

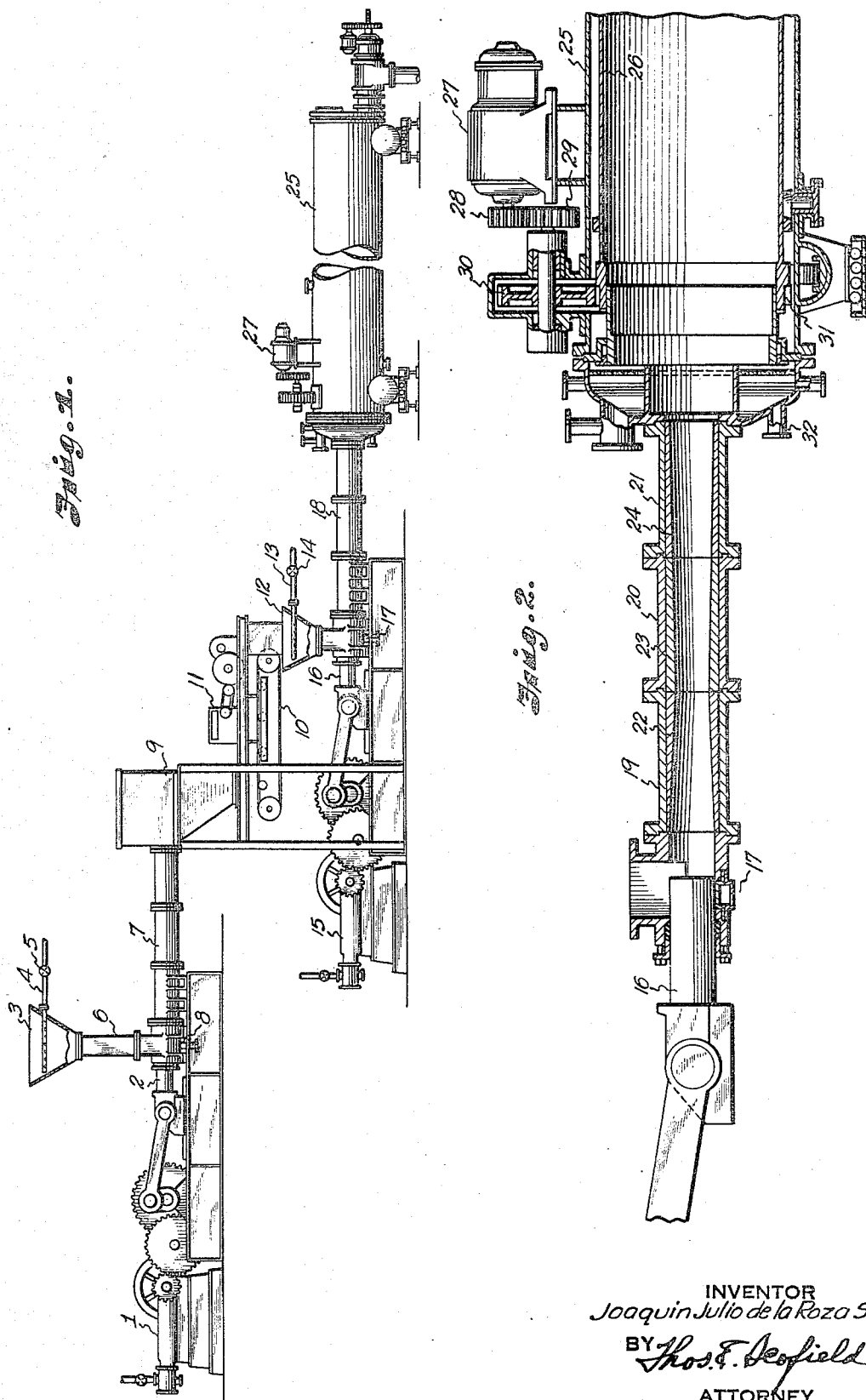
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PROCESS OF MANUFACTURE OF PULP

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PROCESS OF MANUFACTURE OF PULP

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My invention relates to a process of manufacture of pulp from wood, fibrous or cellulose bearing materials and more particularly to improvements in the art of digestion of such materials with chemicals at elevated temperatures and pressures.

One of the numerous factors to be considered in the digesting of wood for the manufacture of pulp is the relationship of quantity of cooking liquor required to effect digestion of a given quantity of chips in an economic manner. For example, in the digestion of wood chips, it is apparent that different batches of chips having substantially the same weight may show considerable variation in the bone dry weight of chips present. Since the quantity of cooking liquor to be used must be governed by the bone dry weight of chips, it is obvious that there will be changes in the liquor ratio with resultant uneconomic operation from the standpoint of liquor waste, heat load required and accurate predetermination of the cooking time required.

Irrespective of the economic disadvantages of variation in moisture content, other disadvantages exist with respect to present modes of pulp manufacture particularly as concerns the attainment of the color desired in the finished pulp. In the various processes used for manufacturing pulp from wood, the material is first digested and is then decolorized to produce a white cellulose. The disadvantage of decolorizing subsequent to the digesting operation lies in the presence of the large quantities of coloring matter and other undesirable materials in the wood chips during digestion. I have found that it is preferable to remove the coloring matters wholly or in part before digestion at elevated temperatures and pressures, in order to avoid fixing them within the cellulose.

In addition to those features to which I have already referred, the manufacture of a high grade of pulp such as is produced by the so-called "Mischerlich Process" requires a cooking time up to seventy-two hours for a single batch. Generally, the sulphite process employs a mixture of chemicals consisting of lime water and sulphur dioxide which forms a compound or mixture called "calcium bisulphite". In that process, a digesting vessel is filled with wood chips and a chemical and, after the cover is bolted on, heat is applied slowly. The object in this is to allow the calcium part of the chemical to penetrate the chips thoroughly before the temperature is raised sufficiently high to digest the material. This is due to the fact that cel-

lulosic raw material which is impregnated thoroughly with a base will not be adversely affected by the acid cooking liquor at the maximum temperatures employed in digestion. If the chips are not thoroughly penetrated with lime or some other base and the digester temperature is raised to the normal cooking temperatures, the acid part of the chemical will decompose the cellulose as well as the incrustants. All but one or two hours of the total time required in this process is employed in slowly penetrating the chips with the base and the remainder in the actual digesting operation wherein the acid plays the part of hydrolytic agent. It will be apparent therefore that if the cellulosic raw material were first impregnated with a base in some rapid and expeditious manner, that the overall cooking time either in a batch or continuous process would be materially lessened.

It is an object of my invention to provide a method for obtaining a uniform moisture content in material to be digested.

It is another object of my invention to provide a method for preparing material for treatment in a digesting zone which will permit more exact determination of the quantities of cooking liquor needed in the digesting zone and closer control of the digesting conditions.

It is a further object of my invention to provide a method for accurately determining the quantity of bone dry material being passed to the cooking zone in a continuous digesting operation.

It is still another object of my invention to provide a method for treating material prior to digestion by an acid cooking process which will thereby secure a very high grade of pulp, and appreciably reduce the cooking time.

It is also an object of my invention to provide a method of treating fibrous or cellulose bearing material before a digesting operation to remove large quantities of coloring and other undesirable materials in the material whereby an improved yield of pulp of better strength and color will be obtained.

Other and further objects of my invention will appear from the following description and the appended claims.

In the accompanying drawing which forms part of the instant specification and is to be read in conjunction therewith and in which like reference numerals are used to indicate like parts in the various views;

Figure 1 is an elevation of one mode of ap-

paratus capable of carrying out the process of my invention.

Figure 2 is a sectional view on an enlarged scale of a portion of the digester and the inlet assembly of the apparatus shown in Figure 1.

In general, the establishment of a uniform moisture content in wood chips, fibrous or cellulose bearing materials to be digested is carried out by means of a reciprocating piston type of press such as is shown in my Patent No. 1,991,244 bearing date on the twelfth day of February, 1935. I prefer to term wood chips in which a uniform moisture content has been established as being uniformly impregnated. This will perhaps be more easily understood by reference to a simple illustration. If a block of wood having a certain normal moisture content is permitted to float in a body of water for a sufficient period of time, the pores or interstices of the wood will eventually absorb the water until finally, as a result of complete saturation or "uniform impregnation", the wood being water-logged, will sink. In my process uniform impregnation is achieved, but in a much more rapid manner.

The wood chips or other material to be digested are placed in the hopper of a press and wetted with a liquid which may be either hot or cold. Preferably when uniform impregnation is all that is desired, water will be used. The wetted chips will be compressed by the force applied by the piston, the excess liquid being squeezed out of the chips and the mass of chips formed into a dense body of material confined by the restrictive choke of the press to a uni-directional movement. The applied intensity of the force in conjunction with the resistance to forward movement caused by the friction of the choke will force the wetting liquid throughout the pores of the material to thereby uniformly distribute the liquid in the material.

As the uniformly impregnated material issues from the choke of the press it falls into a hopper which is provided at its bottom portion with a hinged gate arranged to open and close automatically to feed a predetermined weight of chips from the hopper. The weight of bone dry chips in any given weight of uniformly impregnated chips may easily be determined by distilling the liquid from the impregnated chips and weighing the bone dry chips remaining. Obviously, therefore, for a given compressive force and a given restrictive action of the choke, all chips leaving the press will be uniformly impregnated and have the same moisture content. The weight of bone dry material in the body of the impregnated chips will thus bear a precise relation to the total weight of chips and liquid contained in the chips and the amount of cooking liquor required may be readily arrived at.

The impregnated chips are discharged from a weighing hopper onto a moving belt which carries the chips forward over a weighing device and drops them into the hopper of a second press serving as the feeding device for a continuous digester such as is shown in my Patent No. 1,991,244 to which I have previously referred.

In this second press the chips are wetted in the hopper with a solution of a base, preferably very hot lime water, although the solution may be warm, or even cold. Other solutions containing a base such as compounds of calcium, sodium, magnesium, potassium, or ammonium,

alone or in any mixture with each other, as economics and other factors may dictate, may be used as the wetting liquid. The piston of this press applies a compressing force to the wetted material sufficient in conjunction with the restrictive force of the choke to uniformly impregnate the chips with the solution of a base, squeeze the excess liquid from the chips, and to form an internally unreinforced plug of a density sufficient of itself to withstand the pressure existing in the digesting chamber to which this press is connected. This press as well as the first press is provided with a drain by which the excess of liquid expressed from the material and escaping backwardly around the surface of the piston may be withdrawn from the impregnating zone. The material now uniformly impregnated with the solution of a base is intermittently advanced by the piston into the digesting chamber of the continuous digester. The material may be digested in this chamber with plain sulphur dioxide gas, sulphurous acid, bisulphite of lime, or any acid cooking liquor. I prefer to cook with sulphurous acid made by passing sulphur dioxide into water. The actual cooking time required in the digesting chamber will not vary more than from a few minutes to a few hours, depending upon the material and process employed, as compared to the maximum of seventy-two hours required in the "Mischerlich Process" previously referred to while producing an even higher grade of pulp than the highest grade produced by this latter process.

Instead of using water as an impregnating liquid in the first press my invention also contemplates the use of sulphurous or other acid to subject the material before digestion to a decolorizing operation. The dilute hot acid solution used will remove a substantial amount of the coloring matters from the material before digestion at elevated temperatures and pressures is carried out. The decolorizing may be effected by either a single or double pressing operation.

In the single pressing operation, a dilute acid solution is added to the chips at the hopper of the digester inlet press. The piston compresses the chips forcing the acid solution through the chips and thus dissolving the coloring materials. The excess of solution containing dissolved coloring materials is expressed from the body of chips, escapes backwardly around the piston and is withdrawn from the impregnating zone through the drain provided. The acid impregnated pulp is then forced by the piston into the digesting chamber of the continuous digester and cooked at an elevated temperature and pressure to form pulp. The cooking liquor in this case will contain an alkali, calcium bisulphite for example, and the time of cooking will be relatively long. This follows, since in accordance with usual practice, the calcium part of the cooking liquor must have time to penetrate the chips before the cooking liquor is brought to the final high temperature.

In the double pressing operation, the chips are thoroughly wetted with preferably a hot dilute acid solution in the hopper of a first press, the acid being forced into the chips by the piston, and the excess with dissolved coloring matters escaping backwardly around the piston and being removed through the drain provided. The acid impregnated chips after being weighed are then transferred to the hopper of a digester inlet press

wherein they are wetted with water to which may be added small amounts of a base. Preferably, I employ hot water or solution of a base although warm or even cold liquid may be employed. The piston of the second press forces the water or solution of a base through the chips, washing out additional amounts of the acid with dissolved coloring matters, the liquid expressed and that in excess escaping backwardly around the piston and being removed through the drain provided. By employing a solution of a base as the wetting liquid in the second press, I am enabled to employ a short cooking time during the subsequent digesting operation under heat and pressure. The chips will be uniformly impregnated with the solution of a base permitting immediate cooking at high temperature with an acid cooking liquor without danger of destruction of the cellulose. On the other hand, if I employ only water as a wash liquid in the second press, although additional quantities of coloring matters will be removed in the second pressing operation, the subsequent cooking operation must be carried out with an alkaline cooking liquor with an appreciably longer cooking time. In either case, however, the color and strength of the resultant pulp will have been improved by the decolorizing operation.

More particularly referring now to the drawings, a steam engine 1 drives reciprocating plunger 2 through any suitable transmission of gearing or the like. The cellulose bearing material to be pulped is fed into hopper 3 by any suitable means (not shown). A supply pipe 4 which may be of any desired shape, supplies water for establishing moisture content of the chips or sulphurous acid or other bleaching medium, the supply being controlled by valve 5. The liquid material and the fibrous material which may be wood chips or the like, pass through conduit 6 where they are forced through conduit 7 by the plunger 2. The conduit 7 is provided with liners forming a passageway of constantly decreasing cross section, to a point, and then diverging as will be more fully described hereinafter. The excess liquid is squeezed from the material to be digested, and is drained through connection 8. The impregnated material passes into a hopper 9 and is deposited on a conveyor belt 10. The conveyor belt is provided with a device 11 for weighing the material. The assembly may be that which is made by the Merrick Scale Manufacturing Company of Passaic, New Jersey, known as the "Merrick Conveyor Weightometer." The conveyor belt 10 conveys the material to a hopper 12, into which pipe 13, controlled by valve 14, leads. Through pipe 13, I may inject an alkaline solution or water for washing out bleaching acid.

A steam engine 15 drives reciprocating plunger 16 through a suitable transmission of gears or the like, similar to that which drives plunger 2. A drain 17, similar to drain 8, is provided for carrying off the excess liquid. The plunger 16 forces the bleached and preimpregnated chips or other fibrous material through a passageway 18 which is provided with liners forming a converging-diverging passageway. By referring to Figure 2, it will be observed that the passageway 18 is formed of three sections, 19, 20, and 21, provided with liners 22, 23, and 24. Liner 22 is of constantly decreasing cross section in the direction of movement of the material. Liners 23 and 24 are of constantly increasing cross sectional area so that the assembly forms a con-

verging-diverging passageway. The structure of the passageway 18 shown in Figure 2 is similar to that of passageway 7. The preimpregnated material passes to the digester which comprises a shell 25 and an inner rotary shell 26 which is rotated by motor 27 through gears 28, 29, 30, and ring gear 31 secured or formed upon rotary shell 26. The cooking liquor is injected into the digester through connection 32. The cooking liquor may be sulphurous acid for an acid cook, or calcium hyposulphite for an alkaline cook. In the case of an acid cook, water is injected through pipe 4 for establishing the moisture content of the chips and the basic solution is injected through pipe 13 for impregnating. In the case of an alkali cook, sulphurous acid or other bleaching acid is injected through pipe 4 and water or a base solution is injected through pipe 13 for washing out the bleaching agent.

It will be seen that I have accomplished the objects of my invention. I have provided a method of digesting fibrous material to obtain pulp in which a uniform moisture content is obtained in the material to be digested. By preimpregnating the digesting material and weighing the same before passing it into the digester a more exact determination of the quantities of cooking liquor needed in the digesting zone can be made and a closer control of digesting conditions can be exercised. The cooking time is considerably reduced and a very high grade of pulp is obtained. Large quantities of coloring matter and undesirable materials are removed prior to entering the material in the digesting zone and an improved yield is obtained of pulp of better strength and color.

It will be understood that certain features and subcombinations are of utility and may be employed without reference to other features and sub-combinations. This is contemplated by and is within the scope of my claims. It is further obvious that various changes may be made in details within the scope of my claims without departing from the spirit of my invention. It is, therefore, to be understood that my invention is not to be limited to the specific details shown and described.

Having thus described my invention, what I claim is:

1. A process for the manufacture of pulp from fibrous or cellulose bearing material comprising, wetting the material with a bleaching liquid, subjecting a body of the wetted material to a pressure sufficient to uniformly impregnate the material with the bleaching liquid, wetting the uniformly impregnated material with a wash liquid, subjecting the uniformly impregnated material to a pressure sufficient to displace the greater portion of the bleaching liquid and dissolved matter with the wash liquid and then digesting the material with a cooking liquor to produce pulp of improved color and strength.

2. A process for the manufacture of pulp from fibrous or cellulose bearing material comprising, uniformly impregnating the material with an acid solution by pressing, impregnating the acid impregnated material with a hot base solution by pressing and then digesting the material by an alkaline process.

3. A process for the manufacture of pulp from fibrous or cellulose bearing material comprising wetting the material with that amount of dilute acid solution necessary to completely impregnate the material, applying a compressing force to the wetted material while confining the body of

material to a uni-directional restricted movement, said force having an applied intensity sufficient in conjunction with the restrictive force to uniformly impregnate the material with the acid solution, wetting the impregnated material with a solution containing a base, applying a compressing force to the impregnated wetted material while confining the body of material to a uni-directional restricted movement into a digesting chamber, said last mentioned force having an applied intensity sufficient in conjunction with the restrictive force to uniformly impregnate the material with the solution containing a base and form a material body of high density, and digesting the material under pressure in the digesting chamber with an acid cooking liquor to produce pulp of improved color and strength.

4. The process of claim 3, said confined body of base impregnated material forming an internally unreinforced plug of a density sufficiently high to withstand the pressure existing within the digesting zone.

5. The process of claim 3 including the step of withdrawing from the zone of impregnation the liquids displaced from the material during the base impregnating step.

6. A process for the manufacture of pulp from fibrous or cellulose bearing material comprising, wetting the material with a dilute acid solution, pressing the wetted material to impregnate the material with the acid solution and to dissolve the coloring matter of the material in the acid solution, withdrawing the excess liquid and dissolved coloring matters from the impregnating zone, feeding the acid impregnated material into a digesting zone and cooking the material therein with an alkali liquor for a period of time sufficient to form pulp of improved strength and color.

7. A process for the manufacture of pulp from fibrous or cellulose bearing material comprising, wetting the material with a hot dilute solution of sulphurous acid, applying a compressing force to the wetted material while confining the body of material to a uni-directional restricted movement, into a digesting chamber, said force hav-

ing an applied intensity sufficient in conjunction with the restrictive force to uniformly impregnate the material with the dilute acid solution, withdrawing the expressed liquid with its dissolved coloring material from the impregnating zone, and digesting the impregnated material in the digestion chamber with an alkaline cooking liquor for a period of time sufficient to produce pulp of improved strength and color.

8. The process of claim 7, said confined body of acid impregnated material forming an internally unreinforced plug of a density sufficiently high to withstand the pressure existing within the digesting chamber.

9. A process for the manufacture of pulp from fibrous or cellulose bearing material comprising, wetting the material with that amount of liquid necessary to completely impregnate the material, applying a compressing force to the wetted material while confining the body of material to a uni-directional restricted movement into a digesting chamber, said last mentioned force having an applied intensity sufficient in conjunction with the restrictive force to uniformly impregnate the material with the liquid, wetting the impregnated material with a chemical solution, applying a compressing force to the impregnated wetted material while confining the body of material to a uni-directional restricted movement into a digesting chamber, said last mentioned force having an applied intensity sufficient in conjunction with the restrictive force to uniformly impregnate the material with the chemical solution and form a material body of high density, and digesting the material under pressure in the digesting chamber with a predetermined amount of cooking liquor to produce pulp of improved color and strength.

10. The process of claim 9, said confined body of chemically impregnated material forming an internally unreinforced plug of a density sufficiently high to withstand the pressure existing within the digesting zone.

11. The process of claim 9, including the step of withdrawing from the impregnating zones the liquids displaced from the material during the impregnating operations.

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