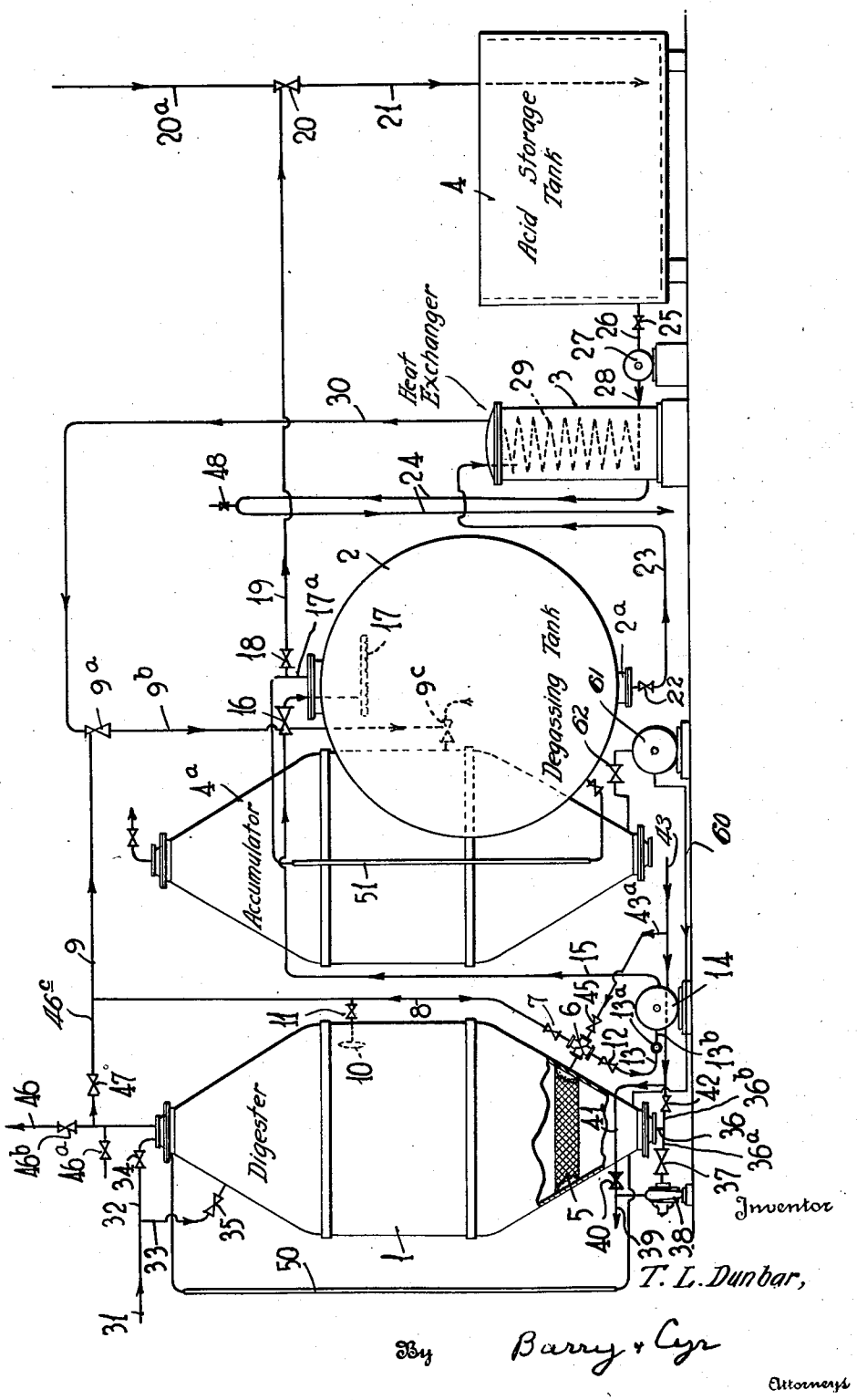
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DIGESTING PROCESS AND APPARATUS

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DIGESTING PROCESS AND APPARATUS

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This invention relates to improvements in digesting systems and more particularly to specific improvements in the digesting processes and apparatus disclosed in my Patents 1,955,057 dated April 17, 1934, and 2,041,597, dated May 19, 1936.

The primary purpose of the invention is to provide a novel process and apparatus for washing the stock and emptying the same from the digester and for recovering gases and heat units released in such operations.

With the foregoing object outlined and with other objects in view which will appear as the description proceeds, the invention consists in the novel features hereinafter described in connection with the accompanying drawing, and more particularly pointed out in the appended claims.

The drawing is a diagrammatic side elevation of the improved apparatus employed in practicing the new process.

In the drawing, 1 designates an ordinary sulphite digester of which there may be one or several in a plant. Although only one is illustrated, the present invention may be employed with one or more such digesters. 2 is a degassing tank; 3, a heat exchanger; 4, an acid storage tank; and 4a, a pressure accumulator; one or more of which may be used depending on the capacity of the particular plant.

Each digester is provided with a strainer 5 communicating with a fitting 6 having a valve 7 to control the flow of fluid from the digester into a pipe 8 leading to a high pressure header 9 which discharges into an eductor 9a communicating with a drop leg 9b, joined to a second eductor 9c for leading the fluid into the lower portion of the accumulator 4a.

A side relief branch 10 leads from the upper portion of the digester to the pipe 8 and is provided with a control valve 11.

A pipe 60 connects the lower ends of the accumulator and the digester and is provided with an interposed pump 61 for forcing liquor from the accumulator into the digester. A valve 62 is arranged in the pipe for controlling the flow of liquor through the same.

The fitting 6 is provided with a second valve 12 controlling flow from the fitting into a pipe 13 that discharges into a header 13a accommodating the various digesters of the plant; and a pipe 13b leads from the header to a pump 14 which is used to force liquids through a pipe 15 having a differential pressure valve 16. This pipe terminates in a spray head 17 within the upper portion of the degassing tank 2.

A gas and steam conducting pipe 17a extends from the top of the degassing tank and joins a pipe 19 provided with an automatic relief valve 18, set to open at any desired pressure, say 10 to 15 pounds per square inch. The pipe 19 leads to a raw acid eductor 20 into which the raw acid is introduced through a pipe 20a. A drop leg 21 extends from the eductor into the lower portion of the acid storage tank.

The degassing tank 2 has a liquid outlet 2a at its bottom leading to a control valve 22 arranged in a liquid conducting pipe 23 that discharges into one end of the heat exchanger 3. This liquid is discharged from the other end of the heat exchanger through an inverted U-shaped pipe 24 leading the liquid to a sewer or by-product plant. The bend at the top of the pipe 24 may be provided with a valve controlled vent 48 leading to the atmosphere.

Acid from the tank 4 can be discharged through a valve 25 and pipe 26 into a cold acid pump 27 which forces the acid through a pipe 28 leading to a coil 29 arranged in the heat exchanger 3. Acid heated in this way passes through the pipe 30 and enters the top of the accumulator eductor 9a.

In order that water may be introduced into the top of the digester, the latter is provided with an intake pipe 31 having branches 32 and 33 provided respectively with control valves 34 and 35. The branches permit the water to be introduced into the very top of the digester or at a point somewhat lower down. The lower end of the digester is provided with a pipe 36 having branches 36a and 36b, the former being provided with a valve 37 leading to a trash pump 38 which discharges into a pipe 39 leading to a stock chest (not shown). A water pipe 41 is provided with a control valve 40 and leads into the pipe 39 to aid in removing the stock from the digester. A pipe 43 leads water to the pipe 41 and also to the pipe 36b and it is provided with a valve 42 for controlling the water conducted to the branch 36b. The water pipe 43 has another branch 43a leading to a pipe 44 which discharges into the fitting 6 for the purpose of cleaning the strainer 5; and the pipe 44 is provided with a control valve 45. The top of the digester has a vent pipe 46 through which air may be discharged to the atmosphere by means of valved branch 46a. Pipe 46 also has a control valve 46b and it is joined by a branch 46c to the high pressure header 9. A valve 47 is interposed in the branch.

The digester is provided with a conventional

gauge glass 50 and the degassing tank is provided with a similar gauge glass 51.

As above mentioned, the present application is especially concerned with waste liquor drainage from each digester through the header 13a which assists in conveying the waste cooking liquor from the digesters to the degassing tank.

The normal operation is as follows: The filling of the digester with chips and acid; pumping a hydraulic pressure on the digester and precirculation of the accumulator acid through the digester back to the accumulator are as disclosed in my above-mentioned Patent 2,041,597. When precirculation of the accumulator acid through the digester is completed, as indicated by the same temperature readings in both the upper and lower thermometers of the digester, the valve 62 in the acid filling line is closed and the filling pump 61 stopped. Valve 7 is immediately opened, valve 11 is usually closed but may be left open if conditions warrant, and liquor is forced out of the digester by the hydraulic pressure through 5, 6, 7, 8 and 9 into the eductor 9a where it commingles with the raw acid liquor forced by the cold acid pump 27 from the storage tank 4 through the heat exchanger and pipe 30. The mixture travels through the drop leg 9b and eductor 9c into the lower portion of the accumulator 4a. Meanwhile the entrained air and gases pass off the digester through the valved branch 46c into the high pressure header 9 in the same manner as the liquor, explained above. After a short time interval, which varies with the size and type of digester, high pressure developed, etc., steam is admitted to the digester in the conventional way and the liquor level is lowered to the desired elevation. Digesting temperature and pressure is quickly reached, due to the uniform moisture content of the chips at a high uniform temperature, resulting from the precirculation of a large volume of hot accumulator acid through the digester mass. Again, when the digester goes on side relief to lower the liquor level due to steam condensate value, valve 7 is opened and the liquor is forced by the digester pressure through 5, 6, 7, 8, 9, 9a, 9b and 9c into the accumulator.

The draining of the liquor in this manner produces several beneficial results. It removes the cooler liquor from the dormant areas of the digester, which occur at the lower steam line and thus permits hotter liquor to enter these areas. Therefore, circulation in the digester is greatly facilitated and an improved uniform quality pulp is produced in less time and with a saving in steam and chemicals. This improvement in quality also assists greatly in emptying the digester of stock when cooking is completed. Furthermore, the quality of the pulp is improved as there are less undercooked and overcooked chips, and a consequent reduction in "rejects" thus increasing the yield. This results in a saving in time, steam and chemicals as the digester contents will be in a more uniform condition, as to temperature, acid concentration, moisture content of the entire mass, resulting in more uniform digestion. Emptying the digester contents at the end of the cook will also be made easier due to uniform moisture conditions and more uniform cooks.

When cooking is completed the remaining gases in the digester are vented through the pipe 46 to the low pressure header, not shown herein but illustrated in my Patent 2,041,597, which leads to the recovery tank. The digester pressure is thus lowered to correspond with that of the atmosphere, at which time valve 12 is opened to allow the liquor to drain through the strainer 5 into the header 13a from which it is forced by the pump 14 through 15, 16 and 17 into the top of the degassing tank which may operate at a pressure from 10 to 15 pounds per square inch. The gases released in the tank are discharged through 17a, 18 and 19 into the raw acid eductor 20 where they meet raw acid introduced into the drop leg 21 through the pipe 28, and obviously the mixture finally arrives in the acid storage tank 4. The valve 18a is preferably set so as to maintain any suitable pressure in the tank 2, for example a pressure from 10 to 15 pounds per square inch.

Due to the eductor 20, the hot gases released from the tank 2 are absorbed in the cold acid passing to the tank 4.

The waste liquor after being degassed in the tank 2 is forced through 2a, 22, 23, 3 and 24 due to the static head or static head and gas pressure in the tank 2 or by means of a pump (not shown). Of course, the hot liquor in passing through the heat exchanger will heat the acid liquor passing through the coil 29 and after being deprived of its heat units the waste liquor will be discharged through the pipe 24 to a sewer or by-product plant for further treatment.

As the inverted U tube 24 extends a considerable distance above the heat exchanger 3, the column of liquor in such tube will put a back pressure on the heat exchanger.

The heat units of the waste liquor, imparted to the raw acid liquor in the heat exchanger 3 will, of course, preheat the liquor passing to the accumulator eductor 9a, and these units will be carried into the accumulator for pre-conditioning the acid liquor therein. Of course, if it is not desired to preheat the cooking liquor in this way, the waste acid liquor may be cooled by passing water or the like through the heat exchanger coil.

While liquor is being drained from the digester, water is introduced into the top of the latter through 31, 32 and/or 33 to displace the drained liquor and wash the stock, and when the water has entirely displaced the liquor which may be determined by the gauge glass 50, the valve 12 will be closed. Then valve 37 is opened and digester contents are forced out by the stock or trash pump 38 through 36, 36a, 37 and 39 into a stock chest (not shown). Valves 40 and 42 may be opened if desired and valves 44 and 45 may be left open to assist in washing and pumping the contents out of the digester.

After the contents have been removed, the strainer 5 may be cleaned by introducing a stream of water into the strainer through the valve 45. Of course, strainers of any type or style may be used and they may be located in any position in the lower cone, above the lower steam line, or as a separate fitting attached to the bottom flange of the digester. In other words, any of the conventional strainers may be employed.

The herein described and illustrated embodiment of the invention has given satisfactory results, and it will be obvious to those skilled in the art, after an understanding of my invention, that other changes and modifications may be made without departing from the spirit and scope thereof, and it is intended that all features contained in the above description or shown in the drawing shall be interpreted as illustrative and not in a limiting sense.

What I claim and desire to secure by Letters Patent is:

1. In a process of the character described filling a digester with fibrous material and acid liquor, pumping a hydraulic pressure on the digester and precirculating acid liquor from the digester through an accumulator and back into the digester, continuing such precirculation until the temperature readings at the top and bottom of the digester are substantially equal, then discontinuing the pumping and discharging liquor from the digester through an eductor into the accumulator, discharging gases from the top of the digester while the liqour is discharging and feeding said gases into the accumulator, and mixing raw acid liquor with the digester liquor in the eductor while the last-mentioned liquor is on the way to the accumulator.

2. In a process of the character described filling a digester with fibrous material and acid liquor, pumping a hydraulic pressure on the digester and precirculating acid liquor from the digester through an accumulator and back into the digester, continuing such precirculation until the temperature readings at the top and bottom of the digester are substantially equal, then discontinuing the pumping and discharging liquor from the digester through an eductor into the accumulator, discharging gases from the top of the digester while the liquor is discharging and feeding said gases into the accumulator, mixing raw acid liquor with the digester liquor in the eductor while the last-mentioned liquor is on the way to the accumulator, and subsequently admitting steam into the digester.

3. In a process of the character described filling a digester with fibrous material and acid liquor, pumping a hydraulic pressure on the digester and precirculating acid liquor from the digester through an accumulator and back into the digester, continuing such precirculation until the temperature readings at the top and bottom of the digester are substantially equal, then discontinuing the pumping and discharging liquor from the digester through an eductor into the accumulator, discharging gases from the top of the digester while the liquor is discharging and feeding said gases into the accumulator, mixing raw acid liquor with the digester liquor in the eductor while the last-mentioned liquor is on the way to the accumulator, and subsequently admitting steam into the digester and lowering the liquor level in the latter to a desired elevation.

4. In a process of the character described leading waste acid liquor from the lower portion of a digester to a degassing tank at the end of a cook, separating gases from the waste liquor in said tank, absorbing said gases in raw acid liquor, and then heating the last mentioned liquor by heat exchange with the first-mentioned liquor.

5. In a process of the character described passing waste acid liquor from the lower portion of a digester at the end of a cook into a degassing tank, separating gases from the liquor under superatmospheric pressure of approximately ten to fifteen pounds per square inch, and absorbing said gases in raw acid liquor.

6. In a process of the character described passing waste acid liquor at the end of the cook from the lower portion of a digester into a degassing tank, separating gases from the liquor in said tank, introducing said gases into an eductor having a drop leg and also introducing raw acid liquor into said eductor and thereby absorbing the gases in the raw acid liquor, and then heating said raw acid liquor by heat exchange with said waste acid liquor.

7. In a process of the character described passing waste acid liquor at the end of the cook from the lower portion of a digester into a degassing chamber maintained under superatmospheric pressure of approximately ten to fifteen pounds per square inch, separating gases from liquor in said chamber and discharging said gases into an eductor having a drop leg, and introducing raw acid liquor into the eductor and thereby absorbing the gases in the raw acid liquor.

8. In a process of the character described passing waste acid liquor at the end of the cook from the lower portion of a digester into a degassing tank maintained under superatmospheric pressure, separating gases from the liquor in said tank, releasing the pressure on the gases, and then absorbing the gases in raw acid liquor.

9. In an apparatus of the character described a degasifying chamber, a heat exchanger and a raw acid storage tank, a pipe for leading waste acid liquor from the degasifying chamber into the heat exchanger, a pipe for discharging waste acid liquor from the heat exchanger and provided with means for maintaining a back pressure on the heat exchanger, an eductor, means for leading gases from the degasifying chamber to said eductor, a pipe for introducing raw acid liquor into the eductor for absorbing said gases, a pipe for leading a mixture of raw acid liquor and gases from the eductor into the storage tank, and means for passing acid liquor from the storage tank through the heat exchanger for effecting heat exchange between the raw acid liquor and the waste acid liquor.

10. In the digestion of fibrous material, filling a digester with chips and hot acid liquor, pumping a hydraulic pressure on said chips and liquor, then circulating hot acid liquor through the accumulator to the digester and back to the accumulator until the temperature of the digester is substantially the same throughout the digester, stopping the circulation of the liquor and then discharging liquor from the digester until the liquid level of the liquor in the digester falls to a predetermined elevation, admitting steam into the digester until the digesting temperature and pressure are reached, then discharging acid liquor from the bottom portion of the digester and mixing it with raw acid liquor, and finally introducing the mixed acid liquor into the accumulator.

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