

UNITED STATES PATENT OFFICE

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PROCESS FOR PRODUCING FIBER OR PULP

No Drawing.

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The invention relates to a digesting or cooking process of treating wood chips for the purpose of producing fiber or pulp, said process to consist of more than one stage.

The usual practice in the production of fibrous pulp from deciduous woods by the "soda process" is to fill a digester with wood chips then add a quantity of caustic soda, sodium hydroxide, in aqueous solution, equal to about 25% of the dry weight of the chips, to raise this charge to a temperature of about 340° F. and a pressure of approximately 110 lbs. and to hold it at this temperature for from 4 to 6 hours and then to discharge the digested mixture to washing pans. This is a very drastic treatment which results in the solution of a substantial percentage of the cellulosic fiber and its loss so far as its value as pulp is concerned. Moreover, the comparatively expensive chemical, sodium hydroxide is used throughout the digesting period.

The "sulphate process", which is applicable to deciduous woods although more generally used with coniferous woods, differs from the soda process in utilizing a mixture of caustic soda and sodium sulphide as a digesting agent instead of caustic soda alone. This process as heretofore practiced is equally subject to the disadvantages above pointed out in connection with the soda process.

The purpose of my invention is to produce cellulosic fiber from woods by a process in more than one stage. In treating deciduous woods, for example, I use a comparatively cheap chemical, sodium carbonate, in weak solution in the first stage, and in the second stage a solution of caustic soda which is weaker than that now commonly used in the "soda process". By so doing, it is possible to obtain a larger yield of pulp, from one to five per cent, and a greater economy in the use of chemicals, than has been possible by the usual method of using caustic soda only.

The same advantages can be obtained in the "sulphate process" by using in a first stage a solution containing sodium carbonate instead of caustic soda and in the second stage a solution containing less caustic

soda and less sodium sulphide than has hitherto been considered necessary.

The following illustrates a preferred way in which to carry out my process on deciduous woods. The first stage is initiated by filling a digester with chips equal to 12,500 lbs. of dry wood and adding 2500 gallons of an aqueous solution containing 1250 lbs. of sodium carbonate. Steam is admitted to the digester and its charge is brought to about 110 lbs. per square inch gauge pressure (not over 125 lbs.), and a temperature of approximately 330° F. and is held at this temperature from 30 to 60 minutes. At such temperatures, acids tend to be freely formed. The sodium carbonate present effects the neutralization of these acids and the generation of carbon dioxide gas, CO₂. This CO₂ is permitted to escape together with some steam through a relief valve at the top of the digester. This removal of the CO₂, or the greater portion thereof, prevents it from combining detrimentally with the caustic soda pumped in at the beginning of the second stage of the process.

At the end of the first stage of the process the admission of steam to the digester is stopped.

To initiate the second stage of the process, 2750 gallons of a solution containing 1900 lbs. of caustic soda is pumped in. To facilitate this, the pressure in the digester may be lowered slightly, as by 10 or 15 lbs. on the gauge.

Steam is again admitted and the pressure in the digester brought to about 110 lbs. and the temperature of the charge to approximately 340° F. This temperature is maintained for about 4 hours. At the end of this period, the admission of steam is stopped and the contents of the digester blown out into a suitable receiving vessel.

During the process a vigorous circulation of the liquid contents of the digester is maintained, preferably by means of a pump. The volume of solution used may be varied to correspond with the moisture content of the wood and to the type of digester being used.

The spent liquor resulting from the first stage of the process may be removed from the

digester as far as is practical by pumping, or through the action of the pressure existing therein, and may be treated for the recovery of sodium acetate, or as a source material for acetic acid, and other by-products, which may be recovered from such spent liquor by well-known methods. When my process is practiced in more than two stages, this removal of the spent liquor may take place between any two stages. When the spent liquor is drawn out of the digester after treating the material in the sodium carbonate solution, it is in such a condition that the by-products may be easily recovered, that is, more easily than in the case of the spent liquor removed at the end of the ordinary soda process. Moreover, when the liquor is removed prior to the final stage of the digestion, the bleaching of the product is facilitated. However, the removal of the liquor between stages of the process is not necessary to the successful production of pulp by this invention.

My invention is equally applicable as an improvement in the digestion of woody material by the "sulphate process". In this case, the first stage is carried on with a solution of sodium carbonate in the proportionate amount above set forth, namely about 10 to 12% of the dry weight of the chips, if wood be the material treated. The CO_2 is permitted to escape as above. After the first stage of the digestion is completed, a solution containing about 10% of the dry weight of the chips of caustic soda and about 6% of the same weight of sodium sulphide is pumped into the digester. The second stage is completed substantially as in the present practice of the "sulphate process".

Whereas I have described in detail methods of carrying out my process, I do not confine myself to these particular details, as it is possible to increase the number of stages and to vary the percentages of chemical, time of digestion and temperature to correspond with the different types of woody material being treated or to obtain different grades of cellulosic fiber.

Having thus described my process I claim:

1. The process of producing fiber or pulp from wood which consists of first cooking wood chips in a sodium carbonate solution at a temperature of about 330°F . for about $\frac{1}{2}$ to 1 hour, while permitting the escape of CO_2 formed, then adding a stronger solution containing sodium hydroxide and maintaining this charge at a temperature of about 340°F . for 2 to 4 hours.

2. The process of producing fiber or pulp by a multi-stage cooking process comprising a first stage in which wood chips are cooked in a sodium carbonate solution sufficient in amount and for a sufficient time and at such temperature as to neutralize substantially all acids formed with the generation and emission of CO_2 ; and a later stage in which the

chips are cooked in a sodium hydroxide solution sufficient in amount and for such time and at such temperature as to reduce the wood to pulp.

3. Process of producing fiber or pulp by multi-stage cooking process comprising a first stage in which the raw material is cooked in a sodium carbonate solution sufficient in amount and for a sufficient time and at such temperature as to neutralize substantially all acids formed with the generation and emission of CO_2 , and a later stage in which the material is cooked in a solution of sodium hydroxide and sodium sulfide, sufficient in amount and for such time and at such temperature as to dissolve substantially all the constituents of the material except the cellulosic fiber.

4. A process of producing paper pulp from wood chips which consists of a two stage cooking process, using in the first stage a solution containing sodium carbonate equivalent to from 8 to 12% of the dry weight of the chips and raising this to 80 to 125 lbs. steam pressure and maintaining this pressure for $\frac{1}{2}$ to 1 hour or more while permitting the escape of the CO_2 formed, and using in the second stage a solution of sodium hydroxide equivalent to 15% to 20% of the dry weight of the wood, raising the pressure to 80 to 110 lbs., and holding it there for 2 or 4 hours or until the cook is completed.

5. A process of producing paper pulp from cellulose material which consists of a two stage cooking process, using in the first stage a solution containing sodium carbonate equivalent to from 8 to 12% of the dry weight of the chips, raising this mixture to from 80 to 125 lbs. steam pressure and maintaining this pressure for $\frac{1}{2}$ to 1 hour or more, while permitting the escape of the CO_2 formed, and using in the second stage a solution of sodium hydroxide equivalent to 8 to 12% of the dry weight of the wood, and sodium sulphide equivalent to 4 to 8% of the dry weight of the wood, raising the pressure to 80 to 110 lbs. steam pressure, and holding it there for from 2 to 4 hours or until the cook is completed.

6. The process of producing paper pulp from wood which consists of first digesting wood chips for 30 to 60 minutes in a solution containing an amount of sodium carbonate equal to approximately 10% of the dry weight of the wood, at a steam pressure of about 110 lbs. per square inch, while permitting the escape of the CO_2 formed, then adding a stronger solution containing an amount of sodium hydroxide equal to approximately 15% of the dry weight of the wood and digesting the chips at a steam pressure of about 110 lbs. per square inch for about 4 hours, or until substantially all the constituents of the wood except the cellulose fibers are dissolved.

7. The process of producing paper pulp from wood which consists of first cooking

wood chips for 30 to 60 minutes with a solution containing an amount of sodium carbonate equal to approximately 10% of the dry weight of the wood, at a steam pressure of about 110 lbs. per square inch, while permitting the escape of the CO_2 formed, then adding a solution containing an amount of sodium hydroxide equal to approximately 10% of the dry weight of the wood, and sodium sulphide equal to approximately 6% of the dry weight of the wood, and cooking the mixture at a steam pressure of about 110 lbs. per square inch for about 4 hours or until the cook is completed.

8. The process of producing pulp from wood chips by a multi-stage cooking process comprising a first stage in which the wood chips are digested in a sodium carbonate solution of sufficient strength and for a sufficient time and at such temperature as to neutralize substantially all acids formed with the generation and emission of CO_2 , and a later stage in which the wood is digested in a stronger solution containing sodium hydroxide, of sufficient strength and for such time and at such temperature as to dissolve substantially all constituents of the wood except the cellulose fiber.

9. The process of treating cellulosic material, comprising first a mild digestion of the material in a sodium carbonate solution, removal of the spent liquor from the digester upon the completion of this stage of the process, treatment of such liquor for the recovery of organic by-products, and subsequent digestion of the material in a stronger solution containing sodium hydroxide until the material is reduced to pulp.

10. The process of producing pulp from wood chips by a multi-stage cooking process which comprises digesting the chips in a sodium carbonate solution with the application of heat and at a pressure in excess of 80 pounds per square inch, drawing off the spent liquor, and digesting the remaining material in a solution containing sodium hydroxide at a pressure in excess of 80 pounds per square inch until the material is substantially reduced to pulp.

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