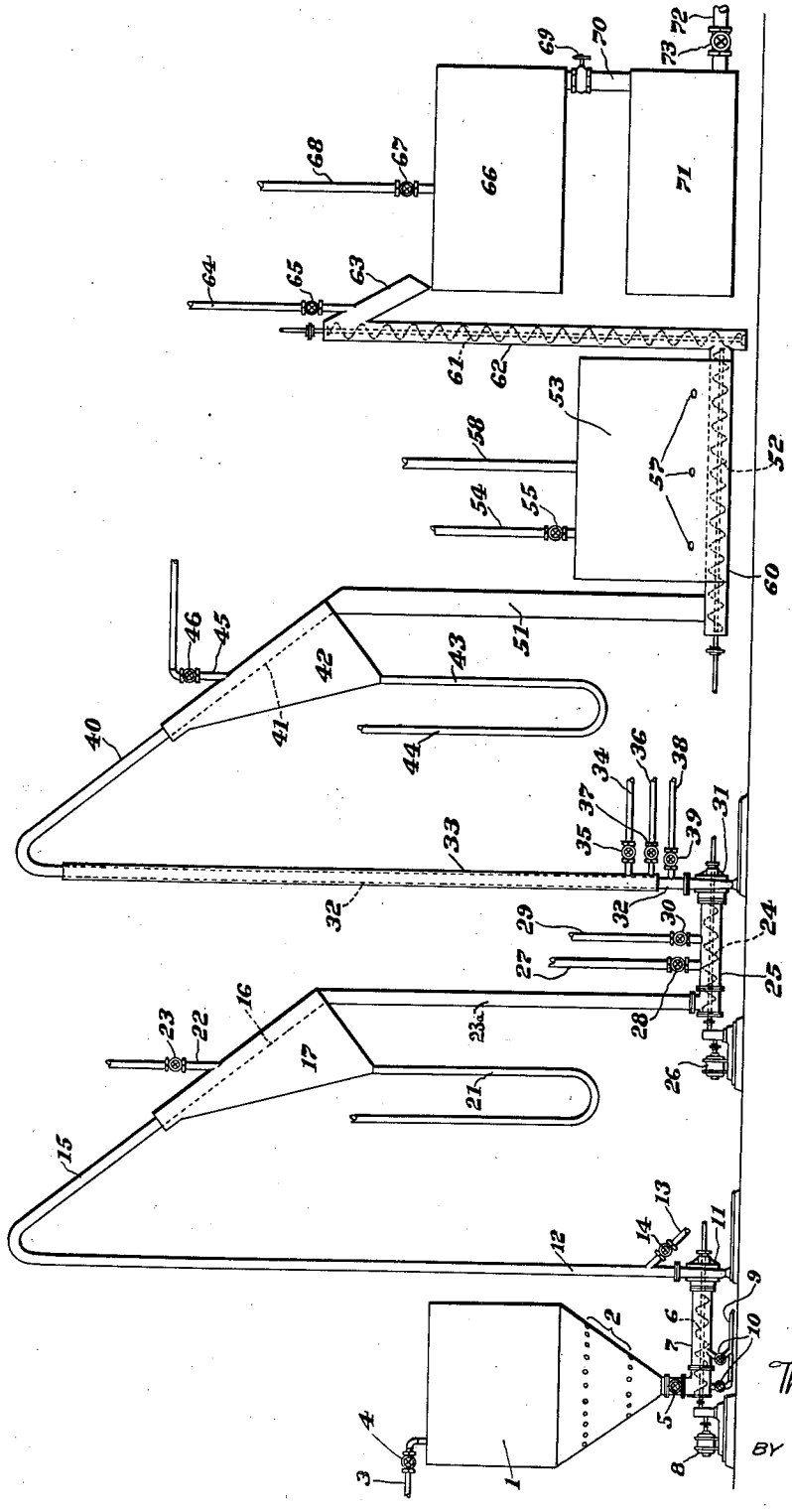
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TREATMENT OF FIBROUS MATERIAL

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TREATMENT OF FIBROUS MATERIAL

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This invention relates to the treatment of fibrous material, and more particularly to a normally continuous process of and apparatus for the production of pulp. While the invention is of particular value in the production of so-called semi-chemical pulp from which the lignin is not entirely dissolved, its applicability is not limited thereto.

An object of my invention is the provision of an improved process for the production of pulp, which may be carried on continuously, and the provision of apparatus suitable therefor. Intermittent filling and draining of a digester may be obviated by my process and I have provided means whereby the pulp is continuously discharged from the digestion apparatus to improved washing and degassing apparatus. Economies in operation are effected by the practice of my invention.

Generally speaking, my invention comprises a treatment of fibrous material in which this material is subjected first to a water pretreatment and then to the action of cooking liquor at elevated temperatures and under hydrostatic pressure, procured, for example, by the use of novel apparatus hereinafter fully described. The fibrous material may pass continuously through this apparatus, wherein the pulp is liberated, and the cooking liquor may then be continuously drained off and the pulp washed while at the same time gases are liberated and vented back to a recovery system and the pulp is diluted with water or other suitable washing liquid. The removal of digestion liquor from the pulp is very effectively accomplished in my process, resulting in an improved pulp product. The invention is applicable to both acid and alkaline pulping processes.

My improved process and apparatus are adapted for use in conjunction with a pretreatment of the fibrous material as described and claimed in my co-pending application, Ser. No. 753,893 filed November 20, 1934.

Further beneficial features of my invention will in part be set forth and in part be apparent as a description is given of the accompanying drawing, which illustrates diagrammatically apparatus suitable for the practice of my invention.

In this drawing, 1 is a pretreatment tank, provided with nozzles 2, through which steam may be admitted, and a line 3 with valve 4 for the admission of water or other suitable solvent liquid. This tank may be drained through valve 5, the contents being emptied into the casing 7, which encloses a worm conveyor 6, driven by a motor 8. A steam admission line 9 with valved branch entrances 10 is provided to admit steam or hot liquid to the casing 7. A pump 11 is provided at the end of the worm conveyor, to pass the material up the leg or conduit 12, into which conduit steam may be admitted through the line 13 with its valve 14.

The leg 12 is a vertical conduit, connected to or integral with a further conduit 15, which contains a strainer 16. Beneath the strainer is a collecting apparatus 17 and a drainage line 21, through which the drained water may pass. In conjunction with this collecting apparatus 17 I provide a gas vent 22, with valve 23. This gas vent 22 and the drainage line 21 are preferably both provided with seal legs or traps, such as are shown and described in my aforesaid co-pending application, Ser. No. 753,893, now U. S. Patent No. 2,038,925, such seal legs being provided to maintain fluid pressure on the material as it passes through this part of the system. A storage tank for the liquid drained through the line 21, connecting with the pretreatment tank 1, may be provided as shown in my said co-pending application.

Drop leg 23a is a conduit from the strainer 16 to another worm conveyor 24, encased in a casing 25, and driven by motor 26. Pipe line 27 with a valve 28 is an admission line for either hot or cold cooking liquor from a liquor storage tank or hot acid accumulator (not shown). 29 is a steam admission line, controlled by the valve 30.

Pump 31 is connected between the casing 25 and a vertical leg 32, which is enclosed in a steam jacket 33. Connected with the steam jacket is the steam admission line 34 with valve 35 and also a condensate removal line 36 with valve 37. I also provide a steam admission line 38 with valve 39 connected directly with the interior of the vertical leg 32.

Connected with the leg 32, or integral therewith, is a further conduit 40, which contains a strainer 41 above a second collector 42. The collector 42 terminates at its bottom in a drain pipe 43, which is provided with a seal leg or trap 44, similar to the seal leg which may be provided in connection with pipe 21, to maintain the pressure. This drain may lead to the sewer, or to a tank for further treatment of the liquor.

A top relief line 45 with a control valve 46 passes from the conduit 40 to means for recovering the relief gases and liquids. These recovery means may conveniently comprise an eductor, drop leg and accumulator, as shown in connec-

tion with a digester in my aforesaid co-pending application, Ser. No. 753,893.

A conduit or drop leg 51 connects the conduit 40 with a worm conveyor 52, which is contained in the bottom of a wash tank 53. The casing 60 of this worm conveyor is open at the top to communicate with the interior of the tank 53, into which the worm discharges the pulp. This wash tank 53 has a hot water admission line 54, with its valve 55. Tank 53 is also provided with steam admission nozzles 57, and a gas and vapor outlet line 58, which may lead to the acid recovery or make-up system.

Communicating with the worm conveyor 52 is a further vertical worm conveyor 61, enclosed in a vertical casing 62, at the top of which is a discharge 63, which is provided with a water supply connection 64 having valve 65. This discharge 63 is directed to a washer 66, which may be any of a standard type, usually provided with a further water supply connection 68 having a valve 67. The washer 66 at its bottom is connected by a valve 69 and conduit 70, with a defibering machine 71, which may be of usual construction. The defibering machine is also provided with outlet 72, containing valve 73.

In operation, fibrous material is placed in pretreatment tank 1, where, in the presence of hot water and steam, admitted respectively by line 3 and nozzles 2, it is cooked at an elevated temperature. The material so treated may be drained from the pretreatment tank 1 through the valve 5 into the worm conveyor 6, where, during its passage, it is mixed with steam supplied by the line 9, and is then pumped by the pump 11 into the vertical leg 12, and across the strainer 16, where the water is removed and passes off through the drain pipe 21. Gases pass through the gas vent 22.

This pretreatment to this point is the same as that described and claimed in my aforesaid co-pending application. The pretreatment may be continuous by addition of one or more pretreatment tanks as required.

My present invention is particularly concerned with the treatment of the pretreated material, from this point to the defibering machine. Although this treatment may be carried on without the pretreatment referred to, the operation will be less efficient in this case.

The drained pulp drops through the leg 23a into the operating worm conveyor 24, wherein it is mixed with either hot or cold bisulphite cooking liquor or any of the alkali cooking liquors from a storage tank (not shown) or from an accumulator in the case of the hot acid method, through the admission pipe 27, and valve 28. I prefer that, as stated in my co-pending application above referred to, the cooking liquor be at an approximate temperature of 130° C. at the time of introduction, although this is by no means essential. Steam at the same time may be admitted by opening the valve 30 in the steam inlet 29.

The pump 31 is put in operation, and forces the material up the leg 32, in which the material is cooked, and which may be indirectly heated by steam admitted through the inlet 34 to the steam jacket 33. Steam may also be directly admitted to the leg 32 by the inlet 38, if so desired or conditions require, but this method of heating is optional and its use is usually dependent upon the moisture content of the particular material being treated.

The height of the leg 32 creates a hydrostatic pressure at its bottom, which varies according to the height of the leg.

After passing over the top of the leg 32, the material passes through the conduit 40 and the spent cooking liquor is drained off through the strainer 41, collector 42 and pipe 43, either to the sewer or to a tank for further treatment, and gases escape through the top relief line 45 to the acid recovery system, thus conserving heat units.

The cooked pulp then drops through the leg 51 to the worm conveyor 52, which passes the pulp into the tank 53, where the pulp absorbs the water and steam supplied thereto, and wherefrom gases and vapors are allowed to escape back to the acid recovery or to the make-up system through the connection 58. After absorbing water in the tank 53, the pulp is elevated by the worm conveyor 61, mixed with further hot water from the pipe 64, and finally discharged into the washer 66, where it is subjected to the usual washing and then is passed into the defibering machine 71.

The time required for the passage of the material through this apparatus will vary according to mill conditions and the character of the raw material, but in general, in making a so-called semi-chemical pulp, normally about three or four hours' time is required from the time the pulp enters the line 15 after the pretreatment, until it is discharged into the worm conveyor 61. This time element is controlled by the speed of operation of the worm conveyors 24 and 52 and the speed of the impeller in the pump 31.

The height of the leg 32 may also be varied according to mill conditions to regulate the hydrostatic pressure necessary to secure the proper treatment.

The treatment secured in the tank 53 is, in the acid pulping process, mainly one of acid dilution, the pulp absorbing water and steam, which are present in the tank 53. As the pulp passes up the conveyor 61, a certain amount of disintegration of the fibres takes place. The work of this conveyor may be done by a good so-called "trash pump", although the worm is considered more efficient. The final washing is then accomplished in the tank 66, and further removes acids from the material before the pulp passes to the defibering machine.

Having thus described my invention, I claim:

1. In apparatus for cooking fibrous material in the presence of digestion liquor, means to separate said liquor from such material, an outlet for said separated liquor including a trap to maintain pressure on said material while removing said liquor, and a gas relief line and a control valve in conjunction with said separating means.

2. In apparatus of the character described, a pretreatment tank, a vertical conduit and means for forcing fibrous material from said pretreatment tank through said conduit, a strainer communicating with said conduit, means for removing liquor separated by said strainer and a trap in conjunction with said removing means, a second vertical conduit communicating with said first conduit, and means to force fibrous material therethrough, means to inject digestion liquor into said second conduit, a second strainer connecting with said second conduit, means for removing digestion liquor separated by said strainer and a second trap in conjunction with said removing means, and means communicating with said second conduit for further treating the fibrous material with water.

3. In a process of the character described, treating fibrous material with heated water, forcing the fibrous material so treated through a vertical conduit under decreasing hydrostatic pressure, straining water from said material while maintaining the same under pressure, adding digestion liquor to said material and forcing the same through a second conduit under decreasing hydrostatic pressure, straining digestion liquor from said material, diluting said material with water and steam and washing the same.

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