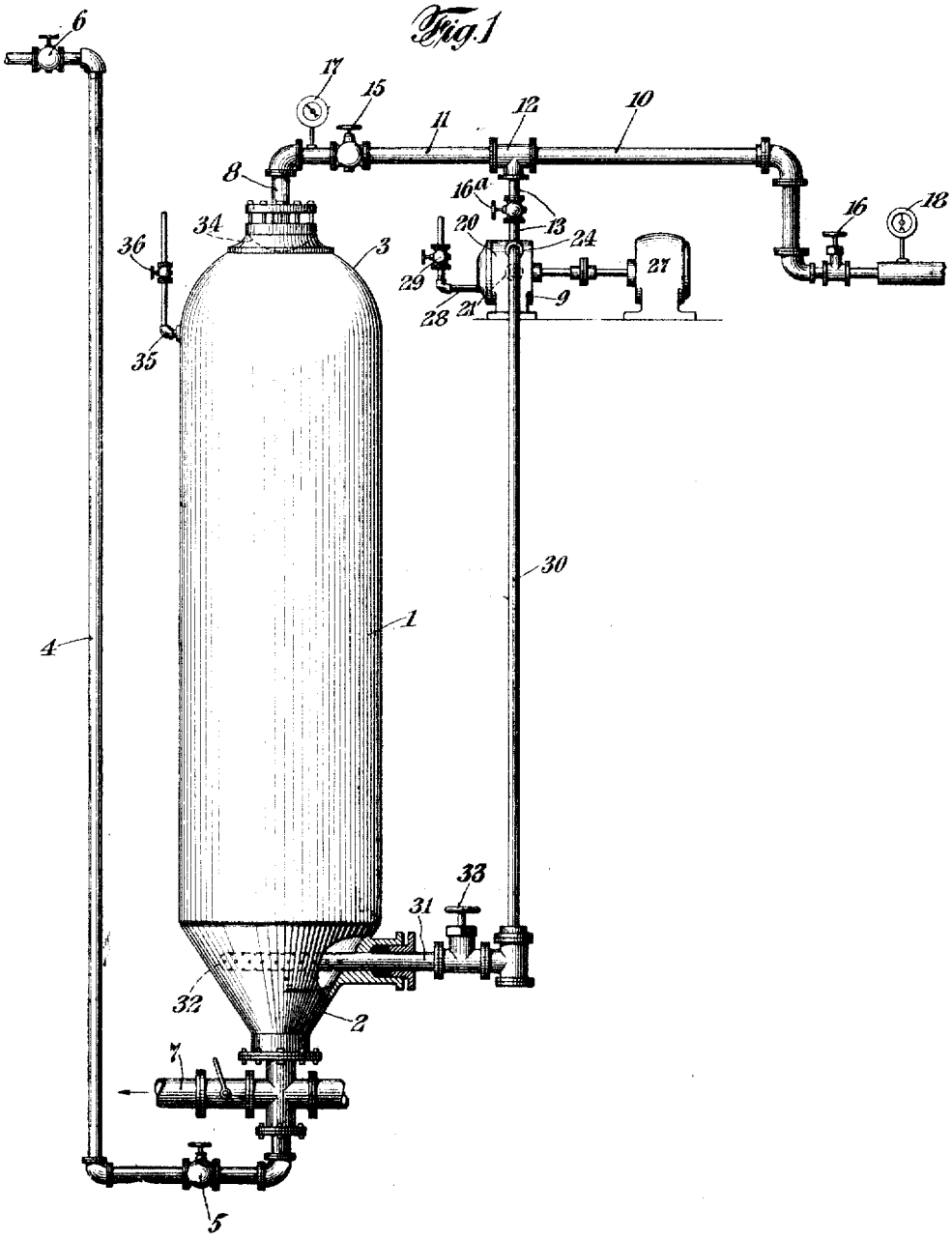
June 5, 1923. 1,457,326

J. D. TOMPKINS

PROCESS OF AND APPARATUS FOR COOKING FIBROUS MATERIALS

Filed April 12, 1919 2 Sheets-Sheet 1

Fig. 1



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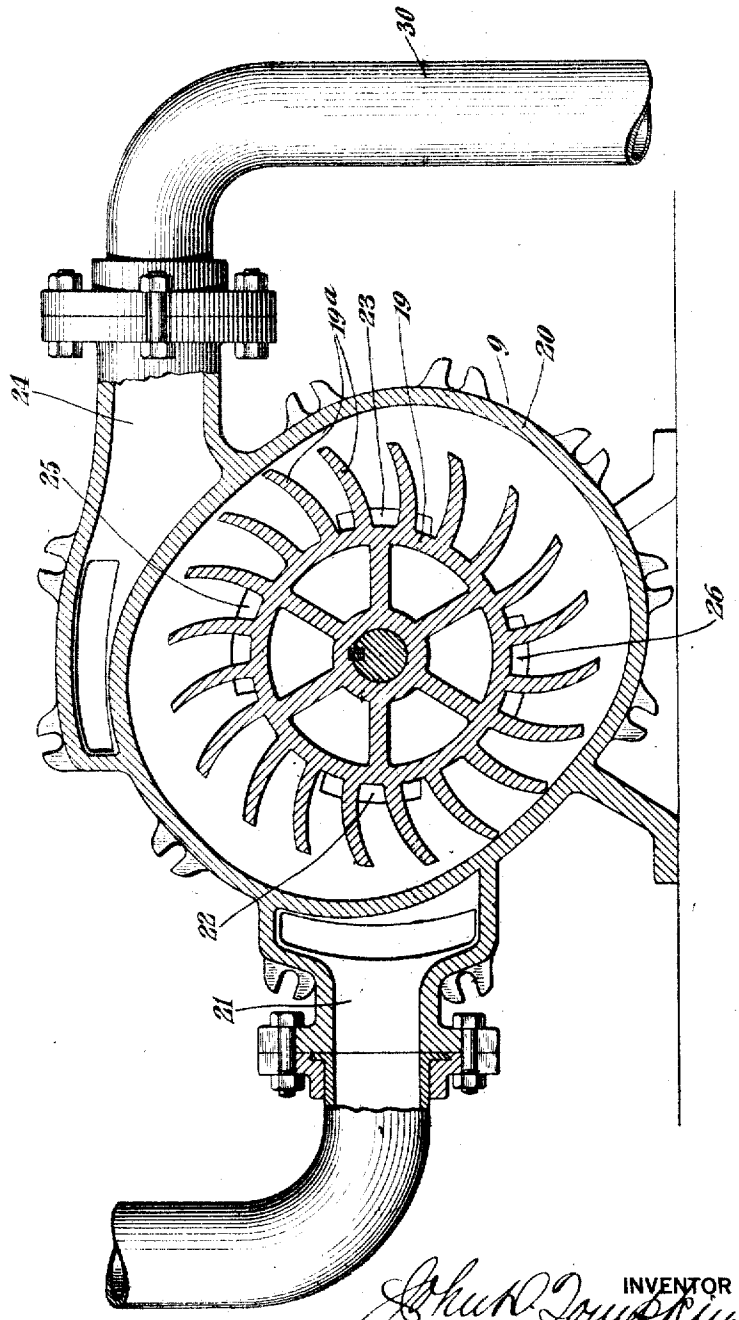


Fig. 2.

INVENTOR

BY

ATTORNEY

Patented June 5, 1923. 1,457,326

UNITED STATES PATENT OFFICE.

JOHN D. TOMPKINS, OF VALATIE, NEW YORK.

PROCESS OF AND APPARATUS FOR COOKING FIBROUS MATERIALS.

Application filed April 12, 1919. Serial No. 289,694.

To all whom it may concern:

Be it known that I, JOHN D. TOMPKINS, a citizen of the United States, residing at Valatie, in the county of Columbia and State of New York, have invented a certain new and useful Process of and Apparatus for Cooking Fibrous Materials, of which the following is a specification.

The object of my invention has been to provide an improved process of and apparatus for cooking fibrous material, which apparatus shall be simple and durable in construction, and when operated according to my said process shall be efficient and economical in operation.

In the accompanying drawings:

Figure 1 is an elevation of a digester embodying my invention; and

Figure 2 is a vertical sectional view on an enlarged scale of the pump appearing in Fig. 1.

I have illustrated my invention by that embodiment which is the best embodiment thereof known to me; but such embodiment is to be regarded as typical only of many possible embodiments, and my invention, both as to the form of the apparatus and the method of cooking, is not to be confined thereto. In illustrating my invention I shall apply it to the well known sulphite process of cooking wood fibre to make paper, but it is to be understood that my invention is applicable to many other apparatuses and processes for cooking fibrous material.

In the illustrated apparatus the digester 1, which may be of usual form, preferably consists of a cylindrical body having a conical lower end 2 and a dome-shaped top 3. A pipe 4 conducts live steam to the bottom of the digester and may be controlled by valves 5 and 6. A blow-off pipe 7 enables the pulp to be expelled from the digester when the cooking has been completed. I desire to provide a safe means for withdrawing the gases and steam from the top of the digester and forcing them into the bottom thereof so as to cause the gases repeatedly and without interruption to come in contact with the fibres being cooked and thus to afford the fullest opportunity to completely utilize the chemical reagents in the gases. I also desire to provide means for reheating the gases during such circulation so that a proper temperature may be continuously maintained within the digester. For these purposes I provide a pipe 8 leading out of the top of the digester which is connected with a pump 9 for effecting the said circulation of the gases. To effect the said reheating, and for other purposes, I connect a steam pipe 10 from a boiler preferably in such a way that steam will directly enter the gases from the digester and impart heat to said gases and be more or less condensed before reaching the pump. In the present instance I have shown the pipe 8 connected by a pipe 11 with a T 12 or other proper fitting and have connected the steam pipe 10 with the said T. The T is connected by a pipe 13 with the pump, which pipe may be long or short according to the length of time which it is desired to leave the gases and steam intermingling before they pass into the pump. I preferably provide a valve 15 in the pipe 11 and a valve 16 in the pipe 10 and a valve 16ª in pipe 13 for the purpose of controlling said pipes and also providing gages 17 and 18 for respectively indicating the pressure in the said pipes. I preferably use a pump having some form of water piston so that the water of condensation from the steam of the boiler may be used as part of the said piston thus affording an additional opportunity for the heat of the steam to be communicated to the gases from the digester, to serve as a medium to dissolve condensable vapors and reagents which are driven off from the wood fibre in the cooking, and yet which would either be harmful to the succeeding operation or, at least, would dilute the gases which are to be affected in the cooking. The form of pump which I have illustrated is one in which a circular rotor 19 is mounted in an elliptical casing 20, the casing being provided with a suction 21, communicating with ports 22 and 23, and with a delivery 24 communicating with ports 25 and 26. The suction 21 is connected with the pipe 13 and the delivery 24 is connected with a pipe 30 leading to the bottom of the

digester. Water being supplied to the casing, the rotor by means of arms or veins 19ª causes the water to travel around the inner periphery of the casing, and the latter being elliptical, the water recedes from the rotor as the arms are passing over the entrance ports 22 and 23, thus causing a suction or partial vacuum between the arms and permitting the gases from the digester to flow in between the said arms, after which the eccentricity of the casing causes the water to approach the rotor and to expel the gases between said arms through delivery ports 25 and 26. The rotor is shown as driven by a motor 27. The pump casing is provided with means to draw off the excess of water due to the concentration of steam. In the present instance I have shown a pipe 28 leading from the lower portion of the casing which pipe is provided with a valve 29. The pipe 30 is connected by a pipe 31 with a perforated pipe 32 in the bottom of the digester, a valve 33 being provided to control passage of steam to the perforated pipe.

In order to prevent the fibres from clogging the pipe 8 and from being drawn off therethrough and reaching the pump, the entrance of the said pipe is guarded as by a sieve 34. I also desire to circulate only the gases from the digester and do not wish to draw the liquor up through the said pipe in the usual way, as the liquor would carry with it the fibre and tend soon to choke the said screen. For this latter purpose I provide an overflow pipe 35, also guarded by a screen not shown, at the highest level to which it is safe to have the liquids rise and such pipe is controlled by a valve 36.

In the operation of the described apparatus according to my said process, the digester is first filled with chips and cooking liquor to a proper extent, steam is admitted through either or both of the pipes 4 and 30 to the bottom of the digester and allowed to escape through the top by the pipes 8 and 11 with valves 15, 16ª and 33 wide open and valve 16 partially open and, the pump having been started, this action is continued until the temperature has risen to a point suitable for cooking, when the valve 6 is closed. Valve 36 is kept closed until necessary to open to prevent liquor from rising to the top relief screen, and the valves 15, 16 and 33 are opened to the proper extent. The pump then draws in the gases from the digester and the steam from the boiler, the two intermingling in the pipe 13 so that the steam reheats the gases. The gases and water of condensation pass through the pump, the water of condensation being left in the casing except as it may be allowed to escape through the pipe 28. Thus the steam and water of condensation are kept intermingled with the gases from the digester until the latter have been forced beyond the pumps, and the fullest opportunity is afforded for the transfer of heat from the steam and water of condensation to the gases. The water of condensation washing the parts of the rotor and casing, tends to protect them from the corrosive action of the reagents in the gases. The gases are continuously forced down the pipe 30 and through the pipe 31 to the perforated pipe 32 whence they escape upward through the continuous digester, the rising stream of bubbles tending to keep the fibre in a state of suspension in the digester throughout the entire cooking process, and thus continuously insuring an even temperature and even exposure to the reagents in the gases and liquor and tending to bring about an even cooking of all the fibres. As only the gases and vapors from the digester rise through the screen 34, the tendency of the said screen to clog is reduced to a minimum. This is very desirable, since whenever the screen is clogged it is necessary to admit steam from the boiler backward from the pipe 11 to clear the screen and this interruption of the suspending action of the bubbles of gas immediately gives the fibres a chance to settle to the bottom of the digester, a condition rarely recovered from, and to cook unevenly. This avoidance of the rise of the liquor to the screen is due to the overflow afforded through the pipe 35.

The constant and uniform circulation of the gases combined with the reheating of them not only maintains uniform conditions and temperature throughout the cook but makes it possible to pass the gases through the digester again and again without interruption, giving the utmost opportunity to utilize their reagents to the fullest possible extent and to dissolve in the condense water and trap away soluble reagents which are liberated from the wood fibre in cooking it and which are not beneficial to have in the gases as they are returned for repeated use in cooking. This fuller utilization of the chemicals in the gas of the digester also permits liquors to be used which are of a lower degree of chemical activity (acidity in the case of the sulphite process and alkalinity in the sulphate or soda process) and so the danger of the stock settling, charring, or otherwise over-treating the fibres is not only avoided but uniformly perfect cooks and stronger fibres are insured.

While the steam is used directly in reheating the gases, the water of condensation does not dilute the liquor in the digester because it is separated from the gas in the pump and trapped out. Any liquor or spray which might be in the gases from the top of the digester is also separated from the gases by the centrifugal action of the pump and trapped away.

I claim:

1. The process of cooking fibrous material

consisting in withdrawing gases from the top of the digester and re-introducing them into the bottom thereof by means of a pump, introducing steam into the gases before they reach the pump and using the water of condensation as a compressing member for the gases in the pump.

2. The process of cooking fibrous material comprising pumping gases out of the top of the digester and into the bottom thereof, introducing steam into said gases before they reach the pump and permitting the water of condensation to pass with the gases into the pump.

3. The process of cooking fibrous material comprising pumping gases out of the top of the digester and into the bottom thereof, introducing steam into said gases before they reach the pump, permitting the water of condensation to pass with the gases into the pump, and withdrawing the water of condensation from the pump separately from said gases.

4. The process of cooking fibrous material comprising pumping gases out of the top of a digester and into the bottom thereof, introducing steam into said gases before they reach the pump and withdrawing the water of condensation from said gases after they have entered the pump.

5. The process of cooking fibrous material comprising pumping gases out of the top of a digester and into the bottom thereof, introducing steam into said gases and washing portions of said pump that are exposed to said gases with the water of condensation.

6. The process of cooking fibrous material comprising pumping gases out of the top of a digester and into the bottom thereof, and permittitng the liquors in the digester to escape at a level sufficiently below the top of the digester to prevent their entering the suction of the pump.

7. The process of cooking fibrous material consisting in removing gases from the top of the digester and re-introducing them into the bottom thereof and in the meantime drying said gases by centrifugal action.

8. In an apparatus for cooking fibrous material, the combination of a digester, a pump, piping so connecting the top of the digester with the suction of the pump that substantially all the water of condensation will pass into said pump, means for introducing steam into said piping, and connections between the delivery of the pump and the bottom of the digester.

9. In an apparatus for cooking fibrous material, the combination of a digester, a pump, piping connected with the top of the digester with the suction of the pump, means for introducing steam into said piping, connections between the delivery of the pump and the bottom of the digester, and an overflow for the liquor of the digester at a level below the exit at the top of said digester.

10. In an apparatus for cooking fibrous material, the combination of a digester, a pump, connections between the top of said digester and the suction of said pump, connections between the delivery of said pump and the bottom of said digester, and an overflow in said digester at a level below the exit from the top of the digester.

11. In an apparatus for cooking fibrous material, the combination of a digester, a pump having a water compression member, a connection between the top of said digester and the suction of said pump, and a connection between the delivery of said pump and the bottom of said digester.

12. In an apparatus for cooking fibrous material, the combination of a digester, a pump having a water compression member, a connection between the top of said digester and the suction of said pump, a connection between the delivery of said pump and the bottom of said digester, and means for introducing steam into the circuit thus formed.

13. In an apparatus for cooking fibrous material, the combination of a digester, a pump having a water compression member, a connection between the top of said digester and the suction of said pump, a connection between the delivery of said pump and the bottom of said digester, and means for introducing steam into the circuit thus formed at a point in advance of the pump.

14. In an apparatus for cooking fibrous material, the combination of a digester, a hydro-turbine pump, a connection between the suction of said pump and the top of the digester, and a connection between the delivery of said pump and the bottom of the digester.

15. In an apparatus for cooking fibrous material, the combination of a digester, a hydro-turbine pump, a connection between the suction of said pump and the top of the digester, a connection between the delivery of said pump and the bottom of the digester, and means for introducing steam into the circuit thus formed in advance of the pump.

16. In an apparatus for cooking fibrous material, the combination of a digester, a hydro-turbine pump, a connection between the suction of said pump and the top of the digester, a connection between the delivery of said pump and the bottom of the digester, means for introducing steam into the circuit thus formed in advance of the pump, and an overflow for the liquor of the digester at a point below the exit from the top of the digester.

17. In an apparatus for cooking fibrous

material, the combination of a digester, a hydro-turbine pump, a connection between the suction of said pump and the top of the digester, a connection between the delivery of said pump and the bottom of the digester, means for introducing steam into the circuit thus formed in advance of the pump, an overflow for the liquor of the digester at a point below the exit from the top of the digester, and means for withdrawing the water of condensation from the chamber of said pump.

In testimony that I claim the foregoing, I have hereunto set my hand this 25th day of March, 1919.

JOHN D. TOMPKINS.

Certificate of Correction.

It is hereby certified that in Letters Patent No. 1,457,326, granted June 5, 1923, upon the application of John D. Tompkins, of Valatie, New York, for an improvement in "Processes of and Apparatus for Cooking Fibrous Materials," errors appear in the printed specification requiring correction as follows: Page 2, line 75, strike out the word "continuous" and insert the same to follow the article "the", second occurrence, same line; page 3, line 119, claim 16, for the misspelled compound word "hpdro-turbine" read *hydro-turbine;* and that the said Letters Patent should be read with these corrections therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 17th day of July, A. D., 1923.

[SEAL.]

WM. A. KINNAN,
Acting Commissioner of Patents