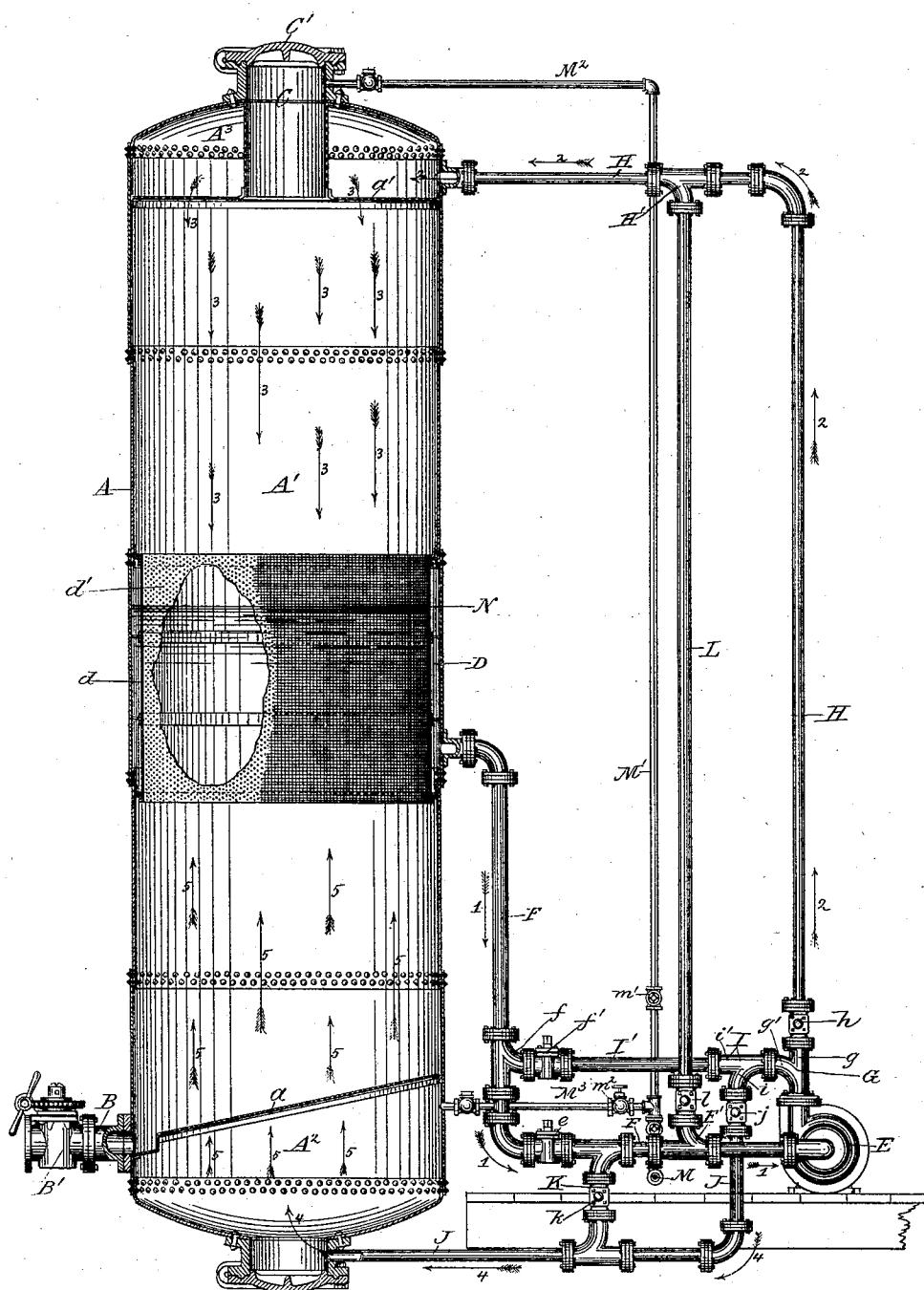


(No Model.)

A. SELKIRK.
DIGESTING APPARATUS.

No. 487,783.

Patented Dec. 13, 1892.



Witnesses:

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UNITED STATES PATENT OFFICE.

ALEXANDER SELKIRK, OF ALBANY, ASSIGNOR, BY MESNE ASSIGNMENTS, TO
ROBERT WHITEHILL AND DANIEL WARING, OF NEWBURG, NEW YORK.

DIGESTING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 487,783, dated December 13, 1892.

Application filed May 31, 1889. Serial No. 312,749. (No model.) Patented in Germany August 15, 1888, No. 46,940; in England August 16, 1888, No. 11,848; in France August 16, 1888, No. 192,466; in Belgium August 16, 1888, No. 82,939; in Norway August 20, 1888, No. 1,043; in Sweden August 21, 1888, No. 1,900, and in Austria-Hungary February 20, 1889, No. 33,742 and No. 54,310.

To all whom it may concern:

Be it known that I, ALEXANDER SELKIRK, a citizen of the United States, residing at Albany, in the county of Albany and State of New York, have invented certain new and useful Improvements in Digesting Apparatus, which apparatus may be used in the performance of a process for disintegrating vegetable substances, (for which I have obtained patents in the following countries, viz: Great Britain, No. 11,848, dated August 16, 1888; Austria-Hungary, No. 33,742 and No. 54,310, dated February 20, 1889; Germany, No. 46,940, dated August 15, 1888; France, No. 192,466, dated August 16, 1888; Belgium, No. 82,939, dated August 16, 1888; Norway, No. 1,043, dated August 20, 1888, and Sweden, No. 1,900, dated August 21, 1888,) of which the following is a specification.

My invention relates to a digesting apparatus for treating vegetable substances with cooking liquors for dissolving the soluble portions of the same; and it consists of the devices and elements and combinations of devices and elements hereinafter particularly described, and specifically set forth in the claims.

In the accompanying drawing, forming a part of this specification, the figure illustrates a sectional elevation of the digesting apparatus embodying the essential elements and devices in this invention.

In the drawing, A represents a digesting-vessel, which is preferably made of steel, though it can be made of iron or other suitable material, and has its parts riveted together and made both steam and liquor tight, so as to sustain an internal pressure of from sixty to one hundred and fifty pounds per square inch. This digesting-vessel contains within it the digesting-chamber A', which occupies nearly the entire length of this vessel and has for its bottom the perforated diaphragm *a*, which is shown in the drawing to be inclined. This perforated diaphragm or bottom of the digesting-chamber A' separates the latter from the liquor-chamber A², which

occupies the lower end portion of the digesting-vessel.

B is a blow-off pipe or opening at the bottom of the digesting-chamber and is provided with a blow-off cock or valve B', through which the cooked product of the vessel will be discharged.

C is an opening or passage-way leading from the outside of the digesting-vessel to the digesting-chamber within, and through this opening the material to be cooked can be introduced. This opening is closed by a suitable cover C', secured by bolts or other devices in a steam-tight manner. In the upper end of this digesting-vessel is arranged a perforated plate or diaphragm *a'*, which limits the extension of the digesting-chamber and produces above the same the liquor-chamber A³, which chamber is shown to be concentric to the opening or passage-way C. The drawing shows the wall inclosing the passage-way C and separating it from the liquor-chamber A³ to be perforated; yet in some cases the perforations in this circular wall can be omitted. A perforated plate can be employed to close the lower end of the passage-way C, if preferred. At about midway between the two ends of the digesting-vessel is the annular chamber D, which chamber is formed between the shell of the vessel and the perforated wall *d*. This chamber thus formed is concentric to the digesting-chamber at the middle portion of its length and is made with a horizontal extension (between the shell of the digesting-vessel and the internal perforated wall *d*) of about one and one-half to three inches and is made with a vertical extension from its lower to upper ends, or from forty to fifty inches, more or less. This liquor-chamber D is formed as above described and has communication with the digesting-chamber A' through the numerous perforations *d'* in the wall *d*. In some cases this internal wall *d* has a covering next to the digesting-chamber, made of fine wire-cloth suitably secured to the metal of the perforated wall.

E is a pump situated at any suitable place

and preferably conveniently near the digesting-vessel and has a capacity suitable for discharging about three hundred gallons (more or less) of liquor per minute and is operated
5 by any suitable power. (Not shown.)

This pump communicates with the digesting-vessel by means of a suitable system of pipes and valves connected, respectively, with
10 the inlet and outlet of the pump and with the digesting-vessel at three points, so that the draft of the pump will draw the cooking solution or liquor from one of the liquor-chambers and discharge the same into someone
15 or two of the liquor-chambers at the will of the operator. Although the system of pipes employed for effecting these results can be varied, yet I prefer to use, substantially, the arrangement and combinations of the several pipes, their connections, and cocks or
20 valves shown in the drawing to be employed between the pump and the digesting-vessel, whereby I am enabled to control and variously change at will the circulation of liquor from one direction to another and from a
25 single direction or circulation to a dual circulation in opposite directions through the digesting-chamber. In this preferred system or arrangement of pipes between the pump E and the digesting-vessel A is the main draft-
30 pipe F, leading from the annular liquor-chamber D to the inlet of the pump, as in direction of arrow 1. In the course of this pipe F there is a valve or cock *e*, which can be opened and closed at will to a greater or less
35 extent. Through this pipe the cooking solution or liquor will be drawn from the liquor-chamber D to the pump when valve *e* is opened.

G is a branch outlet-pipe connected with the
40 outlet of pump E and with pipe H and branch pipe I. Pipe H leads from branch *g* of the branch pipe G to the liquor-chamber A³ and is provided with valve or cock *h*. Branch
45 pipe I is connected with the branch *g'* of the branch pipe G, and one of the branches of this branch pipe I, as branch pipe *i*, connects with pipe J, which communicates with the lower liquor-chamber A². In the course of
50 this pipe J is a valve or cock *j*, which controls the volume of liquor passing through said pipe. The branch *i'* of branch pipe I connects with pipe I', which communicates with
55 pipe F by branch *f*, and a cock *f'* is provided in the course of the pipe I' for controlling the circulation of liquor through the same. The horizontal limb of pipe F is connected with the horizontal limb of pipe J by means of suitable branches or pipes K, and in the
60 course of this pipe K there is placed a valve *k*. Between pipes H and F and preferably between their horizontal limbs is pipe L, which is connected with said pipes H and F by suitable branches, as H' and F'. In the
65 course of this pipe L is placed the cock or valve *l*. With this above-described system of pipes and valves between the pump and the digesting-vessel there can be produced at

will a variety of circulations of the cooking solution or liquor into and through the digesting-chamber. When valve *e* of pipe F and
70 valve *h* of pipe H and valve *j* of pipe J are opened and valve *f'* of pipe I' and valve *k* of pipe K and valve *l* of pipe L are closed and the pump is operated, the liquor or solution will be drawn from the annular chamber
75 D in direction of arrow 1 into the pump and be discharged into the branch outlet-pipe G and thence in two directions into the digesting-vessel, in which one portion of the solution or liquor will be discharged in direction
80 of arrow 2 through pipe H into the upper liquor-chamber A³, from whence the liquor or solution will have passage downwardly in direction of arrow 3 and through the upper-
85 half portion of the digesting-chamber, while another portion of the liquor, drawn through pipe F from liquor-circulating chamber D, will be made to pass from branch outlet-pipe G
90 in direction of arrow 4 and through pipe J into the lower liquor-chamber A² and from thence through the perforated bottom or diaphragm *a* into the lower half portion of the digesting-chamber to circulate upwardly through the material therein in direction of arrows 5. The
95 operation of the pump being continued, the liquor or solution will be continuously drawn from the annular liquor-chamber D into the pump through pipe F and be continuously discharged by the pump through the pipes H and
100 J into the respective liquor-chambers A² and A³ and from thence into the charge being treated to circulate in directions, respectively, as indicated by arrows 3 and 5, and toward the middle of the length of the digesting-chamber, where the solution or liquor of the two
105 currents will mingle and be drawn together by the force of the pump through the perforated wall *d* into the annular liquor-chamber D to be repeatedly returned into the digesting-chamber in two streams to be circulated
110 as above described. By partially closing the valve *h* in pipe H and leaving valve *j* or pipe J fully opened a large portion of the solution or liquor drawn from the annular chamber D through pipe F will be discharged into the
115 lower end of the digesting-chamber to circulate upwardly in direction of arrow 5 to be returned to the annular liquor-chamber D, while a smaller volume of liquor will be made to pass through pipes H and be discharged
120 into the upper portion of the digesting-chamber to circulate downwardly and in direction of arrow 3; but when valve *h* is fully opened and valve *j* of pipe J is partly closed a greater volume of the solution or liquor will
125 be discharged through pipe H into the upper liquor-chamber A³ than will be through pipe J into the lower liquor-chamber A², and thereby cause a greater volume of the liquor or solution to circulate downwardly through the
130 upper half portion of the charge within the digesting-chamber than will be circulated upwardly through the lower half portion of the same. When valve *h* is fully closed, all the

liquor drawn through pipe F will be discharged into the lower liquor-chamber A² and be wholly made to circulate through the lower half portion of the charge being treated, and when valve *j* is wholly closed and valve *h* is opened all the liquor drawn through pipe F will be discharged through pipe H into the upper liquor-chamber A³ and from thence pass downwardly in small streams through the upper half portion of the charge within the digesting-chamber. When valve *k* of pipe K is opened and cock or valve *h* of pipe H is also opened and cock or valves *e, f, j, and l* are closed, the pump will draw the liquor from the lower end of the digesting-vessel through parts of pipes J and F and discharge the same through pipe H into the upper liquor-chamber A³, so that the circulation of the liquor will be downwardly through the entire length of the charge within the digesting-vessel and into the lower liquor-chamber A² to be again drawn by the pump through pipe J and returned into the upper end of the digesting-vessel in a continuous manner as long as the pump is operated and the valves are turned as above described. When the digesting-vessel is filled with water or liquor up to the mouth of pipe H and cock or valve *l* of pipe L and cock or valve *j* of pipe J are opened and the other valves or cocks are closed, the pump when operated will draw the liquor from the upper liquor-chamber A through the horizontal limb of pipe H and the pipe L and the horizontal limb of pipe F and discharge the same through branch *g* of branch pipe G and pipe J into the lower liquor-chamber A², from whence the liquor will be circulated upwardly through the entire length of the digesting-chamber, to be returned to the upper liquor-chamber A³, and, with the respective cocks or valves, opened and closed as above described, and, the pump operating continuously, the water or liquor, by the force of pump E, will be continuously circulated upwardly through the mass of material within the digesting-chamber.

I have shown only one pump employed for drawing the liquor from the annular chamber D and discharging the same into the opposite ends of the digesting-vessel; yet, if desired, two pumps can be employed as the equivalent of the single pump shown for drawing the liquor from the said annular chamber and discharging the same into the opposite ends of the digesting-vessel, and in such a case each of the pumps will be connected by a suitable separate draft-pipe with the said annular chamber and by separate discharge-pipes with the opposite ends of the digesting-vessel, so that when one of the pumps is drawing the liquor from the annular chamber D and discharging the same into the upper end of the digesting-vessel the other pump will be drawing liquor from the same chamber and discharging it into the lower end of said vessel.

M is a live-steam-supply pipe leading from any suitable steam-generator (not shown) and connecting with steam-pipes M', from which

are extended branches M² and M³, communicating, respectively, with the upper and lower ends of the digesting-vessel, and preferably with the liquor chambers A² and A³. In the course of steam-pipe M' is placed a valve *m'*. In the course of pipe M³ is valve *m*². These valves are under the control of the operator, who will regulate the volume of steam admitted to the digesting-vessel as may be required during the progress of the treatment of the material to be reduced. A check-valve is preferably placed in the course of each of the pipes M² and M³.

By the employment with the digesting-vessel of the annular liquor-chamber D, with its internal perforated wall *d*, and the pump E, with pipes F, H, and J, as above described, I am enabled to produce a continuous dual circulation of the cooking solution or liquor through the material being treated within the digesting-chamber. In this dual circulation the liquor will be drawn continuously from the digesting-chamber into the annular liquor-chamber D and from thence be continuously drawn and discharged by the pump through pipes F, H, and J into the respective chambers A² and A³ at the opposite ends of the vessel and from thence circulate in directions toward each other, as in directions of arrows 3 and 5, with a portion passing upwardly through the interstices between the particles of material in the lower half portion of the digesting-chamber and downwardly through the interstices between the particles composing the upper half portion of the same. The upward circulation of the liquor in direction of arrow 5 through the lower half of the mass of material of the charge, together with the buoyant force of the liquor, operates to counteract the tendency of the charge to settle down and prevents the packing of the material on the perforated bottom of the digesting-chamber. At the same time the draft of the pump through pipe F on the liquor in the annular liquor-chamber D operates to prevent the middle portion of the mass of material in the digesting-chamber from packing together, so that the more internal portions of the charge will be kept loosened, and thereby afford to the liquor a free circulation through the same without any substantial packing of the material horizontally and hard against the internal perforated wall *d* of said annular liquor-chamber. With this annular liquor-chamber D midway between the ends of the digesting-vessel and with a draft-pipe F drawing from this annular liquor-chamber I am enabled to employ with a full charge of material a comparatively small volume of water or liquor, and by circulating this small volume of liquor with the dual circulation, as above described, I am enabled to supply the material being treated with a suitable amount of the cooking-liquor for completely dissolving the soluble portions of the material in all parts of the digesting-vessel.

By the employment of the perforated dia-

phragm or devices in the upper end portion of the digesting-vessel for the passage of the liquor in numerous small streams through the same, with liquor extending up to a short distance above the mouth of draft-pipe F (as to liquor-line N) and with the pipes F, II, and J between the pump E and the respective liquor-chambers A², A³, and D, the lower half portion composing the charge will be completely submerged in the cooking liquor, while the upper half portion of the charge will be kept constantly saturated (without submergence) by the volume of liquor being discharged into chamber A³ and sprayed down on the upper surface of the material to percolate downwardly through the interstices between the particles composing the upper half of the charge and circulate in contact with the same, so that every particle in the upper half portion of the charge will have such a liberal supply of liquor as may be necessary to contribute to the rapid and uniform cooking or dissolving of the soluble portions of the material. By means of the live-steam pipes M M' M² M³, connecting the digestive vessel with a steam-generator, (not shown,) live steam can be introduced at will into the digesting-vessel in greater or less volume, as may be required from time to time in the progress of the cooking of the charge, to sufficiently heat the water or liquor which is being constantly circulated with this dual circulation through the mass of material within the digesting-vessel.

I have described herein merely the use of steam-pipes for supplying live steam directly to the digester and heating the cooking liquor; but other means may be employed for the purpose in connection with the herein described and claimed system of liquor-circulating devices, and although some means for the purpose is necessary to the conduct of the operation no claim is made herein to combinations of the devices for circulating the liquor with means for heating the same, as such combinations form the subjects of separate applications, Serial No. 301,877, filed March 5, 1889, and Serial No. 312,750, filed May 31, 1889, the claims in this case being limited to the means for effecting the specified dual circulation of the liquor irrespective of the means which may be employed for heating it. The process of digesting the material which is carried out in the apparatus herein described and claimed, also forms the subject of a separate application, Serial No. 282,012, filed August 4, 1889, and is not claimed herein.

Having described my invention, what I

claim, and desire to secure by Letters Patent, is—

1. In a digesting apparatus, the combination, with a digesting-vessel and a pump, of an annular perforated wall supported within the said vessel between the end portions thereof and forming with the wall of said digesting-vessel an annular liquor-chamber, a draft-pipe leading from said annular liquor-chamber to the inlet of the pump, and discharge-pipes leading from the outlet of the pump into the digesting-vessel through the respective end portions thereof, substantially as and for the purposes set forth.

2. In a digesting apparatus, the combination, with a digesting-vessel having a liquor-chamber in its lower end portion separated from digesting-chamber by a perforated diaphragm and an annular liquor-chamber between the end portions of said digesting-chamber and separated therefrom by a perforated annular wall suitably supported from the solid wall of the digesting-vessel, of a pump, a draft-pipe leading from said annular liquor-chamber to the pump, and two discharge-pipes leading, respectively, from the pump into the opposite end portions of the digesting-vessel, one of them into the liquor-chamber below the digesting-chamber, substantially as and for the purposes set forth.

3. In a digesting apparatus, the combination, with the digesting-vessel containing upper and lower liquor-chambers separated from each other by the digesting-chamber and the interposed perforated diaphragms *a a'* and an annular liquor-chamber communicating with the digesting-chamber through the perforated annular wall *d* at about midway between the ends of the said chamber, of a pump, draft-pipe F, and discharge pipes H and J, provided with suitable valves, substantially as and for the purposes set forth.

4. In a digesting apparatus, the combination, with the digesting-vessel having its digesting-chamber separated from a liquor-chamber below by the perforated diaphragm *a* and an annular liquor-chamber about midway between the ends of said digesting-vessel and communicating with said digesting-chamber through the perforated annular wall *d*, of a pump, pipes F, J, K, I, I', and H, and valves *e, f, h, j, and k*, substantially as and for the purposes set forth.

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Witnesses:

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