

UNITED STATES PATENT OFFICE.

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PROCESS OF PREPARING WOOD FIBER.

1,138,907.

Specification of Letters Patent.

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No Drawing.

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To all whom it may concern:

Be it known that I, JOHN H. THICKENS, a citizen of the United States, residing at Buffalo, county of Erie, State of New York, have invented certain new and useful Improvements in Processes of Preparing Wood Fiber; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

It is the object of the present invention to provide a process by which a fibered pulp can be produced from wood and other suitable material without the use of recovery systems of any kind, and more particularly to produce a pulp in which the fibers have not been attacked to the extent now customary and therefore are stronger than usual, and produce a greater yield per cord of wood.

It is the further object of this process to cut down the consumption of chemicals to a minimum, only sufficient amounts of these materials being added to neutralize other compounds formed which would retard the digesting process.

In the furtherance of these objects and others, which will hereinafter appear, the wood either in the form of chips or in much larger sizes is placed in a suitable digester and there steamed thoroughly, after which a solution of an alkaline compound is admitted to the digester at a temperature slightly below the boiling point and in quantity sufficient to substantially flood the digester and cause condensation of the steam in the chips or blocks under treatment, with the formation of a partial vacuum in the wood whereby the alkaline solution is rapidly drawn in to fill the cells of the wood. The solution is then drawn off quickly and the steaming of the chips is continued as before, until the condition of the wood calls for the application of additional alkali, and then the flooding and resultant condensation are repeated. The cycle of steaming and flooding can be continued as many times as desired until the wood under treatment meets the particular requirements of the case. The material, after this treatment, is then mechanically reduced in edge runners or beaters, or is otherwise manipulated as the particular needs of the case may require.

Considering the process more in detail, the

physical and chemical phenomena involved will here be set forth with particular reference to the production of wood pulp, but I am aware that features of the process are of more general application where fibrous or woody structures are to be reduced to a pulpy condition, and a long and strong fiber is desired.

The wood to be used is barked and sawed just as in the ordinary soda or sulfite process, and it can be chipped according to usual methods before digesting. However, I have found that chipping is not necessary, and for certain purposes I prefer to treat the wood in the two foot lengths prepared for grinding or employ "hogged" waste wood such as slabs and edgings. By applying the process to large pieces, an unusual fiber structure is obtainable in the final product.

The wood, whether in the form of chips or in the form of two foot lengths, is placed in a digester either of cast iron or steel lined in a suitable manner to resist the action of the chemicals, and is there subjected to the heating and disintegrating action of steam. The pressure of the steam may vary through a wide range, as from 10 to 80 pounds per square inch, depending on the size of the wood pieces, and other special conditions of the operation, and the duration of the initial steaming will likewise depend on the size of the material and the result required. With wood in small pieces an initial steaming of one-half an hour is satisfactory, while with large chunks it might in extreme cases be prolonged as much as 30 hours. The longer steaming treatment gives a darker color and in some instances the color requirement may determine the duration of the initial steaming. In general the wood should be steamed under pressure for such a length of time as will allow the wood to become heated throughout to the temperature of the steam, and when this point has been reached the alkaline solution can be introduced.

The alkaline solution used for neutralizing the otherwise acid condition of the material may be either a solution of calcium hydroxid, sodium hydroxid, sodium carbonate, or other suitable alkaline material, and is admitted in large quantity and quickly through the bottom of the digester until the digester is substantially filled with the alkaline solution. The temperature of

this solution on its admission is slightly below the boiling point, and this sudden flooding of the digester with a relatively cold fluid causes condensation of the steam in the digester and throughout the chips or wood chunks, with the result that a partial vacuum is formed within the cells and pores of the wood, and the alkaline solution is drawn in or absorbed by the wood in large quantity, penetrating even to the center of relatively large pieces which have been heated up to the temperature of the steam. In this way a much more thorough impregnation of the wood with alkaline solution can be obtained than by mere soaking in the solution, or even by the application of external pressure, for with pressure impregnation there remains in the cellular structure of the wood very little fluid after the external pressure is removed.

As soon as complete condensation of the steam in the wood is effected—and in determining this, account must be taken of the low thermal conductivity of the wood—the alkaline solution is quickly drawn off, leaving the wood impregnated and permeated substantially throughout with the alkaline solution, but leaving the digester otherwise empty of the solution. Then steaming is continued as before, until upon taking off a sample from the digester it is found that the chips or wood react acid, and thereupon the alkaline solution is again introduced as before until it floods the digester and condenses the steam. The alkaline solution is then quickly drawn off again and the steam treatment continued until the chips again react acid. This procedure of alternately steaming and chilling with removal of the excess alkaline solution each time is carried on until the woody substance is digested to suit the particular requirements of the case.

When two foot sections of wood are used, the cooking treatment is not carried to a point where the fiber is as free from lignocellulose as when the chips are used, for after the two foot sections have been cooked or digested as above described, they may be ground in the ordinary manner to further effect subdivision of the woody structure. With either kind of wood, the digesting operation is terminated at a time when the chips react slightly acid.

As the result of the use of this process, when the two foot sections of wood are employed, a much stronger pulp can be obtained than is ordinarily obtained from the ground wood process. The fibers are longer and stronger and the chemical treatment, even though not carried as far toward disintegration as in the case of chipped wood, nevertheless gives advantageous characteristics to the fiber structure.

When chips are used, the further reduc-

tion of the chip is preferably carried on either in a beater having a stone roller or in a kollergang, preference being given to the stone rolled beater.

In applying the process here disclosed, there is the decided advantage of the elimination of the recovery process, and there is an increased yield of pulp from a cord of wood, these factors being due in large part to the absence of unabsorbed alkaline solution in the digester during the steaming treatment and to the ease with which the acidity of the product can be controlled and the possibility of taking the cooked material from the digester after it has itself returned to a slightly acid condition.

I claim:

1. The method of making strong fibered pulp, which consists in steaming the woody material in a digester until thoroughly heated, then flooding the digester with an alkaline solution cold enough to condense the steam in the woody material and effect absorption therein of the alkaline solution, withdrawing the unabsorbed alkaline solution from the digester and continuing the steaming.

2. The method of making strong fibered pulp, which consists in steaming the woody structure in a digester until thoroughly heated, then flooding the digester with an alkaline solution of lower temperature to condense the steam in the woody structure and effect absorption of the alkaline solution, and then withdrawing the alkaline solution and continuing the steaming until the woody structure reacts acid.

3. The method of making strong fibered pulp from wood, which consists in steaming the wood in a digester until thoroughly heated, then admitting an alkaline solution at a temperature slightly below the boiling point until the steam in the wood is condensed and absorption of the alkaline solution is thereby effected, immediately withdrawing the unabsorbed alkaline solution and continuing the steaming until a sample of wood from the digester reacts acid.

4. The method of treating wood, which consists in steaming the wood under pressure until it becomes heated throughout, then flooding the digester with an alkaline solution admitted through the bottom thereof and at a temperature slightly below boiling, whereby the steam in the wood is condensed and absorption of the alkaline solution is effected, then quickly withdrawing the unabsorbed solution and subjecting the wood to further steaming until a sample taken from the digester reacts acid, and subsequently repeating the flooding with alkaline solution and the steaming to acid condition until the desired digesting has been effected.

5. The method of making strong fibered pulp, which consists in steaming the wood

under pressure in a digester until it becomes heated throughout to the temperature of the steam, then admitting an alkaline solution in large quantity and quickly through the
5 bottom of the digester until the latter is substantially filled, the temperature of this solution on its admission being slightly below the boiling point, whereby the steam in the digester and throughout the wood
10 will be condensed and the alkaline solution drawn into the wood in large quantity, then withdrawing the unabsorbed alkaline solution and continuing the steaming until the

wood is returned to acid condition, and alternately repeating the chilling with alkaline solution and the steaming until the desired digesting is effected, and the material placed in condition for mechanical reduction by usual methods; substantially as described. 15

In testimony whereof I affix my signature, in presence of two witnesses. 20

JOHN HERMAN THICKENS.

Witnesses:

G. C. McNAUGHTON,
CHARLES G. S. CURTIS.