

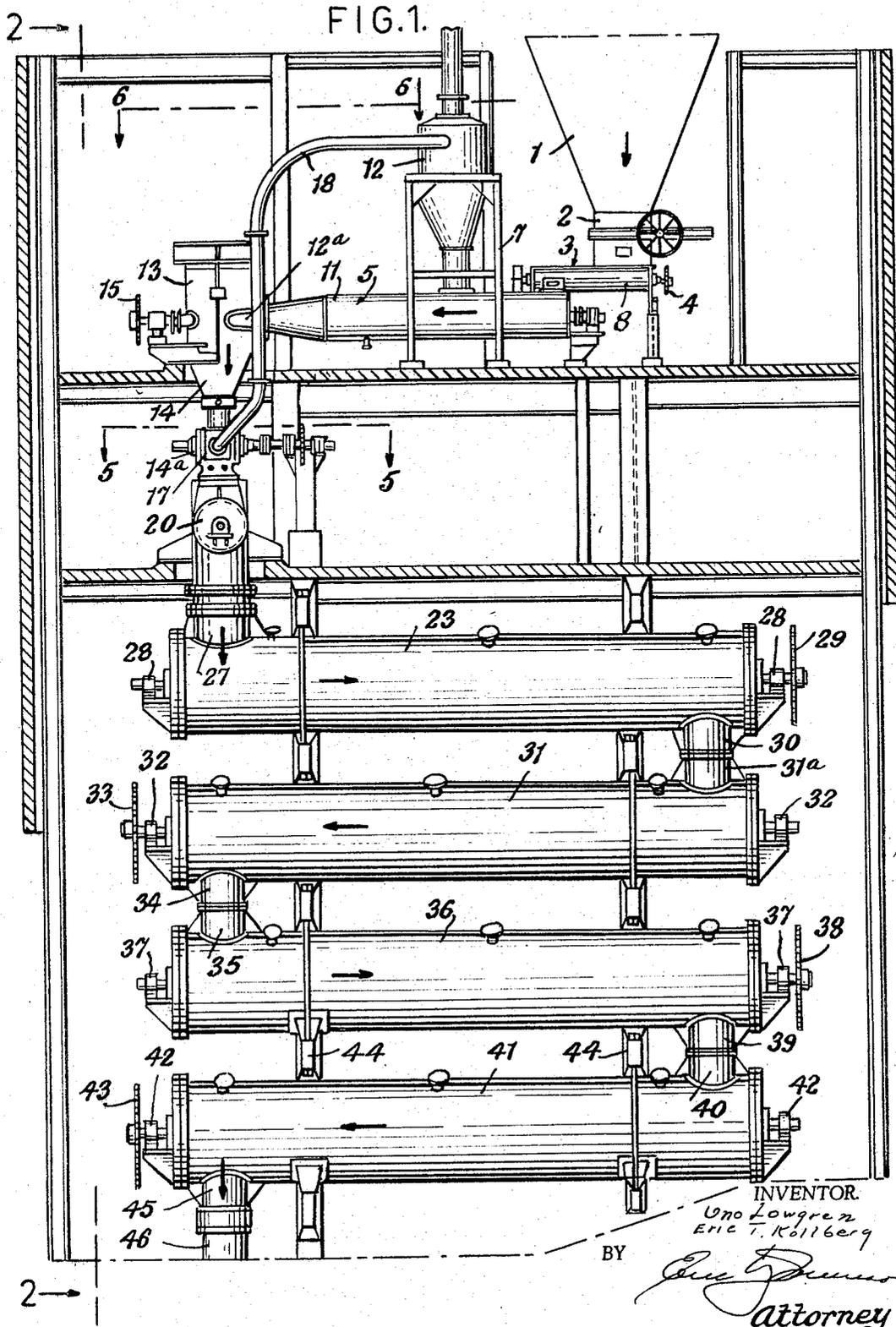
July 25, 1967

U. LOWGREN ETAL  
CONTINUOUS IMPREGNATION AND DIGESTION APPARATUS  
FOR THE PRODUCTION OF WOOD PULP

3,332,836

Filed Aug. 28, 1964

4 Sheets-Sheet 1



July 25, 1967

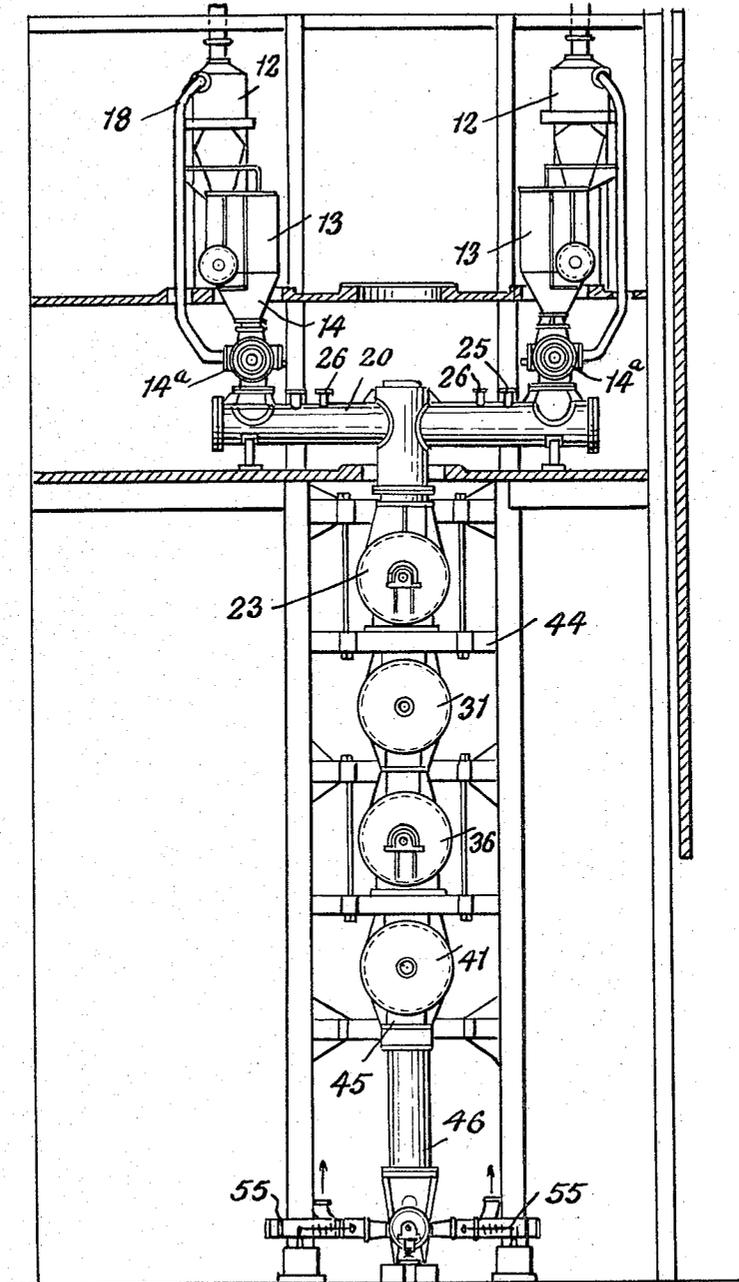
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4 Sheets-Sheet 2

FIG. 2.



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4 Sheets-Sheet 3

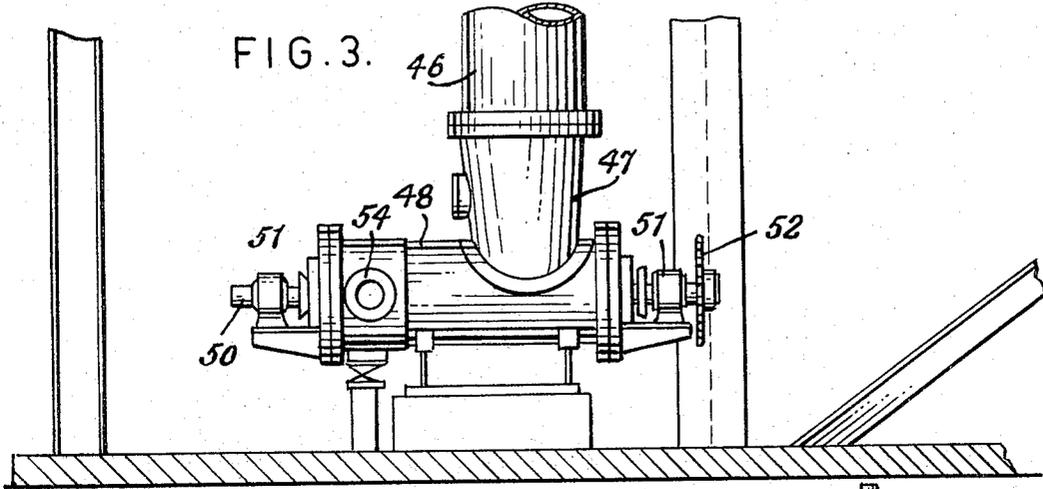


FIG. 4.

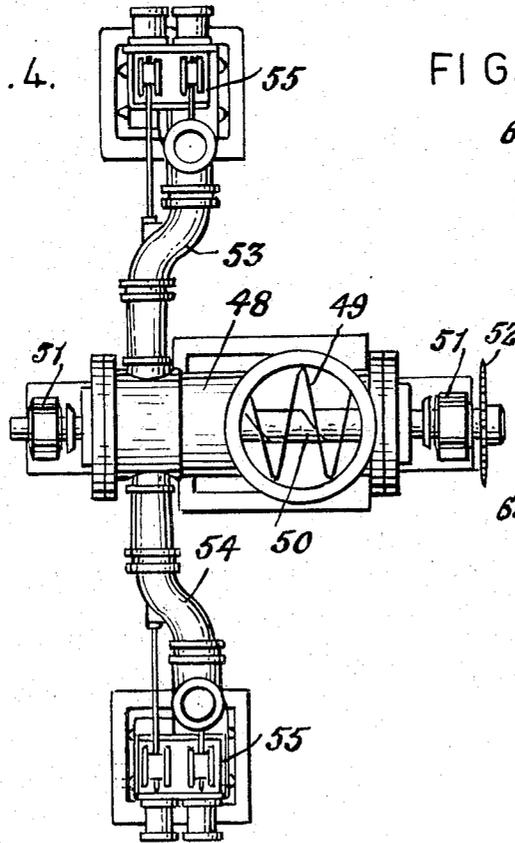
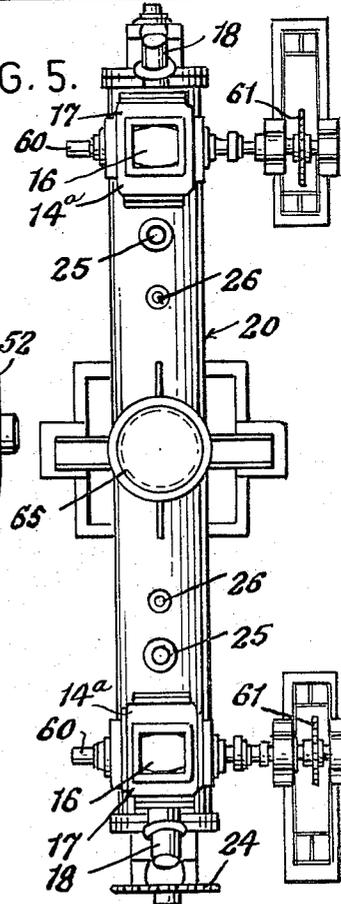


FIG. 5.



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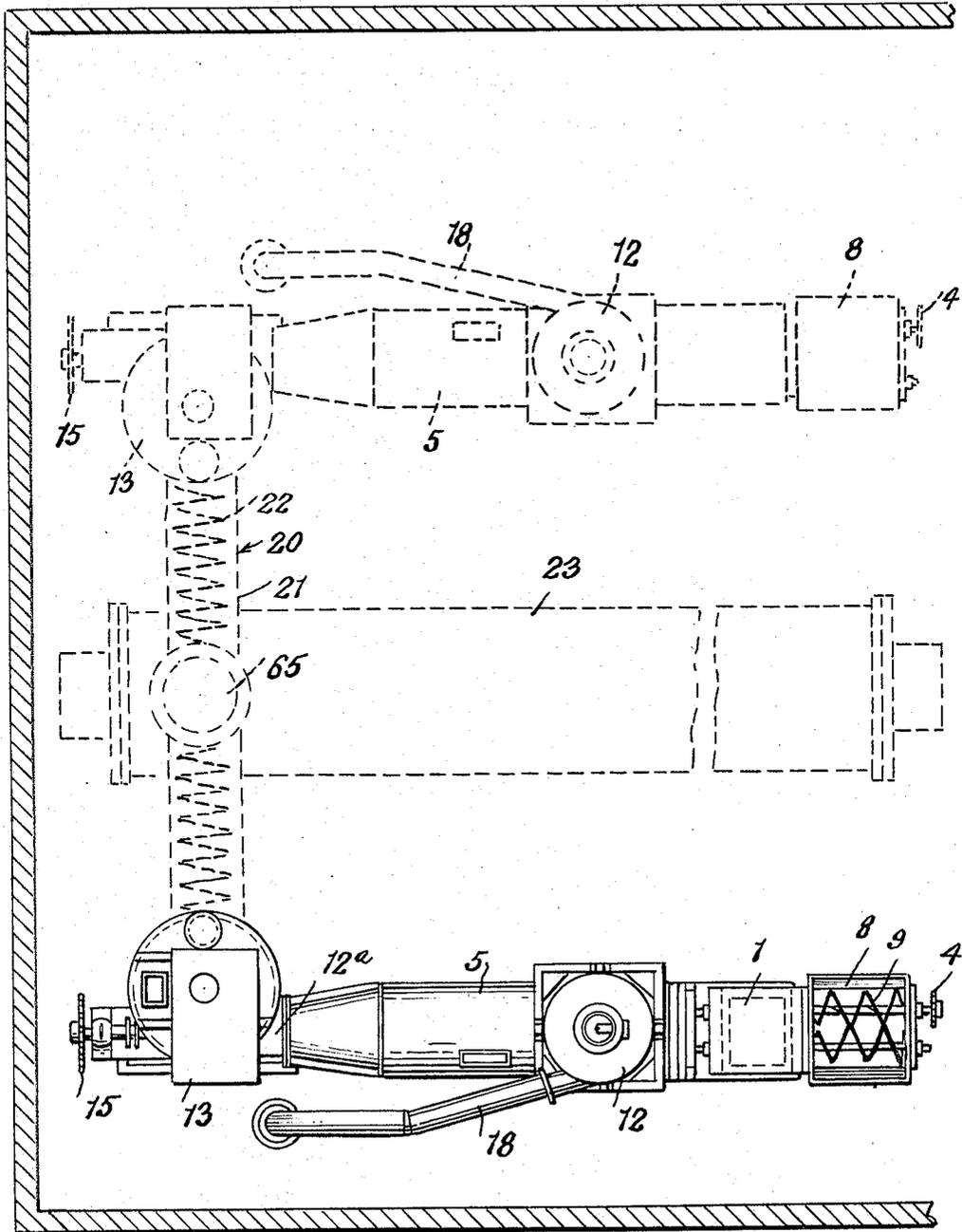
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4 Sheets-Sheet 4

FIG. 6.



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3,332,836

**CONTINUOUS IMPREGNATION AND DIGESTION APPARATUS FOR THE PRODUCTION OF WOOD PULP**

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 Filed Aug. 28, 1964, Ser. No. 392,877  
 4 Claims. (Cl. 162-237)

This invention relates to the production of wood pulp from wood chips, sawdust and other ligno-cellulose material and has for one of its objects the provision of an apparatus of this kind by which the rapid and continuous production of the wood pulp is obtained.

It is an object of the invention to provide an apparatus by means of which the sawdust or other wood particles are delivered from a number of hoppers or other sources of supply into separate wetting tubes to which the white liquor is provided from cyclone means. In the wetting tubes wetting and thorough mixing and steaming of the wood and liquor takes place, resulting in good pulp quality. The mixed material is then conveyed from each of the wetting tubes to separate rotary feeders of the so-called volumetric type from which the material is delivered into a cross feed tube at a predetermined rate of feed and which tube extends between and connects with the outlets of the rotary feeders. Such cross tube contains screw feed means which is operative to move the material toward its outlet, centrally located on the tube and between the feeders, and from which outlet the material passes successively through a plurality of superposed digester tubes wherein a constant steam pressure is maintained and where the cooking of the material is carried out. At the outlet of the lowermost digester tube the cooked sawdust, then in pulp condition, is brought to a sluicing valve system which discharges the pulp into a blow tank at atmospheric pressure.

With these and other objects to be hereinafter set forth in view, I have devised the arrangement of parts to be described and more particularly pointed out in the claims appended hereto.

In the accompanying drawings, wherein an illustrative embodiment of the invention is disclosed,

FIG. 1 is an elevational view of an apparatus for the production of wood pulp, constructed according to the invention;

FIG. 2 is a sectional view, taken substantially on the line 2-2 of FIG. 1, looking in the direction of the arrows;

FIG. 3 is a continuation, in an enlarged scale, of a part of the lower portion of FIG. 1;

FIG. 4 is a top plan view of the reciprocating sluice valves shown in FIG. 3;

FIG. 5 is a sectional view, taken substantially on the line 5-5 of FIG. 1, looking in the direction of the arrows, and

FIG. 6 is a sectional view, taken substantially on the line 6-6 of FIG. 1, looking in the direction of the arrows, and with some parts, which are duplicates of others, shown in dotted lines to simplify illustration.

The material to be treated, such as for example sawdust, wood chips or other ligno-cellulose material is supplied from two hoppers or bins 1 and is fed therefrom by means of a volumetric feeder 2 which includes a delivery tube 3 containing a feeding element rotated by a sprocket 4 from suitable driving means. From the tube 3, the sawdust or other material is fed to a pair of wetting tubes 5, each containing a rotative spiral feeder which moves the material in the direction of the arrow in FIG. 1.

Each volumetric feeder includes a U-shaped trough 8 containing two feed screws 9 (FIG. 6) and by varying the speed of a variable speed motor which drives the screws through sprocket 4, the sawdust can be metered volumetrically. As shown in dotted lines in FIG. 6, the mechanism described is duplicated as indicated at 10 so there are actually two wetting tubes, each having its own feeder. Each of the wetting tubes 5 consists of a trough 11 provided interiorly with a horizontal conveyor screw. In each of the wetting tubes the sawdust is mixed with white liquor. The liquor and water are mixed in a cyclone mixer 12 and the wetting tubes are each provided with several steam inlets in order to preheat the sawdust while it is being mixed with the white liquor. A heat sensing device is mounted in the top cover of each of the wetting tubes 5 and the temperature of the sawdust can be controlled within a wide range from a suitable control panel.

The wetting tubes 5 each discharges the mixed sawdust and liquor through a conical throat 12a into a feed hopper 13, from which the sawdust is discharged into a rotary feeder 14a. The hopper 13 is cylindrical in shape, having a conical bottom 14 and is provided with a vertical paddle screw driven by suitable drive means operating through sprocket 15.

The rotary feeders, which are of known construction, consist essentially of a pocketed feeder 16 mounting in a housing 17 and having its shaft 60 carrying a sprocket 61 driven from a suitable motor source. The rotor of the feeder is provided with a number of pockets, usually six, which are filled with sawdust from the hopper 13 as they pass the inlet port of the housing 17. As the rotor 16 revolves, the pockets filled with sawdust, pass the outlet port of the housing 17 and the sawdust falls out of the pockets of the rotor. To aid in the discharge of the sawdust from the pockets, there are steam jets directed toward the pockets. As the pockets are being emptied of sawdust they are filled with steam. It is therefore important that the pockets be vented before they arrive in front of the inlet opening of the housing 17. For this purpose a blow line 18 is connected between the rotary feeder and the cyclone 12.

The cross conveyor 20, located between and below the two rotary feeders is a pressurized tubular vessel preferably made from carbon steel clad with stainless steel. The cross conveyor 20 receives the sawdust from the rotary feeders 14a. A conveyor screw 22 contained within the cross conveyor, has one half of it provided with left hand helical flights and its other half provided with right hand flights and it thus conveys the sawdust from the two feeders 14a toward the center of the vessel 21 to a central outlet 65 where the sawdust falls by gravity into the uppermost horizontally-supported, pressurized digester tube 23.

The cross conveyor screw 22 is driven by a suitable motor and chain through sprocket 24 (FIG. 5). On top of the cross conveyor are provided flanges 25, 26 for steam lines and liquor lines.

The flow of the sawdust through the apparatus is indicated by arrows in FIG. 1. Therein it will be noted that the horizontal digester tube 23 receives the sawdust at one end, through inlet 27 and carries it by means of an internal feed screw through the digester tube 23 in the direction of the arrow appearing on the digester tube. The feed screw within the tube 23 is preferably provided with interrupted flights and its shaft rides on two grease-lubricated antifriction pillow block bearings 28, both located on the outside of the tube 23. The digester feed screw contained within the digester tube 23, is driven by a sprocket 29 from a chain extending from a suitable motor drive.

After passing through the digester tube 23, the sawdust then discharges through vertical outlet 30 into the connected inlet 31a of a second digester tube 31 located below the first tube 23. Said tube 31 is a pressurized vessel and is substantially similar to the tube 23. The feed screw of the tube 31 is supported in the bearings 32 and the sprocket 33, mounted on the shaft of the feed screw drives the feed screw through suitable drive means from a motor. Means is provided for maintaining a constant steam pressure in this digester tube as well as in all of the other digester tubes.

The sawdust is fed through the digester tube 31 toward the left as viewed in FIG. 1 or in the direction of the arrows appearing on the tube 31, until the sawdust reaches the outlet 34 and it then passes therethrough into the connected inlet 35 to enter the third digester tube 36. Tube 36 is a pressurized vessel and is similar to digester tube 31. This tube has its internal feed screw supported by the bearings 37 and the sprocket 38 carried on the shaft of the screw is driven by a suitable motor through chain drive.

The digester tube 36 discharges the sawdust through outlet 39 into a connected outlet 40 leading into the fourth or last digester tube 41. This tube is similar to the others and is a pressurized vessel. It has its internal feed screw supported by the bearings 42 and the shaft thereof carries a sprocket 43 driven by chain from a motor.

The several digester tubes are supported in the superposed relationship shown in the drawings by means of reinforced framework disclosed generally at 44.

After passing through the lowermost digester tube 41 in the direction of the arrow shown thereon, the sawdust then in pulp form, passes out of the tube 41 by way of the outlet 45 to enter the inlet 46 of a screw discharger generally indicated at 47 and shown more clearly in FIGS. 3 and 4. Said discharger is in the form of a pressurized vessel 48 containing a screw feeder 49 having its shaft 50 supported in the bearings 51 and carrying a drive sprocket 52 driven by chain from a suitable power source. A gate valve is provided at the bottom of the discharger to draw off any condensate water that will collect on the inside of the digester tubes during the heating-up period.

Leading from the opposite sides of the screw discharger are tubes 53, 54 that extend to reciprocating valves 55 that are employed to discharge the pulp from the pressurized digester tubes to a blow tank, not shown, but one which is under atmospheric pressure. The reciprocating valves are of the type which operate on the sluicing principle. The reciprocating valves are equipped with cylinders and solenoid valves so that if there is a tendency to plug, the valves can be operated remotely from a control panel located in a control room.

By means of the continuous digester described, the continuous pulping of wood chips, sawdust or other ligno-cellulose material is effectively obtained. The raw material, which can be sawdust, chips or other ligno-cellulose material, and which is for convenience herein mentioned as sawdust, is delivered from the hoppers 1 to be soaked in the white liquor in the wetting and steaming tubes 5 which also provides for a thorough mixing of the sawdust with the liquor and which is important for the securing of good pulp quality. The liquor-impregnated sawdust is then conveyed to the two rotary feeders 14a which deliver the sawdust to the central outlet 65 of the cross delivery tube 20 and which delivers the material into the uppermost digester tube 23, wherein a constant steam pressure is maintained and wherein the cooking of the material takes place. The material is transported from one of the digester tubes to the others until it has progressed through all of them. The conveyor screws operating in the several digester tubes are rotated at controlled speeds. At the end of the cooking procedure, which usually takes from twenty to thirty minutes, the cooked sawdust, which by this time has become pulp, is brought

to the valves 55, which as previously explained are of the sluice type, and act to discharge the pulp into a blow tank at atmospheric pressure.

Having thus described a single embodiment of the invention, it is obvious that the same is not to be restricted thereto, but is broad enough to cover all structures coming within the scope of the annexed claims.

What is claimed is:

1. An apparatus for the production of wood pulp comprising:
  - a plurality of hoppers from which wood particles are fed, each of said hoppers having an outlet;
  - a wetting vessel for each hopper, which vessel is connected to said hopper outlet for receiving wood particles therefrom;
  - a cyclone mixer for each wetting vessel connected to said vessel for delivering liquor to mix with the wood particles therein;
  - each wetting vessel containing a means for feeding and agitating the mixture, and having an outlet connected to and discharging into a mixture feed hopper;
  - each of said mixture feed hoppers having an outlet connected to and discharging into a rotary feeder, each of said rotary feeders having feed pockets and an outlet;
  - a cross conveyor extending between and connecting said rotary feeder outlets, said cross conveyor having a discharge outlet, said conveyor discharge outlet being between said feeder outlets and being connected to a digester tube means;
  - said digester tube means comprising a plurality of superposed, substantially horizontal digester tubes, an outlet of each tube being connected to an inlet of the tube below so that the path followed by said mixture is sinusoidal; and
  - valve means connected to an outlet of the lowermost of the digester tubes.
2. An apparatus for the production of wood pulp comprising:
  - a plurality of hoppers from which wood particles are fed, each of said hoppers having an outlet;
  - a wetting vessel for each hopper, which vessel is connected to said hopper outlet for receiving wood particles therefrom;
  - a cyclone mixer for each wetting vessel connected to said vessel for delivering liquor to mix with the wood particles therein;
  - each wetting vessel containing a means for feeding and agitating the mixture, and having an outlet connected to and discharging into a mixture feed hopper;
  - each of said mixture feed hoppers having an outlet connected to and discharging into a rotary feeder, each of said rotary feeders having feed pockets and an outlet;
  - a cross conveyor extending between and connecting said rotary feeder outlets, said cross conveyor having a discharge outlet, said cross conveyor discharge outlet being between said feeder outlets and being connected to a digester tube means;
  - said digester tube means comprising a plurality of superposed, substantially horizontal digester tubes, an outlet of each tube being connected to an inlet of the tube below so that the path followed by the said mixture is sinusoidal;
  - valve means connected to an outlet of the lowermost of the digester tubes; and
  - blow tube means connecting each rotary feeder to said cyclone, whereby steam and gases are removed from the pockets of said rotary feeder.
3. An apparatus for the production of wood pulp comprising:
  - a plurality of hoppers from which wood particles are fed, each of said hoppers having an outlet;

5

- a wetting vessel for each hopper, which vessel is connected to said hopper outlet for receiving wood particles therefrom;
- a cyclone mixer for each wetting vessel connected to said vessel for delivering liquor to mix with the wood particles therein;
- each wetting vessel containing a means for feeding and agitating the mixture, and having an outlet connected to and discharging into a mixture feed hopper;
- each of said mixture feed hoppers having an outlet connected to and discharging into a rotary feeder, each of said rotary feeders having feed pockets and an outlet;
- a cross delivery tube extending between and connecting said rotary feeder outlets, said tube having a discharge outlet at substantially the center thereof, and feed means therein by which the material is delivered toward said center outlet, said center outlet being connected to a digester tube means;
- said digester tube means comprising a plurality of superposed, substantially horizontal digester tubes, an outlet of each tube being connected to an inlet of the tube below so that the path followed by said mixture is sinusoidal;
- valve means connected to an outlet of the lowermost of said digester tubes; and
- blow tube means connecting each rotary feeder to said cyclone, whereby steam and gases are removed from the pockets of said rotary feeder.
4. An apparatus for the production of wood pulp comprising:
- a hopper from which wood particles are fed, said hopper having an outlet;

6

- a wetting vessel which is connected to said hopper outlet for receiving wood particles therefrom;
- a cyclone mixer connected to said vessel for delivering liquor to mix with the wood particles therein;
- said wetting vessel containing a means for feeding and agitating the mixture, and having an outlet connected to and discharging into a mixture feed hopper;
- said mixture feed hopper having an outlet connected to and discharging into a rotary feeder, said rotary feeder having feed pockets and an outlet;
- blow tube means connecting said rotary feeder to said cyclone, whereby steam and gases are removed from the pockets of said rotary feeder;
- a delivery tube means connected to said rotary feeder outlet, said delivery tube means containing means by which the material is mixed and fed;
- a plurality of vertically spaced digester tubes, an outlet of each tube being connected to an inlet of the tube below so that the path followed by said mixture is sinusoidal; and
- a valve means connected to the last of said digester tubes for controlling the flow of wood pulp therefrom.

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