they will pull apart into separate fibers. If, however, this woody or fibrous material be first brought into a condition of hydration by treatment with a very dilute alkali or an alkali combined with CS_2, the cells or fibers will be more easily separated from each other, forming a longer, stronger and better pulp. In any process heretofore known, which uses alkali in the treatment of woody material in this way, it is always understood that sufficient alkali is employed to effect a chemical resolution of the ligno-cellulose, either partial or complete, in which case there are more chemical changes than that of merely producing the condition for hydration. In my process, I use solutions so weak that the fiber substance will absorb approximately 2% of its weight of alkali, in which case it cannot be again washed from the fiber.

A special application of this process would be the use of a solution of waste alkali that might be produced as a by-product in an industry such as soda pulp, sulfate pulp, or rubber recovery, the weak alkalinity being insufficient to effect any observable change in the fiber, other than the condition for hydration. Although a dilute alkali may be used, I have found that the hydration is greater when the alkali is associated either directly or indirectly with CS_2.

Having thus described my invention, what I claim is:—

The herein described product consisting of a cellulose or lignocellulose material treated with an alkali and carbon bisulfid, the proportion of alkali being such that the material will absorb approximately 2% by weight of alkali.

In witness whereof I have hereunto set my hand in the presence of two witnesses.

JUDSON A. DE CEW.

Witnesses:

STUART R. W. ALLEN,

G. M. MORELAND.