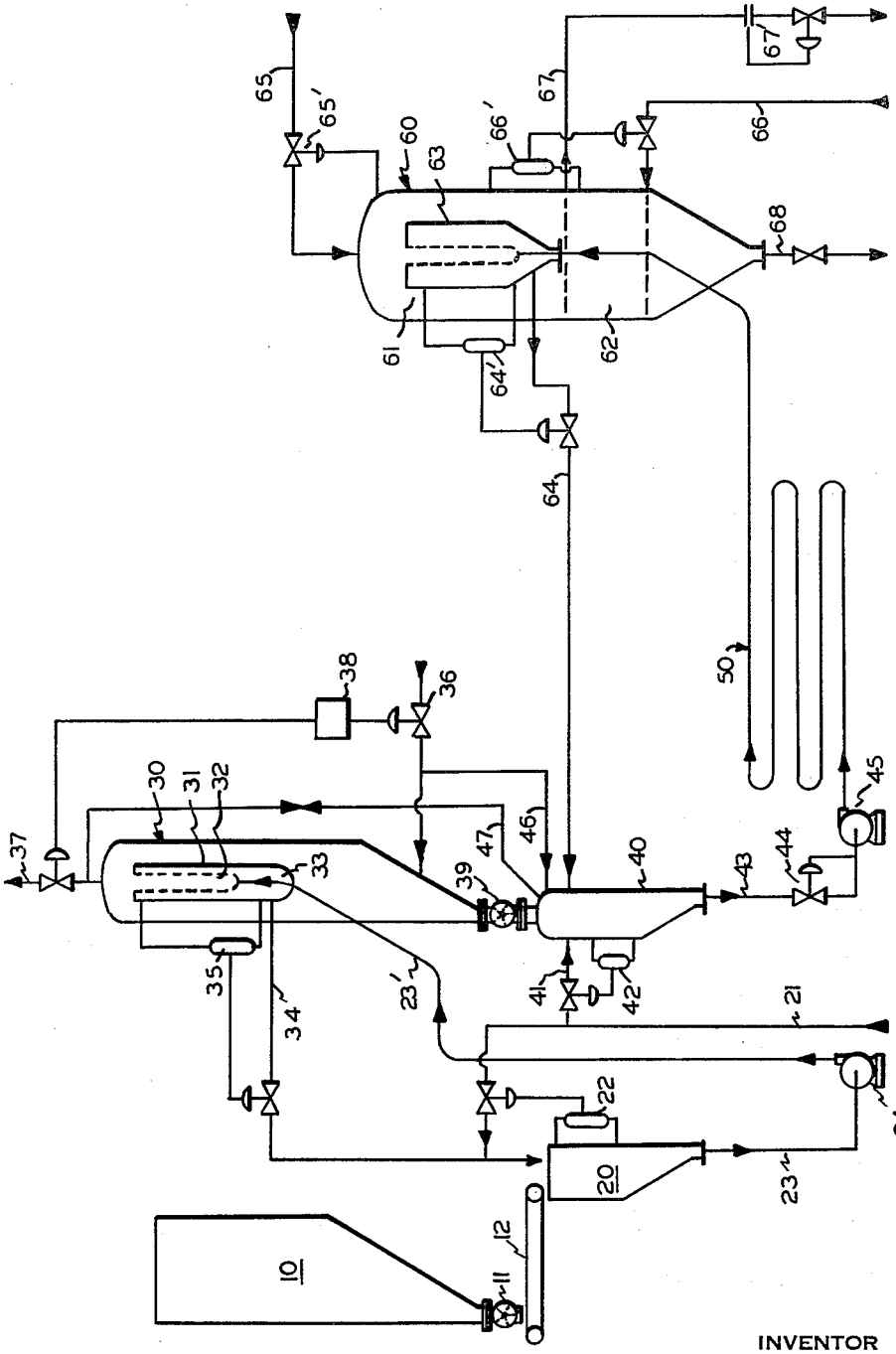
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APPARATUS FOR CONTINUOUSLY PULPING CELLULOSE MATTER

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APPARATUS FOR CONTINUOUSLY PULPING CELLULOSE MATTER

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The present invention relates to an improved apparatus for pulping cellulosic material such as wood chips or the like.

In one of its more specific aspects the present invention relates to continuous digestion of cellulosic material in an atmosphere of steam.

The present invention pertains to modifications of and improvements upon the subject matter disclosed in application Ser. No. 137,121 entitled, "Continuous Pulping Process," by C. O. Bennett and S. A. Guerrieri filed on even date herewith and assigned to the assignee of the present invention.

Like the former the process is described in particular reference to the "Kraft" process but obviously applies with suitable modification of operating conditions to other processes, such as the sulfite process.

Commercial processes for digesting cellulosic material have for the most part been batch processes requiring long cooking periods, and delays while the digesters were charged and discharged. While several commercial continuous processes have recently been developed for pulping cellulosic material, nevertheless, these processes still require relatively long cooking periods and have made little modification in the basic pulping procedures.

In known apparatus, difficulty has been experienced in both feeding chips into vessels maintained at above atmospheric pressures, and in separating pulp from the cooking liquor after digestion. For example, in feeding chips into a degasser or into a digester, feed devices of a plunger or of a screw type have been utilized to obtain an impervious plug of material to prevent leakage from the vessel. However, the properties of the fibers may be seriously damaged in the formation of such a plug. It is also known to utilize rotary or star valves as combined feed and seal means, however, such valves suffer from the inherent disadvantages that steam may be released in the empty pockets returning to the chip filling positions, and that air may be introduced into a digester along with entering chips to produce severe erosion or corrosion causing high maintenance costs and loss of production while the devices are replaced or repaired.

The difficulties in separating pulp from the cooking liquor after digestion have led to substantially conventional practices of utilizing additional apparatus such as a blow tank or a diffuser type of separator to separate the pulp and black liquor.

Accordingly, a principal object of the present invention is to provide a process and apparatus for treating cellulosic material which obviate the above enumerated shortcomings and disadvantages of known pulping process and apparatus.

Another object of the present invention is to provide a continuous process for digesting cellulosic material in an atmosphere of steam.

Another object of the present invention is to provide apparatus for carrying out a continuous digesting process.

Still another object of the present invention relates to utilizing cellulosic material-liquor suspensions for transporting material between treating zones.

Another object of the present invention is to provide for impregnation of cellulosic material with liquor as it travels along a path at a sufficient velocity to avoid separation of

cellulosic material from the liquor, i.e., at a velocity sufficient to maintain the suspension of cellulosic material previously formed.

A further object of the present invention relates to improved separation of cellulosic material from cellulosic material-liquor suspensions.

A further object of the present invention is to reduce the cooking time materially as compared to the cooking time required by present commercial processes while producing pulp having extremely good mechanical properties.

Still further objects of the present invention are to obviate the heretofore required use of rotary valves or the like to feed into a pressure vessel, and to obviate the use of blow tanks or the like to separate pulp from the liquor after digestion has been completed.

These and other objects, features and advantages of the present invention will become more obvious from the following description when taken in connection with the accompanying drawing which shows in the single figure thereof, for purposes of illustration only, a schematic lay-out of suitable apparatus for carrying out the present invention.

Referring now more particularly to the drawing of major components of the illustrative apparatus include a chip feed hopper 10, a chip-liquor mix tank 20 receiving chips from the hopper 10, a degasser 30 to which a chip liquor suspension formed in tank 20 is transported, a degassed chip-liquor mix tank 40 receiving degassed chips from the degasser 30, an impregnator 50, and a digester 60 having an upper digesting zone 61 and a lower leaching zone 62 in which pulped material from the upper zone is subjected to counter-current washing.

In operation, chips are fed from the chip feed hopper 10 through a star valve 11 or other suitable metering device onto a conveyor 12 which conveys the chips to the chip-liquor mix tank 20.

In mix tank 20, the chips are contacted with liquor entering via make-up liquor line 21 to form a chip-liquor suspension. The introduction of liquor via line 21 is regulated by suitable flow control means 22. The chip-liquor suspension in tank 20 is transported through lines 23 and 23' under the influence of pump 24 to the degasser 30.

In the degasser 30 the chip-liquor suspension is discharged from line 23' into a chip-liquor separator 31. The separator 31 is shown for purposes of illustration as an essentially cylindrical double-walled vessel having a closed lower end and an open upper end. Separator 31 has an innerwall 32 provided with previous portions to enable liquor to drain from the chips through wall 32 into a basin 33 formed at the closed lower end of separator 31. From basin 33 the recovered liquor may be recycled to the chip-liquor mix tank 20 through line 34 which is provided with suitable conventional control means 35 controlling the liquor level in basin 33.

Chips entering separator 31 build up within the central recess defined by the perforated inner wall 32, and eventually overflow out the open upper end of separator 31, and fall by gravity towards the bottom of degasser 30. While the chips are overflowing out of separator 31, they are effectively degassed by means of steam line 36 and vent 37 which are sequentiall yopened and closed by suitable control means 38. Degassed chips pass from degasser 30 into the degassed chip-liquor mix tank 40 via suitable feeder means 39. Feeder means 39 is not a valve in the usual sense since it is not intended to be a seal between vessels 30 and 40. Both vessels operate at the same pressure since the pressure in the two tanks is balanced by line 47 connecting the two tanks. Thus feeder 39 will not give the maintenance troubles which would be likely to occur with a valve. Chip movement in degasser 30 is regulated in order to provide sufficient residence time therein to insure completion of the degassing operation.

In tank 40 degassed chips are mixed with cooking liquor from line 64 leading from digester 60 as will be described in more detail hereinafter, and from line 41 which branches off from make-up liquor line 21. The flow of make-up liquor through line 41 may be regulated by control means 42 responsive to the liquor level in tank 40. The degassed chips are suspended within the liquor in tank 40. The resulting suspension leaves tank 40 via line 43 having suitable check valve means 44 which is normally open but which will close in the event of pump failure to prevent a violent back surge from the digester etc., and is pumped to the impregnator 50 by pump 45.

Impregnator 50 is formed of pipe which may be arranged in passes forming a serpentine path or in any other convenient arrangement to provide the residence time required to impregnate the chips with cooking liquor.

From impregnator 50 the impregnated chips are passed to a chip-liquor separator 63 in the digesting section 61 of digester 60. The separator 63 substantially corresponds to the separator 31 in degasser 30. Liquor is separated from the chips by removal through perforated sections of the inner wall of separator 63. This liquor collects within the closel bottom end of separator 63, and is recycled to degassed chip-liquor mix tank 40 through line 64. Appropriate liquor level control means 64' regulate the recycle flow from the bottom of the separator 63 so that the liquor level therein is maintained above the level of line 64 and thus the liquor acts as a sealing medium. High pressure steam is introduced to the digesting section 61 via line 65 and pressure responsive control means 65'. Chips introduced into separator 63 overflow its open upper end and fall towards the bottom of digesting section 61 coming to rest upon a downwardly moving mass of chips that extends from a level adjacent the bottom of digesting section 61 down into leaching section 62. The steam admitted through line 65 rapidly raises the chips to a cooking temperature during chip movement upwardly out of separator 63 and downwardly out of digesting section 61 into leaching section 62. The chips are rapidly cooked during such movement in an atmosphere of saturated steam. The rate of chip movement through digesting zone 61 is regulated so that the residence time therein is sufficient to completely digest the chips without subjecting the chips to undesired excess treatment at the cooking temperature which would damage the pulp fibers.

Digested chips or pulp from digesting section 61 pass downwardly into leaching section 62 where the pulp is subjected to counter-current washing by wash water entering leaching section 62 adjacent the bottom thereof through line 66. The rate of wash water introduction is controlled by conventional control means 66'. A substantial percentage of the soluble digestion products in the pulp is leached out by the wash water and is removed as black liquor via line 67 and flow control means 67'. Due to the relatively high concentration of the black liquor, it is suitable for subsequent burning as a fuel with minimum intermediate processing. In the illustrative embodiment, the liquor level in digester 60, which is regulated primarily by the position of line 67 and the rate of black liquor removal therethrough, essentially determines the lines of demarkation between the upper digesting section 61 and the lower leaching section 62.

Pulp is withdrawn from the bottom of leaching section 62 through a valved line 68 or any other suitable discharge means such as a screw press. The pulp may be further treated by a Jordan heater and by further washing, screening, and subsequent operations of conventional nature.

The control means shown in the illustrative embodiment such as valves, level control means, cyclic venting means, etc., may be of any well known conventional construction, and could be supplemented by additional conventional control means without departing from the spirit of the present invention.

The term chips as used throughout the specification and claims is applied in a generic sense to designate wood chips or other cellulosic material.

While a preferred embodiment in accordance with the present invention has been shown and described, it is understood that the same is not limited thereto but is susceptible of many changes and modifications, and it is intended to cover all such changes and modifications as are encompassed by the scope of the appended claims.

I claim:

1. Apparatus for pulping cellulosic material comprising a mixing tank; means for introducing cellulosic material into said mixing tank; means for introducing liquor into said mixing tank to form a material-liquor suspension; a degasser including a separator vertically positioned therein, said separator being formed with a basin in the lower portion thereof and having a perforated inner wall to enable liquor to drain from said suspension and to pass into said basin; means to sequentially steam and vent the degasser to degas said material; a second mixing tank; means to introduce said degassed material into said second mixing tank, means for maintaining a pressure balance between said degasser and second mixing tank; means to introduce a delignifying liquor into said second mixing tank to form a suspension of the degassed material and liquor; an impregnator; means for passing said suspension of degassed material and liquor through said impregnator wherein said material is impregnated with liquor; a digester to delignify the impregnated material in non-submergence in an atmosphere of steam; and means for passing said impregnated material to said digester.

2. Apparatus for pulping cellulosic material comprising a mixing tank; means for introducing cellulosic material into said mixing tank; means for introducing liquor into said mixing tank to form a material-liquor suspension; a degasser including a separator vertically positioned therein, said separator being formed with a basin in the lower portion thereof and having a perforated inner wall to enable liquor to drain from said suspension and to pass into said basin; means to sequentially steam and vent the degasser to degas said material; a second mixing tank; means to introduce said degassed material into said second mixing tank, means for maintaining a pressure balance between said degasser and second mixing tank; means to introduce a delignifying liquor into said second mixing tank to form a suspension of the degassed material and liquor; an impregnator; means for passing said suspension of degassed material and liquor through said impregnator wherein said material is impregnated with liquor, a digester to delignify the impregnated material in non-submergence in an atmosphere of steam, said digester including a separator vertically positioned therein, said separator being formed with a basin in the lower portion thereof and having a perforated inner wall to enable liquor to drain from said suspension of said impregnated material and liquor and to pass into said basin; and means for passing said suspension of impregnated material and liquor into said digester.

3. Apparatus as defined in claim 2, wherein said impregnator is a conduit impregnator.

4. Apparatus as defined in claim 2, further comprising means to recycle liquor drained from the chips in said second separator to said additional mixing tank means.

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