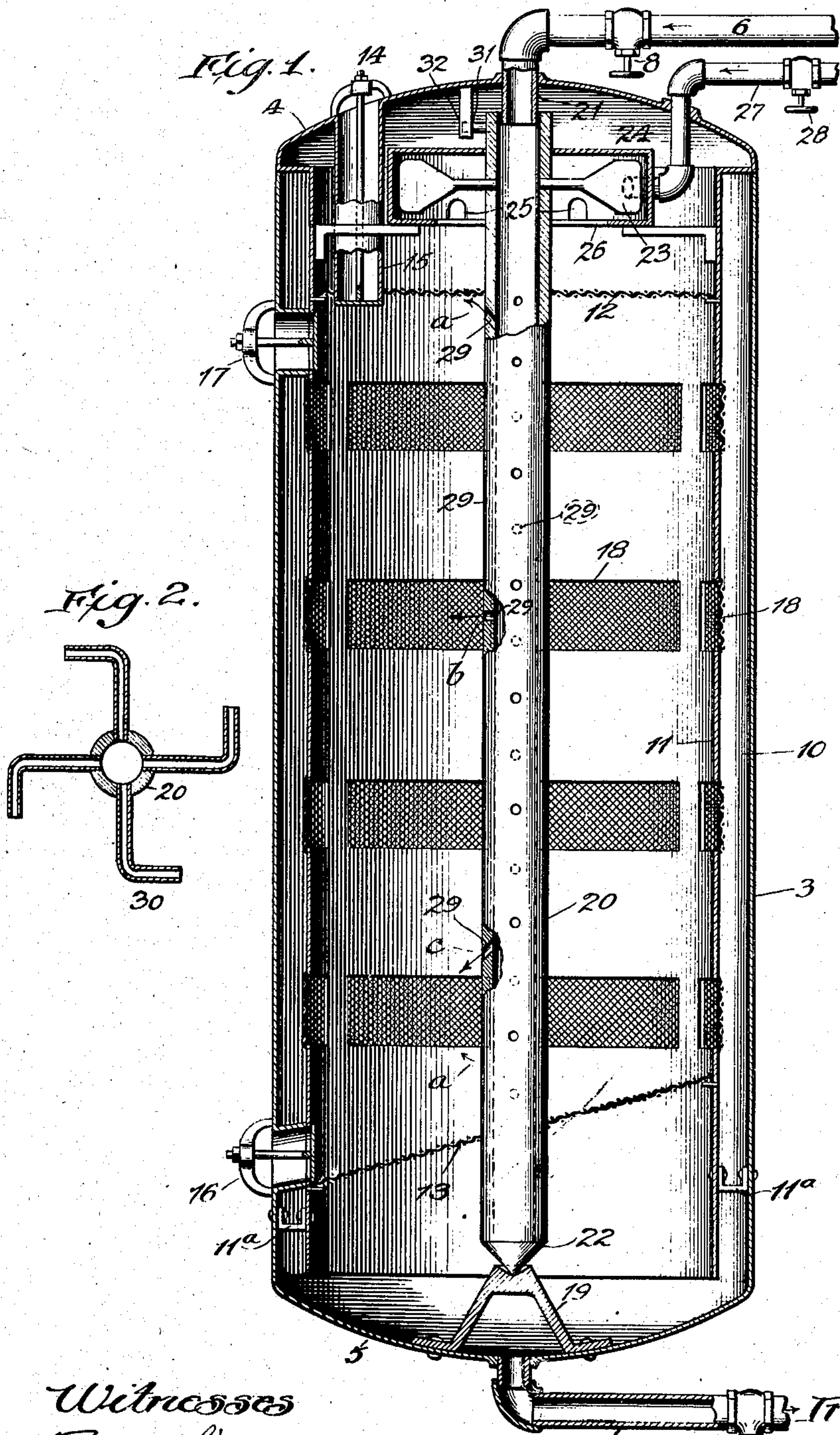


No. 881,888.

PATENTED MAR. 17, 1908.

W. H. ATWOOD.
DIGESTER.

APPLICATION FILED FEB. 4, 1907.



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UNITED STATES PATENT OFFICE.

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DIGESTER.

No. 881,888.

Specification of Letters Patent.

Patented March 17, 1908.

Application filed February 4, 1907. Serial No. 355,619.

To all whom it may concern:

Be it known that I, WILLIAM H. ATWOOD, a citizen of the United States, and resident of Lincoln, in the county of Lancaster and State of Nebraska, have invented certain new and useful Improvements in Digesters, of which the following is a full, clear, and exact specification.

This invention relates to improvements in digesters especially adapted for the reduction of fibers to pulp for the purposes of producing paper stock, and in which there is a continuous circulation of a heated alkaline solution or other liquor under pressure through a fibrous mass contained within the digester, but which is also adapted for the bleaching of fiber by subjection to a bleaching solution either hot or cold under pressure.

The prime object of my invention broadly stated is to deliver the digesting or bleaching liquor or may be steam to the fiber under treatment in a digester in such a manner that the mass thereof will thereby be maintained in a loose condition; that the individual fibers will be continuously exposed to a very rapid circulation of such liquor or steam; that the circulation of the liquor through the digester will be promoted; and that the necessity for mechanical stirrers and the revolving of the digester are entirely dispensed with.

More specifically stated, the object of my invention is to subject the fiber to the force of a digesting or bleaching liquor or steam directed outwardly and obliquely upwardly from the center of the mass through jet orifices, the position of which with reference to the mass may be constantly shifted.

A further object of my invention is to subject the mass of fiber to jets of liquor or steam directed from the center of the mass outwardly and upwardly with such force that the impact thereof will lift the mass continuously at frequent intervals and maintain it in a sufficiently loosened condition for subjecting the individual fibers thereof to a rapid current of liquor or steam which is correspondingly quickly discharged therefrom and correspondingly hasten the disintegration or bleaching of the fiber, as may be.

Another object of my invention is to provide a digester with a supply pipe passing substantially axially therethrough and connected with simple and effective propelling mechanism for revolving said pipe on its axis by means of the liquor or a portion thereof during its delivery to the digester or

by means of steam performing the further function of raising or maintaining, as may be, the temperature of the liquor within the digester.

A further object of my invention is to have the walls of the digester so constructed as to promote the discharge of the liquor from the fiber both lengthwise and laterally of the digester and therefore uniformly through the mass, the circulation of the liquor through the digester and its discharge therefrom.

With these ends in view my invention consists in certain features of novelty in the construction, combination and arrangement of parts, by which the said objects and certain other objects hereinafter appearing are attained, all as fully described with reference to the accompanying drawings, and more particularly pointed out in the claims.

In said drawings: Figure 1 illustrates a longitudinal vertical section through a digester embodying my invention in which the supply or delivery pipe and the turbine or other motor is shown partly in section. Fig. 2, a transverse section through the delivery or supply pipe, illustrating a modified means for discharging the liquor therefrom and for rotating said pipe.

Similar numerals of reference indicate the same parts in the figures of the drawing.

3 indicates the body of the outer shell of a digester and 4 and 5 the upper and lower head ends thereof, which digester is shown of cylindrical form but may be of any other form and which, as usual, is constructed of metal of sufficient strength to withstand considerable pressure.

Projecting through and slightly beyond the upper end of the digester is a supply pipe 6 through which the liquor is introduced to the digester and which during its continuous circulation therethrough, is discharged through a pipe 7 connected with the lower end thereof, which pipes 6 and 7 are respectively provided with ordinary stop-cocks 8 and 9 for regulating the supply and discharge of the liquor employed in the digester.

Within the body of the digester is an annular chamber 10 formed by a shell 11 of less diameter than said body and which extends from a point shortly below the upper end of the digester to the lower head thereof, which annular chamber is open at both ends.

The upper end of the inner shell is closed as near as may be by a wire or other screen

12 and towards its lower end by a similar but inclined screen 13, and is supported by angle irons 11^a riveted to both shells.

The digester is provided in its upper end with a man-hole 14 from which downwardly projects a tube 15 through the screen 12 for the purposes of introducing to the digester the fibrous materials to be treated, a man-hole 16 being also located at the side towards the bottom of the digester in such a position relative to the screen 13 that the materials may be continuously discharged therefrom through said man-hole, and if desired there may be towards the upper end in the side of the digester, a further man-hole 17 or as a substitute for the man-hole 14, all of which man-holes are provided with the usual closing means therefor for resisting the internal pressure of the digester.

The inner shell 11 is provided with a number of openings closed with screens 18 which extend at intervals entirely around the digester and at such distances one above the other as to enable the liquor to freely discharge into the annular chamber 10 after it has passed through the fiber and whence the liquor discharges into the bottom of the digester and out through the discharge pipe 7.

Supported by the bottom end 5 of the digester is a bracket bearing 19 supporting the lower end of the tube 20, which extends upwardly through the digester and preferably axially thereof to an inner projecting end 21 of the supply pipe 6 about which it is free to turn, although preferably fitting the same quite closely, the lower end of the tube 20 being closed and terminating in a cone 22 projecting into the bearing 19, but any other ordinary form of support may be employed for the tube so long as it is adapted to both support and permit the tube to freely revolve when actuated by means hereinafter described.

As a means for actuating the tube 20, I have shown secured thereto, towards its upper end and above the screen 12, vanes or wings 23 of any suitable character, as for example such as are commonly employed in turbine or other water wheels.

Wings 23 may be screwed into the tube 20 as shown or rigidly secured thereto by any other suitable means and are confined within a casing 24, provided near its bottom with a series of openings 25 and with an annular opening 26 in its bottom adjacent the tube 20 for the discharge of liquor or steam supplied through a pipe 27 to the vanes and whereby the liquor or steam employed for actuating the vanes, may pass directly both into the inner shell 11 and the annular chamber 10, the supply and therefore the pressure of said liquor or steam being regulated by an ordinary stop-cock 28 in the pipe 27. Tube 20 has a series of perforations 29 which terminate within the confines of the screens 12

and 13, the arrangement and direction of which, and particularly the latter, are important features of my invention. In other words said perforations 29 are located on a spiral line extending lengthwise of the tube 20 and at such intervals that the planes of the discharge of the liquor or steam therefrom are quite close the one to the other and which is made possible throughout the mass of fiber owing to the revolution of the tube, while at the same time the force required for discharging the contents of the tube with violent impact in and against the fiber is reduced to a minimum.

For the purposes of utilizing the discharge of the liquor through the perforations for maintaining the fibrous mass in a loose condition, a number of the perforations 29 and may be all of them, have an upward incline as indicated at *a*, but as indicated respectively at *b* and *c* some of these perforations may be horizontal and others inclined downwardly and in this connection it may be observed that where the walls of the tube are not of sufficient thickness to give the desired direction to the discharging jets, internal nipples may be employed.

As shown in Fig. 1 the perforated supply tube is rotated by the impact of liquor under pressure from the pipe 27 against the wing but it will be no substantial departure from my invention to connect the perforations in the tube with bent tubular arms 30 (see Fig. 2) as a means for rotating the tube through the change of direction of the current of the fluid or steam discharging therefrom, which arms may also have their outer ends turned upwardly for giving such direction to the jets as will lift and thereby loosen the fibrous mass and so also said means of propulsion may be used as an auxiliary to the propulsion structure in rotating the tube, but in practice under ordinary circumstances these bent arms are dispensed with for the reason that to some extent they gather the fiber where the mass is somewhat dense and thereby tend to retard the rotation of the tube and therefore the digesting of the fiber.

As a means for determining the velocity of rotation of the supply pipe during the operation of the digester, a projecting pin 31 is secured to the tube towards its upper end and in the path of this pin and secured to the inner side of the head of the digester, is a straight spring, which by its intermittent engagement with the pin during the revolution of the tube, serves to cause a clicking sound indicating the rapidity of the movement of the tube but any other suitable means adapted for that purpose may be employed without a substantial departure from the spirit of my invention.

In operation, the supply pipes 6 and 27 and the discharge pipe 7 are connected with a coil, in the usual manner, with some heating

apparatus and the supply pipes are connected with a force pump or motor and by means of which the liquor is conducted through the digester, not only under the pressure of heat but by the physical action of the pump, with the result that it is discharged from the revolving tube with considerable force and in a series of comparatively small jets, the supply of the liquor however being sufficient to maintain the digester continuously filled with the liquor or bleaching fluid, as may be. After the fiber has been introduced through and the supply man-hole closed, the valve of the supply pipe 6 and may be also of the supply pipe 27 are opened until the digester is full of hot liquor and continuously circulating through the digester and out through the discharge pipe 7 and thence through the heater, and when such circulation is once well established, then the valve in the pipe 27 is utilized as far as may be necessary, to regulate the force of its discharge against the wings of the motor and thereby maintain the rotation of the tube at the desired or necessary velocity.

As the liquor discharges through the jet orifices in the supply pipe, so much of it as is directed upwardly through the inclined perforations, operates through its force to lift the entire mass at frequent intervals sufficiently to maintain the fiber uniformly loosened throughout the entire mass, with the result that without an excessive force, the jets are directed with quite a violent impact through out the individual fibers and particularly those lying next the walls of the inner shells and in which respect the jets are substantially aided by reason of the screen openings 18 because of the outward current produced in the mass in the direction taken by the jets, which current moreover operates to subject the fibers to the action of a continuous fresh supply of liquor and promotes the rapidity of the circulation of the liquor throughout the digester, thereby substantially materially shortening the time for digesting the fiber or bleaching it, as may be.

The revolving of the supply tube enables the spiral arrangement of the jet orifices and a corresponding reduction in the number otherwise required and the simultaneous injection of the liquor at different points and in parallel planes in close proximity to each other, for it will be observed that if the same number of orifices encircle the tube in parallel rings, either the distance between their planes of discharge will be increased or else the same fiber would not be as frequently subjected to their discharge. My invention however is not limited to the spiral arrangement, for it broadly includes any means by which the liquor supplied to the digester is under pressure and discharged into the fiber at frequent intervals both in time and location in jets rotated about a common axis.

Having described my invention, what I claim as new and desire to secure by Letters Patent, is:

1. A digester receptacle, in combination with a revolving perforated supply member wholly confined within the receptacle, substantially as described. 70

2. A digester receptacle, in combination with a supply member and provided with discharging perforations, and wholly confined within the receptacle and means in the receptacle revolving said member, substantially as described. 75

3. A digester receptacle, in combination with a supply member provided with discharging perforations in spiral arrangement, and wholly confined within the receptacle and means and wholly located in the receptacle for revolving said member, substantially as described. 80

4. A digester receptacle, in combination with a supply member projected therein and provided with inclined discharging perforations, and means for revolving said member, substantially as described. 85

5. A digester receptacle, in combination with a supply member, projected therein and provided with upwardly inclined discharging perforations, and means for revolving said member, substantially as described. 90

6. A digester receptacle, in combination with a supply member projected axially therein and provided with a series of inclined perforations through which the liquor is discharged upwardly at an oblique angle to said member, and means for revolving the same, substantially as described. 95

7. A digester receptacle, in combination with a supply tube provided with a series of jet orifices extending upwardly at an oblique angle thereto, means for supporting said supply tube from the bottom of the digester, and means for revolving said supply tube on its own axis, substantially as described. 100

8. A digester receptacle, in combination with a revolving tube projecting axially and journaled therein, and having a series of upwardly inclined discharge orifices in spiral arrangement lengthwise of said tube, and means for revolving said tube, substantially as described. 105

9. A digester, comprising in combination a receptacle, means for continuously supplying and discharging liquor therefrom, means for delivering liquor to said receptacle in a series of jets projected along lines extending upwardly and outwardly from the axis thereof, and means for continuously bodily revolving said jets around said axis, substantially as described. 115

10. A digester, comprising in combination an outer shell or body, an inner shell forming an open end annular chamber adjacent said body portion, a series of screen openings at intervals of the length of the inner shell, a 120 125 130

supply tube projected through said inner shell and provided with a series of inclined discharge orifices, and means for revolving said supply tube, substantially as described.

- 5 11. In a digester, comprising in combination, an inner and outer shell or body, an inner shell providing an open end annular chamber adjacent the outer shell, a series of screen openings between the inner shell and
10 said chamber, a supply tube provided with a series of spirally arranged discharge orifices inclined upwardly and outwardly with refer-

ence to the axis of said tube and towards said screen openings, and means revolving said supply tube through the force of the liquor 15 supplied to the digester, substantially as described.

In witness whereof, I have hereunto set my hand and affixed my seal, this 1st day of February, A. D. 1907.

WILLIAM H. ATWOOD. [L. s.]

Witnesses:

JNO. G. ELLIOTT,
M. S. REEDER.