(No Model.) 2 Sheets—Sheet 1.

W. T. FORBES.

DIGESTER.

No. 439,033. Patented Oct. 21, 1890.

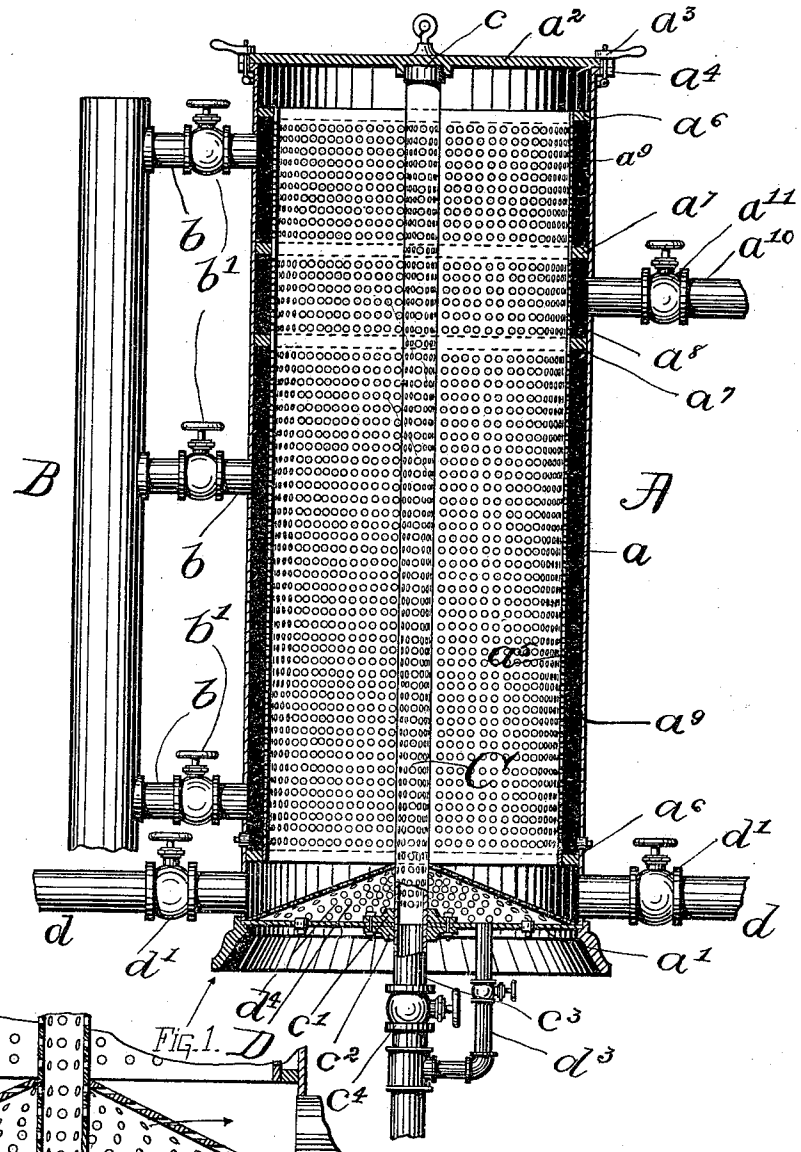


FIG. 1.

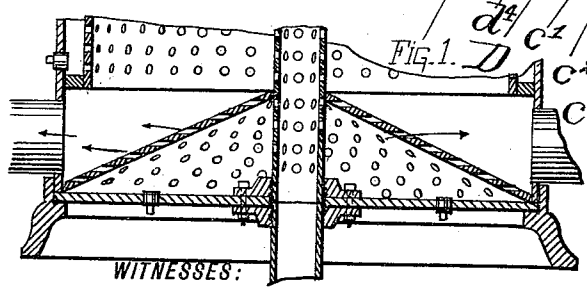


FIG. 3.

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(No Model.) 2 Sheets—Sheet 2.

W. T. FORBES.

DIGESTER.

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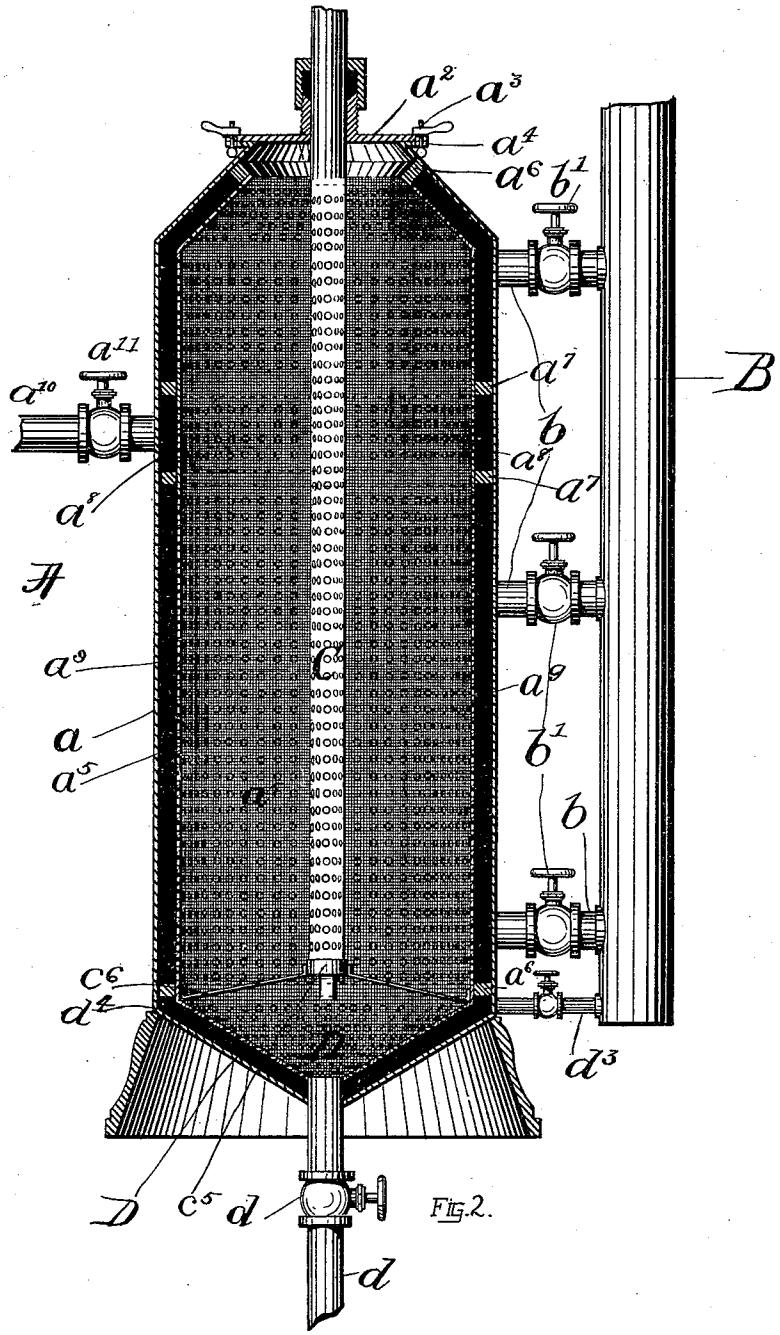


Fig. 2.

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UNITED STATES PATENT OFFICE.

WALTER T. FORBES, OF ATLANTA, GEORGIA.

DIGESTER.

SPECIFICATION forming part of Letters Patent No. 439,033, dated October 21, 1890.

Application filed April 2, 1890. Serial No. 346,316. (No model.)

To all whom it may concern:

Be it known that I, WALTER T. FORBES, a citizen of the United States, and a resident of Atlanta, in the county of Fulton, State of Georgia, have invented certain new and useful Improvements in Digesters; and I do declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to letters of reference marked thereon, which form a part of this specification.

This invention relates to devices in which solid substances may be treated with liquids for the removal by solution or washing of certain of their elements, inherent or foreign, or their disintegration, which said devices are commonly known as "digesters," the present device being mainly intended for the digesting of paper-pulp and for disintegrating fibrous plants for the production or laying bare of their fibrous structure, the means for which and the details of construction whereby these ends are attained being hereinafter fully set forth, and the parts held to be new pointed out in the claims.

In the accompanying drawings, Figure 1 is a vertical longitudinal section of the digester, showing one form of such device. Fig. 2 is a vertical longitudinal section of another form of digester equivalent in its details to the one shown in Fig. 1, and Fig. 3 is a detail vertical section of the false bottom, showing the arrangement of the perforations.

In the figures like reference-marks indicate corresponding parts in all the views.

The digester A has an outer shell a, having bottom plate a' and cover a^2, which cover is removable by being bolted by swivel-bolts a^3, having tail-nuts to the flange a^4, around the top edge of the casing a, over the aperture through which the material to be treated is charged into the inner chamber. Said digester A also has a perforated false shell a^5, secured in place by the rings a^6, placed between the outer shell and the shell a^5 in such a manner as to form partitions separating the annular chamber a^9, so formed from the interior chamber, while the rings a^7, placed in substantially the position shown, further support the said shell a^5 and form a division a^8 of the annular chamber a^9. The annular chambers a^9 are connected by pipes b with a supply-pipe B, which forms a conduit from a pump of suitable character to force into the inner chamber through the perforations in the shell a^5 the liquid solvent, said pipes b being cut by valves b' for the purpose of regulating the inflow of liquor, and hence the force of the circulation and the pressure on the material. The chamber a^8, also annular in form, has connection by discharge-pipe a^{10} with a suitable reservoir for heating or storing the liquor, so that it may be used again or directly with the hereinbefore-mentioned force-pump and is cut by a valve a^{11}.

To prevent the material being treated from packing in the center of the digester and to more thoroughly agitate it and mix it with the liquor, a perforated pipe C, connecting with a supply-pipe C^3, is provided, which, in the construction shown in Fig. 1, enters at the bottom through the plate a', and its upper end, which is stopped against outflow of liquor, is inserted in a depression c in the cover a^2. In order to be easily removable the said column is screwed into a plate c', bolted to the plate a', and the plate c^2, which is also bolted to said plate a', has screwed into it the pipe c^3, which interiorly connects through an opening in the said plate a with the column c and supplies liquor thereto, the flow being governed by the valve c^4, cutting said pipe c^3.

In Fig. 2 the column C is shown entering through a packed gland in the cover a^2, while lateral and downward motion is effectually prevented by the step c^5, supported by arms c^6, extending to the walls of the interior chamber. At suitable points, screwed into the circumference of the casing near its lower end, are outlet-pipes d, cut by suitable valves d', which pipes are for the purpose of drawing off the pulp after having been thoroughly treated or the process finished. In order that the discharge through these pipes d of the material may be free, however hard it may be packed by its gravity, a false bottom D is placed within the inner chamber at the bottom of the shell a, which part D is secured to said casing and forms the upper wall of the chamber d^4, the bottom plate a' being the other wall. Said plate D is perforated, as shown, the general direction of the perforations being at

right angles to the sides of the digester, or nearly so, and in the direction of the flow of material to the sides at the bottom in the construction shown in Fig. 1, or to the center in that shown in Fig. 2. The material will, by its own gravity, settle to the bottom, where it will be broken up and assisted to flow down and out by the liquor which is forced into the chamber d^4, formed by the plate D, through the pipe d^3 or equivalent conduit. In order to prevent the internal pressure from forcing material from the inner chamber into the said chamber under plate D through the perforations during the digesting or disintegrating operation, the central column C is perforated between said plates D and a', which insures a continual pressure on the chamber d^4 equal to that on the inner chamber.

Fig. 2 illustrates, together with the modified details already described, the digester having its upper end conoidal in form for reducing the area subjected to force from internal pressure, a pipe d entering the chamber d^4 from the manifold B, a false bottom D of an inverted conoidal form carrying the pulp to a central discharge-pipe d.

If desired or necessary for any purpose whatever, the perforations of any part of the device may be restricted by the application of a wire-guaze fabric on the necessary side of the perforated plate. An example of this is shown in Fig. 2, and said construction operates to prevent the pulp, however fine, from escaping from the inner or digesting chamber.

The operation of this device is as follows: The cover a^2, the nuts a^3 being released, is raised from its normal position, thus opening the top of the digester. The material to be digested is then charged into the inner chamber in the desired quantity and in the desired condition, after which the cover a^2 is returned to its position, the upper end of the pipe C entering the depression c, after which the swivel-bolts are turned up and the nuts tightened, holding the cover securely in place. The valves c^4 and b', governing, respectively, inlet communication with the pipe C and the annular chamber a^9, and the valve a^{11}, governing outlet communication between the chambers a^8 and the spent-liquor receiver, are opened. The pump handling the liquor is then started, forcing said liquor through the supply-pipe B and the pipes b into the chambers a^9, thence through the perforated shell a^5 into the material to be digested. From thence it will go through the chamber a^8 and the pipe a^{10} back to the pump or to a suitable receiver or heating-coil. The circulation of the liquor will be thus continued at the desired temperature, internal pressure, and speed until the material shall be sufficiently digested, or, in the case of fibrous vegetable growths, disintegrated, after which the valves d' in the outlet-pipes d would be opened, the circulation continued or not, as desired, the valves c^3 opened, causing a circulation of liquor through the openings in the plate D in a direction substantially the same as the outflowing material, which outflow will continue till the digester will be emptied of its solid contents, when all the valves will be closed and the operation, as above described, repeated.

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

1. In a digester, the combination of an outer and an inner shell, the latter being perforated, the partitions a^6 and a^7 between the shells forming the annular chambers a^8 and a^9, a supply-pipe connecting with the chambers a^9, and a discharge-pipe connecting with chamber a^8, substantially as and for the purpose specified.

2. In a digester, the combination of the perforated shell forming the digesting-chamber, the outer shell surrounding said perforated shell, a false conoidal-shaped bottom D, forming a chamber a^4 in the lower part of the digesting-chamber, said false bottom being perforated at right angles to the sides of the digester, the supply-pipe entering said chamber a^4, and the outlet-pipe d, connecting with the lower part of the main chamber, substantially as and for the purpose specified.

3. In a digester, the combination of the outer shell, the perforated inner shell, the false perforated conoidal-shaped bottom forming a chamber in the lower part of the inner shell, the partitions a^6 and a^7, forming annular chambers a^8 and a^9 between the shells, the supply-pipe connecting with the upper and lowest of said chambers, the perforated pipe connecting with the supply-pipe and passing upward through the digester, the discharge-pipe connecting with the intermediate chamber, and the outlet-pipe connecting with the lower part of the digesting-chamber, substantially as and for the purpose specified.

In testimony whereof I hereunto affix my signature in presence of two witnesses.

WALTER T. FORBES.

Witnesses:
A. P. WOOD,
S. M. WOOD.