

1,061,767.

UNITED STATES PATENT OFFICE.

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WOOD-PULP DIGESTER.

1,061,767.

Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, JOHN CHARLES WILLIAM STANLEY, a subject of the King of England, residing in the city and county of San Francisco and State of California, have invented new and useful Improvements in Wood-Pulp Digesters, of which the following is a specification.

This invention relates to a digester for the cooking of wood, straw, flax and other material for the manufacture of pulp.

The object of this invention is to provide a digester for cooking wood, straw, flax and other fibrous material in large quantities; and to provide a simple and efficient means for drawing off the liquors in which the materials are cooked, and for washing and cleansing the pulp so that it will be entirely free from the chemical solutions employed in its digestion.

A further object is to provide means by which the digesting solution may be condensed and the chemicals contained therein separated therefrom.

Other objects will appear hereinafter.

The invention consists of the parts and the construction and combination of parts as hereinafter more fully described and claimed, having reference to the accompanying drawings, in which—

Figure 1 is a vertical, sectional view of the invention partly in elevation and partly in diagram. Fig. 2 is a horizontal section on the line X—X of Fig. 1.

In the drawings, A represents the digester which consists of a vertically disposed cylinder, of any suitable dimensions, and built of such materials as to be able to carry a pressure of approximately from 80 to 125 pounds. The cylinder A is preferably formed of steel and is rigidly mounted on a suitable framework 2, and is provided with a dome-shaped head 3, having a feed opening formed therein which is closable by means of a steam-tight door or manhole cover 4, of any suitable description. The lower end of the cylinder A converges toward and terminates in a discharge opening which is closable by means of a pecu-

liarily constructed gate 5 which is adapted to swing downwardly when it is desired to empty the cylinder A of the digested pulp, as later described. The gate 5 is formed with a hollow, hemispherical dome or spray-hood 7 of a diameter slightly smaller than that of the discharge opening of the cylinder A, which portion 7 is adapted to extend into the discharge opening when the gate 5 is closed. The dome 7 is provided with a series of perforations 6 which form steam communicating passages between the interior of the dome 7 and the interior of the cylinder A, and whereby steam from a pipe 8 is admitted to the digester for the purposes shortly to be described. Pipe 8 connects with a flexible hose 9 leading to a pipe 10, which in turn connects with a steam pipe 11 leading from any suitable source of steam supply; a cut-off valve 12 being disposed between the pipes 10 and 11 at any convenient point. An air pipe 13, leading from any suitable source of air supply, and a pipe 14, leading from any suitable source of water supply, intersect the pipe 10; and a pipe 15 leads from the pipe 10 adjacent to the valve 12 and opens to the interior of the cylinder A adjacent to its upper end. Cut-off valves 16 and 17 are disposed in the pipes 13 and 14 respectively. A cut-off valve 18 is disposed in the pipe 10 near its lower end and a like valve 19 is disposed in the pipe 15 at a point adjacent to the cylinder A.

Mounted within the cylinder A, centrally thereof, is a vertically disposed, perforated pipe 20, the upper end of which extends to a point a short distance above the middle of the cylinder A and terminates in a manifold coupling 21; the lower end of the pipe 20 being adapted to be connected with an opening 22 leading through the wall of the dome 7, when the gate 5 is closed.

A pipe 23 connects with the pipe 10 below the cut-off valve 18 and leads to the spiral coil 24 of a condenser through a cut-off valve 25. The condenser coil 24 is arranged in a tank 26 through which a cooling medium is circulated through pipes 27 and 28. The lower end of the condenser coil 24

leads to a suitable tank 29 from which the fluids may be drawn off in any desired manner and delivered to any suitable point of discharge, such as evaporating pans not necessary to be here shown.

Leading from the manifold coupling 21 is a series of radiating, horizontally disposed pipes 30 which terminate in T-couplings 31 adjacent to the inner wall of the cylinder A. Mounted in the couplings 31 are vertically disposed, perforated pipes 32 which extend upwardly to a point a short distance below the dome 3 of the cylinder A and downwardly to a point a short distance above the converging portion of the lower end of the cylinder.

The pipes 20 and 32 are supported in the cylinder A by means of brackets 33 which are mounted on the inner wall of the cylinder and are connected to the T-couplings 31.

A cut-off valve 34 is disposed in the pipe 20 adjacent to its upper end, which valve is operated through a stem 35 extending through a stuffing-box 36 in the wall of the cylinder A to the exterior thereof and is provided with a hand-wheel on its outer end by which the valve 34 may be opened or closed from the exterior of the cylinder A.

In the operation of the invention the gate 5 is closed and the cylinder A is filled with wood or other materials to be treated, previously reduced to a suitable size, which is delivered to the interior of the cylinder A through the feed opening in the upper end thereof. During this procedure the cut-off valves 12, 16, 17, 18, 19 and 25 are closed. A suitable solution of caustic soda, sulfate of soda, or other appropriate substances, is then delivered to the interior of the cylinder A in sufficient quantities to practically submerge the materials previously placed therein. This solution may be formed by mixing the dry powdered chemicals with the materials to be treated and then admitting water to the interior of the cylinder A through the pipes 14, 10 and 15 by opening the valves 17 and 19. This being done, the cover 4 is closed, whereupon the valves 17 and 19 are closed, and the valves 12, 18 and 34 are opened to admit of the passage of steam to the interior of the cylinder A through the perforated bottom or dome 7, formed on the gate 5, and through the perforated pipe sections 32 on the perforated standard 20, which are so arranged as to insure a thorough distribution of steam throughout the mass contained in the cylinder A. When steam pressure in the cylinder equals boiler pressure the valve 19 is opened. The steam is delivered to the cylinder A at a pressure ranging from 80 to 100 pounds pressure and raises the temperature of the solution in the reservoir A to approximately the boiling point. When the cooking is completed, which may be any

length of time necessary to reduce the fibrous materials to pulp, usually about eight hours, the valves 12, 18 and 19 are closed and the valve 25 in the pipe 23 which leads to the condenser coil 24 is opened so as to allow the solution in the cylinder A to drain therethrough; the solution passing out through the pipe 20 and the dome 7. The liquor being drained from the cylinder A, the valves 34 and 25 are closed and water is delivered to the interior of the cylinder through the pipes 10 and 15 and valves 17 and 19, which water flows throughout the digested pulp and acts to wash and cool the pulp. Valves 17 and 19 are then closed. The valves 16 and 18 are then opened to admit air to the cylinder through the dome 7 at the bottom closure. When air pressure in the cylinder A reaches approximately eighty pounds pressure per square inch, the valve 18 is closed and the valve 25 is opened which allows the wash-water to flow to the tank 29 through the condenser coil 24. The pressure of the air acts to force the liquids in the cylinder out through the pipe 20 and perforated dome 7 to the condenser 24, and thereby thoroughly cleanses and cools the pulp in the cylinder A. This being done, the valve 25 is closed and the gate 5 is opened so as to permit the digested and cleansed pulp to discharge through the lower end of the cylinder into a receiving hopper, of any suitable description, from whence it is removed for further treatment. The discharge of the pulp from the cylinder A is facilitated by directing the air pressure into the upper end of the cylinder by opening the valve 19 so as to bear upon the pulp and force it downward; the valve 34 being closed to prevent the escape of the air through the pipe 20. The liquids drained from the cylinder A contain the chemicals employed in the digesting solution, together with other substances accumulated from the materials being treated during the digesting and cleansing process which are held in suspension in the liquid as it passes through the drains. By subjecting the fluids to a cooling action in the condenser coils 24 the vapors are condensed, thereby preventing the loss of any volatile products contained in the digesting liquors. Such chemicals as are held in solution in the liquid are removed therefrom by drawing the liquid from the tank 29 and evaporating it.

The thorough removal of the digesting solution from the pulp is important, inasmuch as it renders the pulp purer and at the same time admits of the chemicals therein being restored and makes possible the acquirement of by-products accumulated in the digesting process.

The gate 5 is here shown as mounted on an arm 37 on a shaft 38 on which a toothed

segment 39 is mounted. A worm gear 40 meshes with the segment 39 and is adapted to be rotated by means of a hand-wheel 41 so as to rock the shaft 38 and thereby swing the gate 5 to open or close the discharge opening in the lower end of the cylinder A. Bolts 42, pivoted on the cylinder, are adapted to pass between lugs on the periphery of the gate 5 when the latter is closed, and nuts 43 are screwed on the lower end of the bolts to securely clamp the gate 5 in its closed position.

An important feature of this invention resides in the means for introducing air under pressure to the interior of the container both at its upper and lower ends. In the latter instance it acts to agitate the pulp to permit the wash-water to percolate throughout the mass and thereby insures a thorough cleansing action taking place. This also serves to rapidly cool the pulp so that it may be readily handled and worked immediately after its discharge from the container; the delivery of the air to the upper end of the container acting, as before mentioned, to quickly force the cleansed pulp out of the discharge opening after the wash-water has been drained therefrom.

Having thus described my invention, what I claim and desire to secure by Letters Patent is—

1. In a digester, the combination with a digesting tank having a perforated dome in the bottom thereof, of means for delivering steam, air and fluids under pressure to the upper end of the tank, means for distributing steam, air and fluids through the interior of the tank, comprising a plurality of perforated, horizontally and vertically arranged tubes connected together; a condenser, and means for delivering steam, air and fluids through the perforated dome in the bottom of the tank to said condenser.

2. A digester which includes a vertically disposed, cylindrical container having a feed opening at its upper end and a discharge opening at its lower end, a closure with a perforated dome for said discharge opening, said dome consisting of a hemispherical, perforated hood smaller in diameter than the diameter of said discharge opening, a vertically disposed, perforated pipe in the container opening at its lower end to the interior of the perforated dome, and a cut-off valve in said pipe operable from the exterior of the container.

3. A digester which includes a vertically disposed, cylindrical container having a feed opening at its upper end and a discharge opening at its lower end, a closure with a perforated dome for said discharge opening, said dome consisting of a hemispherical, perforated hood smaller in diameter than the diameter of said discharge opening, a vertically disposed, perforated

pipe in the container opening at its lower end to the interior of the perforated dome, a cut-off valve in said pipe operable from the exterior of the container, radial pipes leading from the upper end of said perforated pipe above said valve, and a vertically disposed, perforated pipe connecting with the outer end of each of said radial pipes.

4. A digester consisting of a container having a feed opening at its upper end and a discharge opening at its lower end, closures for said openings and a perforated partition plate at the lower end of the container and forming with said bottom closure a fluid chamber which is in communication through said perforations with the container and in communication with a source of steam pressure supply and also in communication with the discharge for the liquid, said partition plate having a perforated hollow column extending upwardly from it and means for delivering air under pressure into the top of the container.

5. A digester consisting of a container having a feed opening at its upper end and a discharge opening at its lower end, closures for said openings and a perforated partition plate at the lower end of the container and forming with said bottom closure a fluid chamber which is in communication through said perforations with the container and in communication with a source of steam pressure supply and also in communication with the discharge for the liquid, said partition plate having a perforated hollow column extending upwardly from it, means for delivering air under pressure into the top of the container, said column having perforated radial branches with vertical perforated hollow terminals, said chamber below the partition plate and column, branches and terminals so constructed and arranged to afford a percolating system for the steam and fluid through the material undergoing digestion.

6. A digester consisting of a container having a feed opening at its upper end and a discharge opening at its lower end, closures for said openings and a perforated partition plate at the lower end of the container and forming with said bottom closure a fluid chamber which is in communication through said perforations with the container and in communication with a source of steam pressure supply and also in communication with the discharge for the liquid, said partition plate having a perforated hollow column extending upwardly from it, means for delivering air under pressure into the top of the container, said column having perforated radial branches with vertical perforated hollow terminals, said chamber below the partition plate and column, branches and terminals so constructed and arranged to afford a percolat-

ing system for the steam and fluid through
the material undergoing digestion, and a
valve disposed in said column and operable
from outside the digester to interrupt com-
5 munication between said chamber below the
partition plate and said branches.

In testimony whereof I have hereunto set

my hand in the presence of two subscribing
witnesses.

JOHN CHARLES WILLIAM STANLEY.

Witnesses:

JOHN H. HERRING,

CHARLES EDELMAN.
