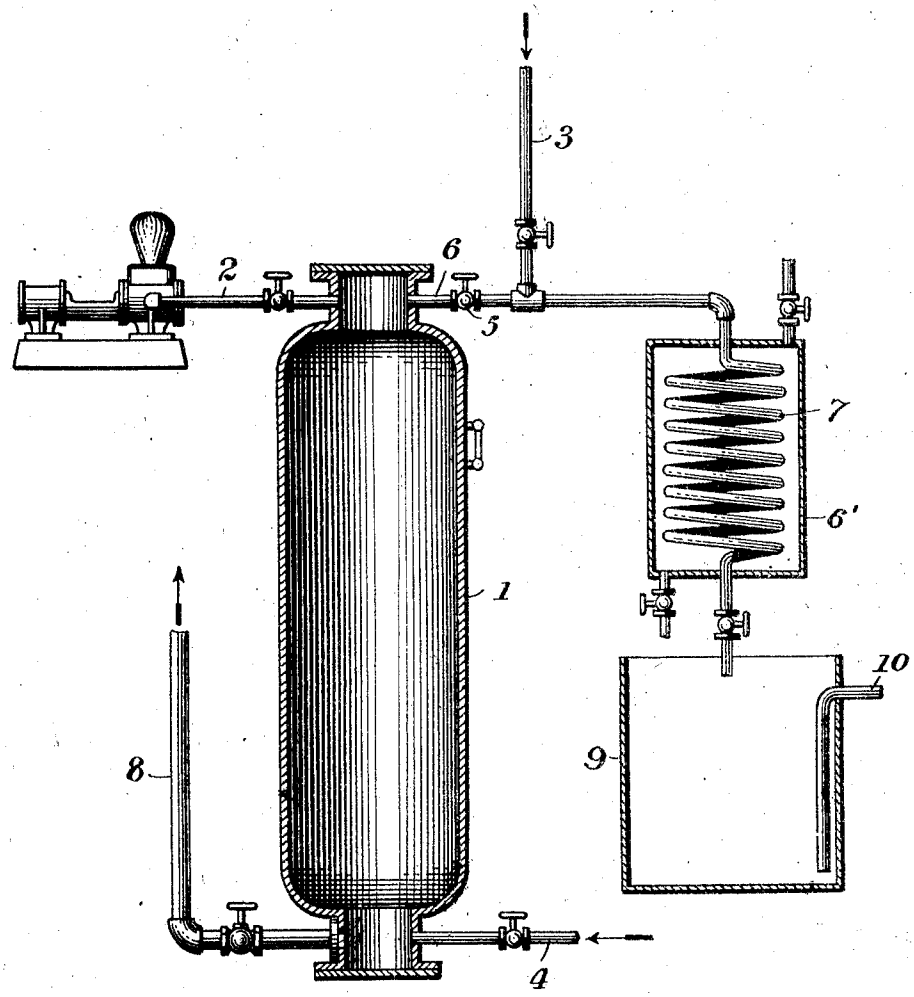
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PROCESS OF CONVERTING WOOD INTO PAPER MAKING STOCK AND BY-PRODUCTS.

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BAILEY F. WILLIAMSON, OF GAINESVILLE, FLORIDA.

PROCESS OF CONVERTING WOOD INTO PAPER-MAKING STOCK AND BY-PRODUCTS.

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To all whom it may concern:

Be it known that I, BAILEY F. WILLIAMSON, a citizen of the United States, residing at Gainesville, in the county of Alachua and State of Florida, have invented certain new and useful Improvements in Processes of Converting Wood into Paper-Making Stock and By-Products, of which the following is a specification.

This invention relates to an improved process of converting wood into paper-making stock and by-products, and refers more particularly to a process especially suitable for treating resinous woods, such for example as Southern pines; the process being such that the ultimate fiber of the wood is isolated from the intercellular matters and converted into paper-making stock, and at the same time the oils of the wood released, removed, and recovered.

Among the salient objects of the invention are to provide a process whereby resinous woods may be successfully treated and a maximum quantity of the ultimate fiber in its purest form secured; to provide a process whereby the elimination of the resin and oils from the wood results in the release of the contained oils and resin and in the formation of a resin soap in solution, the oils and turpentine being volatilized and carried off as fast as released; to provide a process whereby the chemical treatment to which the wood is subjected results in producing a softened and improved quality of fiber; to provide a process in which the chemical reactions are such as to act thoroughly, efficiently, and rapidly in dissolving the intercellular matters, while at the same time protecting and preserving the ultimate fiber against the harsh action of the caustic solution, thereby insuring a maximum yield of superior fiber; to provide a process which results in securing a maximum yield of the turpentine and oils by releasing them entirely from the resinous matter; to provide a process which may be carried out progressively and as a continuous operation, practically in a single digester or suitable receptacle; to provide a process which effects the rapid and thorough reduction of the material with the use of a minimum quantity of chemical; to provide a process in which the chemical reactions result in eliminating a large percentage of the coloring matters and thus reduces the amount of bleaching necessary, in case the product is to be subsequently bleached; to provide a process in which the reduction treatment is accomplished practically throughout in the absence of air, thereby avoiding the formation of oxy-cellulose and at the same time accelerating the process; and in general, to provide an economical commercially practicable process of the character referred to.

The invention consists in the matters hereinafter described and more particularly pointed out in the appended claims.

The process may be more readily understood by a description of a preferred manner of carrying out the same in connection with suitable apparatus, such as that illusrtated in the accompanying drawing.

In said drawing the single figure illustrates in side elevation a digester, a condenser, a receptacle for the condensed products and suitable connections, etc.

In carrying out the process, in reducing long leafed pine, for example, and using apparatus substantially like that herein illustrated, I proceed as follows: I first chip the wood by the use of an ordinary chipper, into comparatively small fragments, cut transversely or obliquely of the grain of the wood, so that the grain and pores are severed at frequent intervals, and charge a suitable quantity of these chips into the digester 1. I then hermetically close the digester and by the aid of a suitable exhausting mechanism, connected with the digester through the exhaust pipe 2, exhaust the air from the digester as thoroughly as is comercially practicable—say, about twenty-five inches or upward of vacuum. Having produced the required vacuum, and while maintaining the same, I introduce the cooking liquor through the inlet pipe 3; this cooking liquor being a solution of caustic soda of a strength ranging from five degrees to thirteen degrees Baumé, and of sufficient quantity to cover the charge. The introduction of the cooking liquor while the charge is under vacuum, results in the rapid filling or impregnation of the pores of the wood with the liquor. I now admit steam through the supply pipe 4, which enters the bottom of the digester, preferably at a pressure of about 120 pounds. The admission of the steam is continued until the gage indicates a plenum pressure in the digester, whereupon I open to a slight extent the

cock or valve 5 which controls the steam outlet pipe 6 leading from the top of the digester to, and connecting with, a closed condensing coil 6' in the condenser 7.

As soon as the caustic liquor is introduced, it begins to attack and dissolve the resins contained in the wood and this reaction is accelerated by the heat resulting from the admission of the steam. The combination of the alkali with the resin forms resin soap, and in so doing releases the contained turpentine and heavier oils; these being volatilized by the steam and carried off continuously and as released, to the condenser. The valve or cock 5 will of course be adjusted to properly regulate the escape of steam and volatilized oils.

The cooking operation is continued by the continuous admission of steam at about the pressure stated, the pressure in the digester gradually rising as the temperature therein approaches more and more nearly the temperature of the steam at admission. The cooking is thus continued until the intercellular matter is practically all dissolved and the ultimate fiber set free, which I have found in practice will occur in from six to ten hours under the conditions described.

The principal quantity of turpentine and of the other oils will be expelled and carried over with the steam during the earlier stages of the process, but some oils will continue to come over until well into the latter stages of the process. The circulation of the steam through the digester is, however, continued throughout the entire cooking process. At the conclusion of the cooking, the charge is blown off through the blow-off pipe 8 into a suitable pit or other receptacle, in the usual manner. Subsequently the dissolved intercellular matter or lignin is washed out and separated from the ultimate fiber in any suitable or usual manner. It is to be noted that the resin soap will be in solution with the intercellular matter and in case the soda is reclaimed, the resinous material will supply a large proportion of the fuel necessary to effect its recovery.

The turpentine and other oils, together with the steam, are condensed in the condenser and flow downwardly into the receptacle 9, where a separation of the water from the oils is effected by gravity. The water flows off through the pipe 10, the intake end of which is located near the bottom of the receptacle 9, in a usual and well understood manner. It is to be noted that as soon as the caustic liquor enters the pores of the wood and the chips begin to swell, the contained gum is expelled, and this expelling action is of course facilitated and augmented by the heat supplied from the steam. It follows that the formation of the resin soap proceeds rapidly and that the turpentine and heavier oils are set free at a corresponding rate. It is further to be noted that the soap so formed performs the double function of acting as a solvent of the intercellular matter or lignin and at the same time protects the ultimate fiber from the harsh action of the caustic liquor and undoubtedly has a softening effect upon the fiber. Still further, it is to be noted that the elimination of the air before the cooking liquor is admitted, prevents the formation of oxy-cellulose, which would otherwise occur to a damaging degree in the presence of air and the alkali. Moreover, the continuous circulation of the steam through the digester serves to expel and carry off any small quantities of air which may be set free from the pores of the wood during the disintegration of the latter.

I have discovered that the more or less rapid deterioration of paper after it has been made is to a substantial extent at least due to the presence of oxy-cellulose which is formed to a greater or less degree in the course of the preparation of the fiber, under all usual methods of making chemical fiber. By preventing its formation, as hereinbefore described, the permanency or keeping qualities of the paper are greatly enhanced. Another and important result of preventing the formation of the oxy-cellulose is that the subsequent bleaching of the stock is accomplished with a very substantial smaller quantity of bleaching chemical.

The fiber produced by the process above described is characterized by unusual softness, strength and lightness of color before bleaching. The amount of caustic soda employed in effecting the reduction, it will be noted is comparatively small, (from 9° to 15° Baumé) and the yield of ultimate fiber is very large because of the mild treatment to which the material is subjected. The yield of turpentine and other oils is likewise very high, since these constituents are entirely set free and the amount recovered approaches quite closely to the total contained in the wood.

While I have herein described what I believe to be a preferred way of carrying out the process, yet it will be understood that the process may be modified without departing from the spirit thereof and without departing from the invention.

I claim as my invention:

1. The improvement in the art of making pulp, which consists in placing the comminuted stock in a closed chamber and substantially depriving it of free oxygen, then, while maintaining the exclusion of free oxygen, subjecting the material to the action of caustic alkali solution and heat and cooking the material, and as the cooking proceeds withdrawing the volatilized products as formed and the free oxygen as released, and

continuing such procedure until the intercellular matter is dissolved and the ultimate fiber set free.

2. The improvement in the art of making pulp from resinous wood, which consists in placing the comminuted wood in a hermetically closed chamber and exhausting the air therefrom to a relatively high vacuum, then, while substantially maintaining the exclusion of air, admitting a caustic alkali solution of relatively mild strength and cooking, withdrawing volatilized products as formed and oxygen as set free, so as to accomplish the reduction without oxidation, and continuing the cooking under these conditions until the desired reduction is completed.

3. The improvement in the art of making pulp from resinous wood, which consists in placing the comminuted wood in a hermetically closed chamber and exhausting the air to a relatively high vacuum, then, while substantially maintaining the exclusion of air, admitting a caustic alkali solution of relatively mild strength and cooking under pressure by the circulation therethrough of steam substantially free from oxygen, withdrawing the volatilized products as formed and oxygen as set free, so as to accomplish the reduction without oxidation of the cellulose, and continuing the cooking under these conditions until the desired reduction is completed.

4. The improvement in the art of making pulp from resinous wood, which consists in placing the comminuted wood in a closed chamber and substantially exhausting the air therefrom, then, while excluding free oxygen, cooking in a caustic soda solution, of a strength less than 15° Baumé, by circulating steam therethrough which is practically devoid of free oxygen, withdrawing the volatilized products as formed and oxygen as set free, so as to accomplish the reduction without substantial oxidation of the cellulose, continuing the operation until the reduction is completed and then separating the cellulose fiber from the residue by washing.

5. The improvement in the art of making pulp from resinous wood, which consists in placing the comminuted wood in a closed digester and substantially exhausting the air therefrom, then, while excluding free oxygen, cooking in a caustic soda solution of such predetermined strength that it will, when combined with the resins and heavier oleaginous materials of the wood, form a soapy solution mildly alkaline, withdrawing the volatilized products as formed and oxygen as set free, so as to accomplish the reduction without substantial oxidation of the cellulose, continuing the cooking in the presence, and under the dissolving action, of said soapy solution until the reduction is completed and finally recovering the ultimate fiber from the residue.

6. The improvement in the art of making wood pulp, which consists in effecting the reduction by cooking the wood in alkali solution in a hermetically closed digester, removing the free oxygen from the charge at an initial stage of the reduction and removing the free oxygen thereafter as liberated during the progress of the reduction, whereby the reduction is performed under conditions substantially free from the contaminating effects of free oxygen.

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