

UNITED STATES PATENT OFFICE.

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PROCESS OF MANUFACTURING PRODUCTS FROM CORNSTALKS, SUGAR-CANE, SORGHUM, OR ANALOGOUS PITHY STALKS AND PAPERS PRODUCED THEREBY.

SPECIFICATION forming part of Letters Patent No. 789,417, dated May 9, 1905.

Application filed September 29, 1904. Serial No. 226,447.

To all whom it may concern:

Be it known that I, VIGGO DREWSSEN, a citizen of the Kingdom of Norway, residing in the city of New York, in the county of Kings and State of New York, have invented a new and useful Process of Manufacturing Products from Cornstalks, Sugar-Cane, Sorghum, or Analogous Pithy Stalks and New and Useful Papers Produced Thereby, of which the following is a specification.

The difficulty in preparing fibrous material (cellulose) and other products suitable for the manufacture of paper from these pithy stalks lies in the different character of the different parts of the stalk. A cornstalk proper—namely, without leaves or husks, for instance—consists of two parts which can be used by paper manufacturers—to wit, the outside shell and the pith. The shell has a character similar to wood and contains a high percentage of fibers, while the pith is spongy and consists principally of oblong cells. This is also true of the sugar-cane and analogous plants. The shell when treated with chemical substances—such as caustic soda and sodium sulfid, for instance—yields a large proportion of fibers which are adapted for paper-making and produce an opaque sheet of paper. The pith, on the other hand, when treated with the same chemical substances disintegrates into cells and the sheet of paper derived therefrom is translucent and constitutes parchment-paper. Attempts were made long ago to utilize the stalks in the manufacture of paper by treatment with a caustic alkali, and in carrying out these attempts various processes were used, the earliest of which consisted in boiling the stalks, after having crushed them, in a weak solution of caustic soda for about six hours. The result was a parchment-like more or less discolored brittle paper which had few uses, and the processes, therefore, never led to any practical manufacturing result. It was thereafter supposed that the difference in character between the fibers of the shell and the cells of the pith required two separate cooking operations wherein the fibers of the shell needed a stronger solution and a longer time for cooking than were needed for the pith,

and it was also thought that if the pith was cooked simultaneously with the shell in the same strength of liquor and for the same length of time as are required for the disintegration of the fibers of the shell and their separation from the incrustaceous matter the cells of the pith are practically destroyed and cannot be utilized. In a previous application for United States Letters Patent filed by me July 9, 1903, Serial No. 164,759, however, I have described and claimed my discovery that this is not always the case and that by the use of proper means only a single operation of cooking is necessary for the entire stalk, shell, and pith and that both can be used either separately or together in making the paper. The papers made by this previous method of mine, while exceedingly useful, lacked some qualities which it was desirable to secure, for the pulp was not sufficiently absorbent and the paper consequently was not soft enough for the most desirable forms of paper for printers' use and other purposes.

The object of my present invention was to secure these desired results, and I have made the discovery that by following the method hereinafter described the requisite qualities of paper can be produced. The discovery is that if the stalks be cooked in a stronger solution and for a longer time than has heretofore been supposed to be possible without destroying the utility of the pith I succeed, instead of destroying the pith, in changing its parchment quality to a soft absorbing nature and in getting a superior quality of paper to any which has heretofore been produced from these substances, and the marked difference is illustrated by the fact that if paper heretofore produced from these substances is thereafter further cooked according to my discovery the quality of the paper will be quite changed, its hard character will be lost, and a paper is produced by this further cooking which has the requisite quality of softness.

In carrying out my process I first separate and cut up the entire stalk into pieces. This exposes the pith lying within the shell. The cutting may be omitted, especially where the stalk has been crushed, as in rollers. I then

place these pieces of stalk in a digester or rotary containing the necessary chemical solution—say twenty per cent. (20%) of caustic soda, ($\text{Na}_2\text{O} \cdot \text{H}_2\text{O}$) calculated from the bone-dry weight of the stalk—though I do not confine myself to this specific strength of the solution, for sodium sulfid (Na_2S) may be used in admixture with the caustic soda. Neither do I confine myself to the specific length of cooking-time and steam-pressure given below so long as the length of time of cooking, the strength of the cooking liquor, and the steam-pressure is sufficient to effect the change in the character of the pith-cells as above described. Cooking the stalk for nine hours at a steam-pressure of ninety pounds to the square inch has given satisfactory results. After cooking the pieces of stalk the pressure is blown off or partially blown off from the digester or rotary and the contents are run out into a draining-vat, the dark-colored liquor is allowed to run off, and is washed out of the solid material and saved to be used for special purposes which form no part of this invention. The solid washed material consisting of the cooked fibers and pith-cells is then thrown on a screen to separate from it any part which may not have been thoroughly cooked and then can be run directly or after bleaching or filling or sizing onto the paper-machine. This pulp is run out onto the wire of a paper-making machine—for instance, the well-known Fourdrinier machine—thence onto the couch-rolls, thence through one or more presses, and therefrom onto the drying-rolls, and thence onto the calendering-rolls. By this method I avoid the necessity of using a beating-engine, for the cells are fine enough to replace the beaten fibers of other methods. The paper resulting from this mode of operation is unlike any paper heretofore produced from stalks of the character described and resembles ordinary opaque soft paper used by printers. The paper may, if desired, be sized and likewise “filled,” as it is technically termed, with clay, talc, and similar filling material known in the papermakers’ art. The filling material does not have to be added in a beating-machine, but can be placed in the washing-vat, where the pulp is washed and stirred therein, so as to thoroughly mix it with the pulp before the mixture is passed onto the apron of the paper-machine. The product of this process when the pulp is filled results in a paper which I have termed “imitated coated paper” as the most appropriate descriptive term, for it is a substitute for coated paper. I can, however, make another form of paper by the same process with an added step, which produces writing-paper and also what I have termed “imitation-parchment paper,” in that it is unlike the parchment-paper which has heretofore been made from the cooked cells of the pith of the stalks of the plants referred

to, in that while such former paper is stiff, brittle, and grease-proof my new paper is flexible, not brittle, and is less grease-proof, while it is translucent. This added step by which I produce this new second kind of paper consists in treating the pulp in a “beating-engine,” as it is termed in the art, or a similar machine. In manufacturing this second kind of paper the cooked and washed fibers and pith-cells, either bleached or unbleached, instead of being run directly onto the paper-machine are conducted to the beating-engine and beaten therein with water—say for an hour—until the pith-cells are broken up. Thereafter the beaten pulp either before or after sizing is run onto the paper-machine and the resulting paper has the qualities which I have described above.

It is essential to my invention that the cooking liquor must contain a caustic alkali, which is not a salt, but a base, and that the cooking be conducted under a greater pressure than atmospheric pressure and that the cooking be conducted for a longer time than has heretofore been practiced. Of course some latitude may be allowed to the operator, for if the strength of the cooking liquor be much increased the time of cooking may be thereby somewhat lessened; but the desirable results which I have obtained will not be realized unless the fibers and pith-cells are cooked substantially longer and in a stronger cooking liquor than has heretofore been thought to be desirable or possible, and this longer cooking and stronger solution give a totally different quality of papers from those heretofore produced by former methods, including my own. What I mean by a “stronger” cooking liquor is one which contains from five per cent. to ten per cent. of the caustic alkali, calculated to the weight of water employed. I secure a more thorough eradication of incrustaceous matter and obtain papers, both opaque and translucent, having the characteristics above described.

I do not claim in this application, which I term “Case B,” the papers which I have above described as the opaque, soft, non-filled, nor the translucent writing and imitation-parchment papers, because they form the subject-matter of separate applications, filed simultaneously herewith and designated, respectively, as “Case A” and “Case C,” filed September 29, 1904, Serial Nos. 226,446 and 226,448, respectively; but,

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

1. Opaque, soft, imitated coated paper produced from sugar-cane, cornstalks, sorghum and analogous pithy stalks in which the fibers of the outer shell, the fibers of the vascular bundles, and the softened altered and absorbent pith-cells are all intermingled and matted together, intermixed with a filling material, substantially as described.

2. The process of producing opaque, soft, imitated coated paper from sugar-cane, corn-stalks, sorghum, and analogous pithy stalks which consists in cooking said stalks in a closed vessel under steam-pressure in a cooking liquor containing from fifteen to thirty per cent. of caustic soda calculated from the bone-dry weight of the stalk for from ten to four hours according to the strength of liquor employed and under a steam-pressure of from sixty to one hundred pounds, until the pith-cells have been converted into soft absorbent pulp instead of parchment-like, water and grease repellent pulp; then mixing the pulp with a filling material; and then running said cooked pulp without beating upon the paper-machine and making paper therefrom, substantially as described.

3. The process of producing opaque, soft, imitated coated paper from sugar-cane, corn-stalks, sorghum, and analogous pithy stalks,

which consists in first cutting said stalks into pieces; next cooking said stalks in a closed vessel under steam-pressure in a cooking liquor containing from fifteen to thirty per cent. of caustic soda calculated from the bone-dry weight of the stalk for from ten to four hours according to the strength of liquor employed, and under a steam-pressure of from sixty to one hundred pounds, until the pith-cells have been converted into soft absorbent pulp instead of parchment-like, water and grease repellent pulp; then mixing the pulp with a filling material; and then running said cooked pulp without beating upon the paper-machine and making paper therefrom, substantially as described.

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