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ART OF PAPER MAKING

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The invention relates to the art of paper making and more particularly to a process and chemical agent for freeing and separating the fibre or cellulose of wood, straw, bamboo, and other vegetable tissues from glutinuous, resinous, albuminous, siliceous and other intercellular and incrusting matters, to form paper pulp.

Heretofore, paper pulp of the type which results from the use of chemicals has been made by crushing, chipping or cutting the vegetable tissues and then subjecting the product to a comparatively strong chemical whereby the cellulose is separated or freed from all foreign substances. In connection with wood, two methods have been used, known respectively as the soda or alkaline process and the sulphide or acid process. In the soda or alkaline process, the wood after being reduced to chips or shavings is boiled from two to eight hours in a solution of soda which under normal conditions consists of approximately one sixteenth per cent of Na_2O estimated on the barked and clean wood. The boiling is done under a pressure which varies from ninety to as much as one hundred and fifty pounds per square inch. In the sulphide process, the prepared wood is boiled in a solution of sulphurous acid (H_2SO_3) combined with a certain amount of base either magnesia or lime. In connection with bamboo, grasses and other vegetable tissues, similar processes are used to eliminate the foreign substances depending largely upon the character of the material. In any case, or instance, regardless of the specific process used, the chemicals heretofore employed have been of such strength and character that a comparatively large portion of the fibres, especially the weaker fibres in the central part of the tissues has been dissolved. As a result, a portion of the cellulose is lost when the liquor or chemical solution is drained off after the boiling operation, and great waste occurs. Additionally great care must be exercised in connection with these processes otherwise the chemicals will attack and destroy a greater percentage of the fibre.

One object of the present invention is to provide a process and chemical agent for reducing wood and other vegetable tissues to paper pulp which will effectively dissolve and free all of the intercellular and incrusting materials without attacking in any way or manner the fibers. As a result, a material saving is occasioned because practically the entire amount of cellulose is obtained from the tissues.

A further object of this invention is to provide a process or treatment of this character which renders the fibres or cellulose suitable for use in making high grade paper and artificial silk, requires less time than processes previously used and does not require the attention and careful performance which heretofore has been necessary.

A further object of the invention is to provide a process for making paper pulp which is of an improved character, is comparatively simple, and reduces the cost of the finished product.

Other objects will appear hereafter from the detailed description.

The invention consists in the process and chemical agent hereinafter set forth and more particularly defined by the claims at the conclusion hereof.

The improved process or formula is applicable to wood, bamboo, flax, hemp, jute, banana-stalks, sugar cane, corn-stalks, cotton, cotton-stalks, straw, palmettos, and rice, wheat and oat-stems, and other various vegetable tissues. The process is carried out by first reducing the material from which the pulp is to be formed to comparatively small pieces. When the process is applied to wood, the latter is first chipped or shaved by any suitable machinery, or is defibered by mechanism, such for example, as that disclosed in Letters Patent of the United States, No. 1,344,180, granted to Uel S. McMillan on the 22nd day of June, 1920. The wood product is then boiled in a solution containing silica of soda (33 to 66 Baumé) and caustic potash. In actual practice, it has been found that the best results are obtainable by using four parts of silica of soda and one part caustic potash, that is by using the chemicals in a ratio of four to one. The chemicals are used in this proportion in amounts ranging from

two to twenty per cent of the dry weight of the wood, depending mainly upon the kind of wood being treated and the condition thereof. The solution operates to separate the fibres and to dissolve the intercellular and incrusting materials or to form, together with the latter, soap. A characteristic of using the solution or chemicals specified is that the fibres are not attacked in any way and consequently no cellulose is lost as occurs in processes which heretofore have been proposed. Furthermore, the fibres are of such character that they may be used for making high grade paper or artificial silk.

After about one-half hour or so of boiling, sodium sulphide is added to the solution, in an amount ranging from two to twenty per cent of the dry weight of the material, depending of course upon the condition and kind of wood used. Generally an amount is added which is equal to the two chemicals first used. This sodium sulphide accelerates or assists the silica of soda and caustic potash to break down the incrusting and intercellular material or to form soap of same. The boiling is then continued for a period which need not exceed two hours, and under a pressure which may vary from five pounds to one hundred and twenty-five pounds per square inch. At the conclusion of the boiling, the liquors including any soap resulting from the action of the chemicals upon the resin, fat and other intercellular and incrusting material are drained. The fibre is then washed in the usual way to remove thoroughly the solution and soap and to place it in condition to be bleached.

When the process is applied to corn-stalks, straw or the stems of rice, wheat and oats, the material to be made into pulp is first crushed by any suitable machinery so that the natural or normal length of the fibres is not broken. This crushing operation serves to break or separate the silica coating and intercellular material so that they are more susceptible to the action of the chemicals which are used in the process. The crushed product is boiled in a solution containing silica of soda (33 to 66 Baumé) and caustic potash in substantially the same proportions (four parts silica of soda and one part caustic soda) as used in connection with wood, the amount depending upon the kind and condition of the material. The boiling is continued for about two hours. Then the liquor is drained and the fibres washed and bleached in any suitable manner. In practice, it has been found that the materials above referred to do not need to have sodium sulphide introduced into the solution during the boiling thereof, and that the fibres freed are in a superior condition and are undissolved.

When the process is applied to grasses, banana-stalks and like vegetable tissues, the material is crushed and boiled in a solution containing sodium sulphide in an amount ranging from two to twenty per cent of the dry weight of the material. The boiling is continued under any suitable pressure until the intercellular and incrusting material is broken down and formed into soap. At the conclusion of the boiling operation, the liquors are drained off. The fibres or cellulose is then washed and bleached to form the paper pulp.

In actual practice, tests have disclosed that when the process herein described is used, seventy-five to seventy-eight per cent of the cellulose actually contained in the material is obtained as against thirty to fifty per cent by methods or processes heretofore practiced.

The process is not to be understood as being limited or restricted to the specified proportions and amounts of the chemicals since these may be changed to meet the various kinds of materials and the condition thereof.

Having thus described the invention, what I claim as new and desire to secure by Letters Patent, is:

1. That improvement in the manufacture of paper pulp which consists in reducing the material to comparatively small pieces, and then immersing the pieces in a solution containing silica of soda and caustic potash.

2. That improvement in the manufacture of paper pulp which consists in reducing the material to comparatively small pieces, and then immersing the pieces in a solution containing silica of soda and caustic potash substantially in the ratio specified.

3. That improvement in the manufacture of paper pulp which consists in reducing the material to comparatively small pieces, and then immersing the pieces in a solution containing silica of soda and caustic potash substantially in the ratio specified, and ranging from two to twenty per cent of the dry weight of the pieces.

4. That improvement in the manufacture of paper pulp which consists in reducing the material to comparatively small pieces, and then boiling the pieces in a solution containing silica of soda and caustic potash and until the fibres are entirely free from the intercellular and incrusting material.

5. That improvement in the manufacture of paper pulp which consists in reducing the material to comparatively small pieces, and then immersing the pieces in a solution containing silica of soda, caustic potash and sodium sulphide.

6. That improvement in the manufacture of paper pulp which consists in reducing the material to comparatively small pieces, then boiling the pieces in a solution containing silica of soda and caustic potash, and then adding sodium sulphide.

7. That improvement in the manufacture of paper pulp which consists in reducing the

material to comparatively small pieces, and then boiling the pieces in a solution containing silica of soda, caustic potash and sodium sulphide substantially in the ratio and amounts specified.

Signed at Chicago, Illinois, this 29th day of October, 1927.

JOHN NEUMANN.