

No. 665,116.

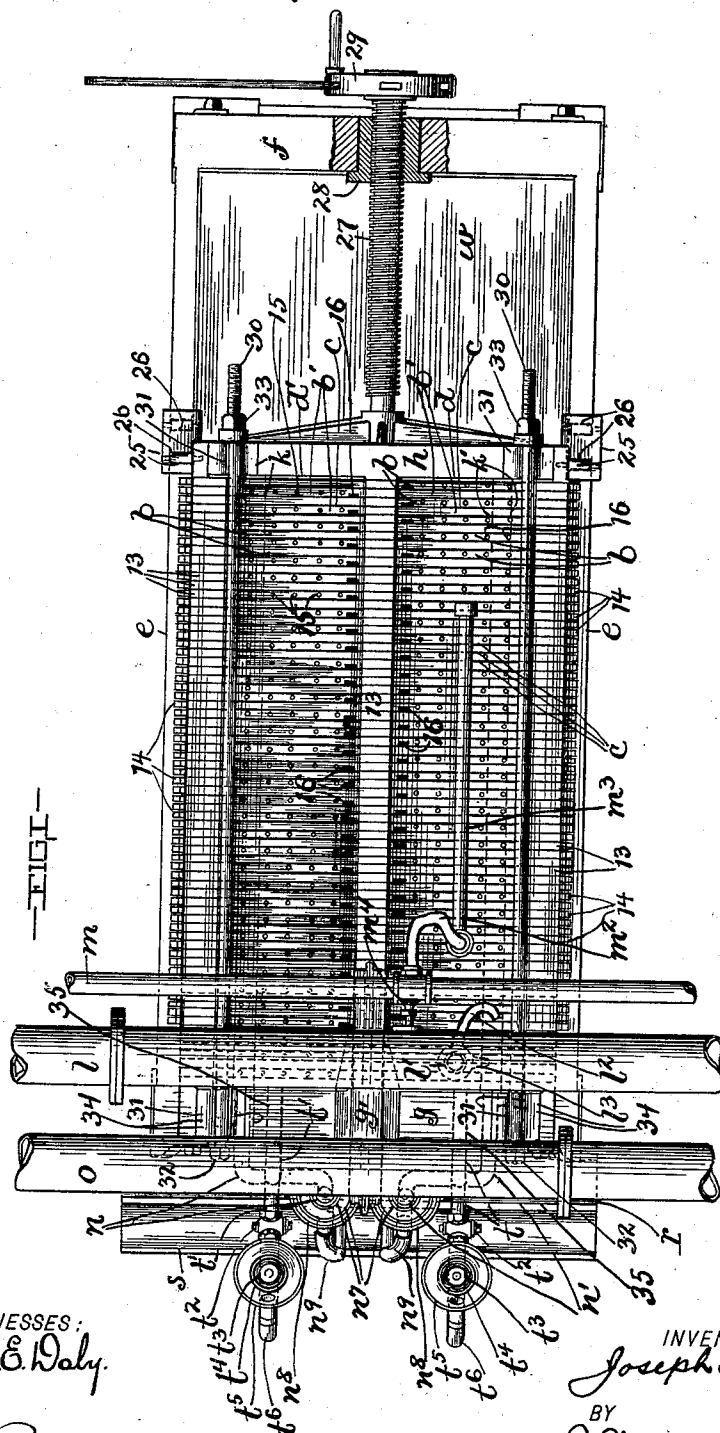
J. E. KOHN.
OSMOGENE.

Patented Jan. 1, 1901.

(Application filed Apr. 2, 1900.)

(No Model.)

5 Sheets—Sheet 1.



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No. 665,116.

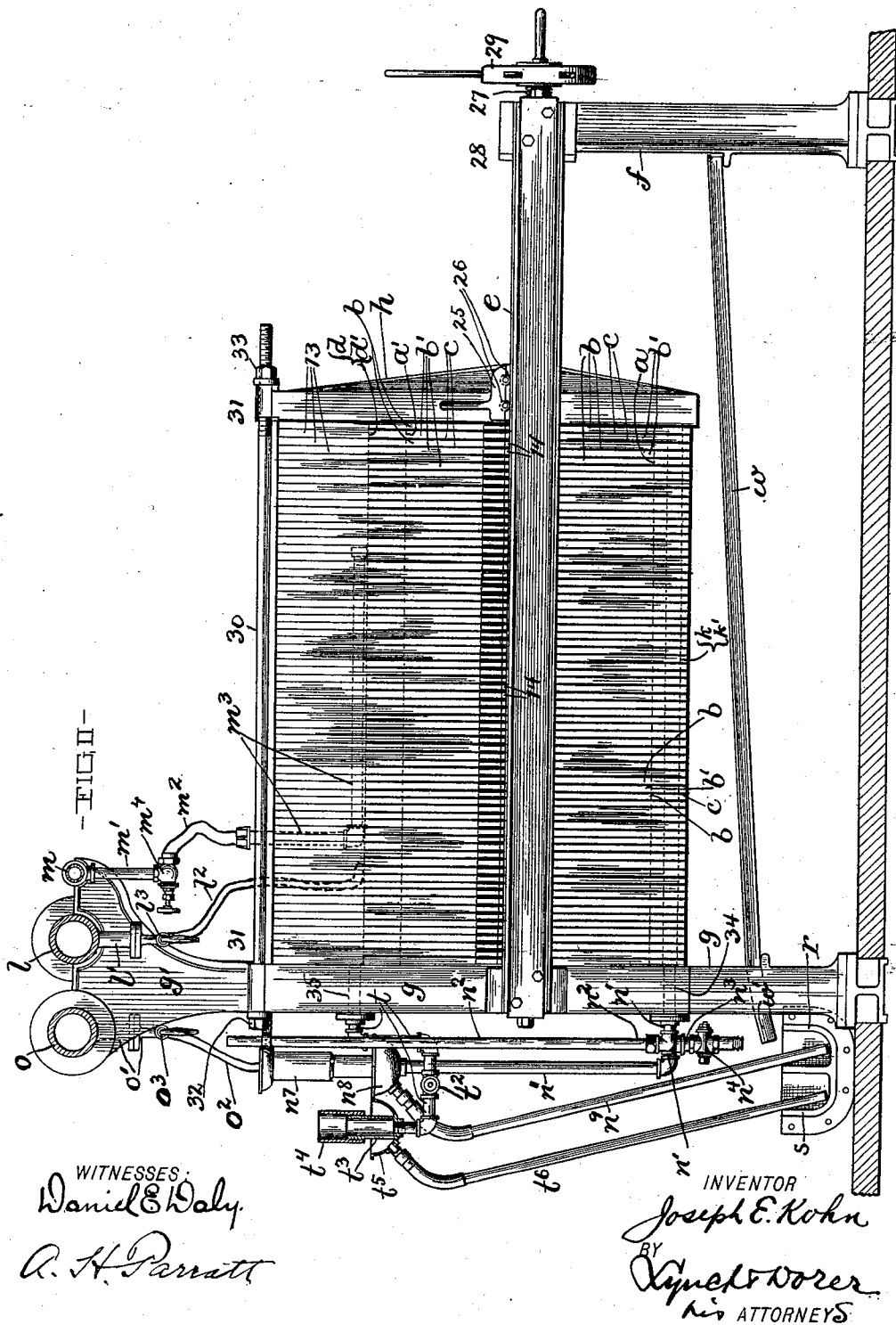
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5 Sheets—Sheet 2.



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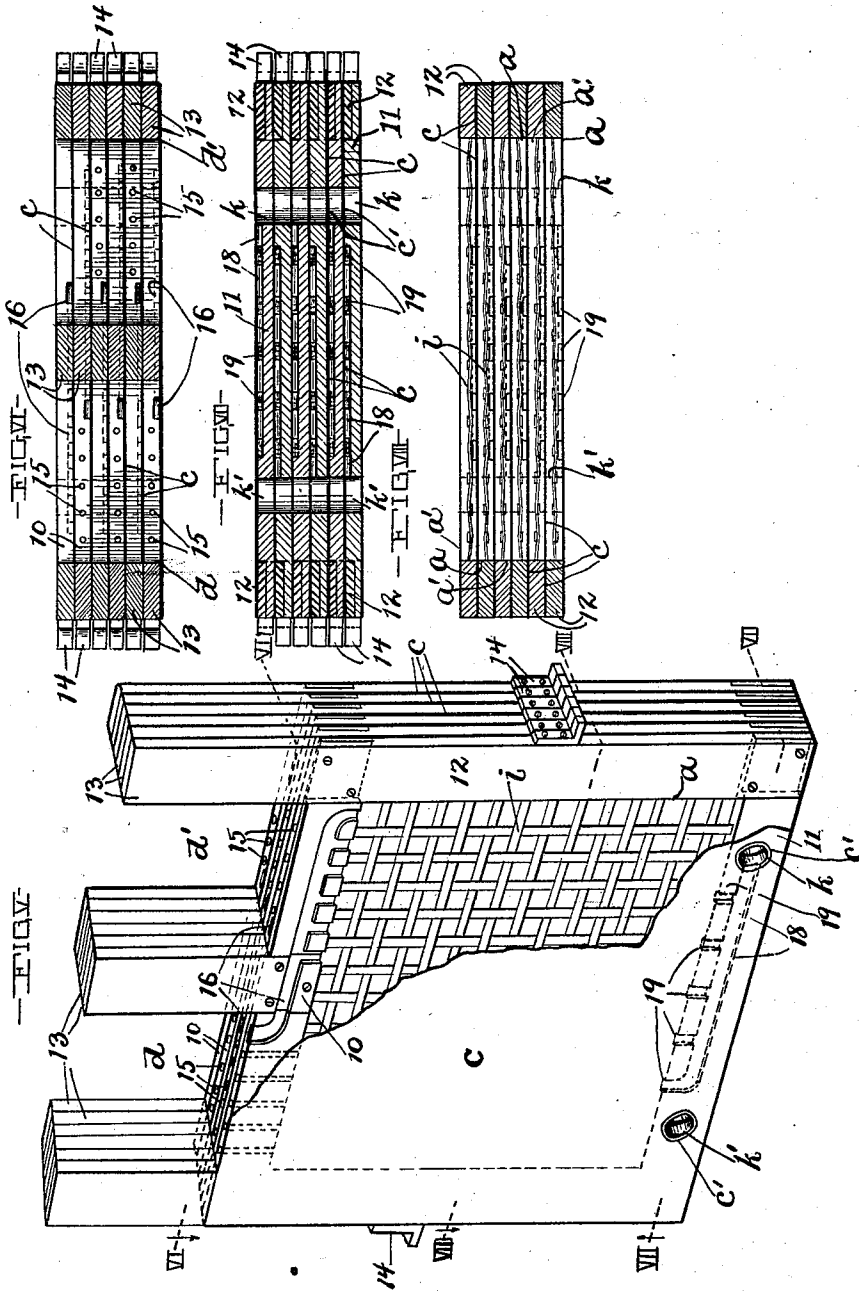
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5 Sheets—Sheet 4.



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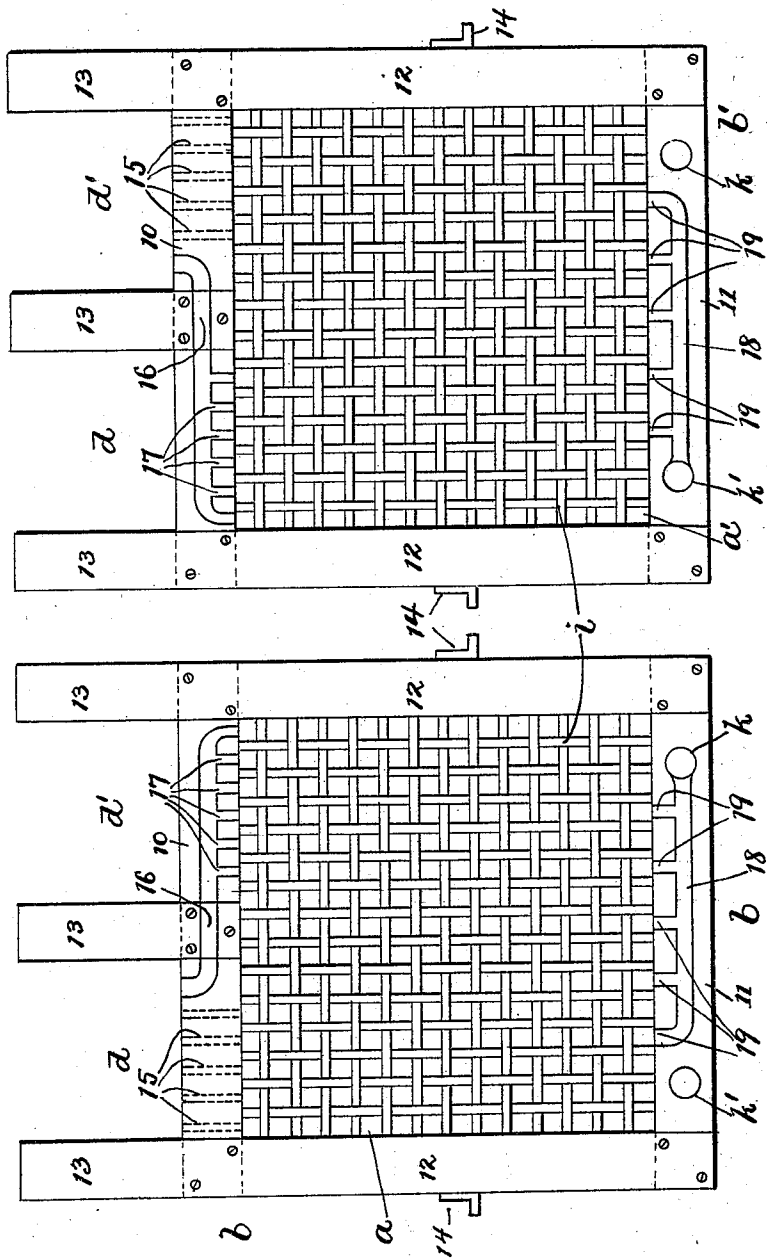
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(No Model.)

5 Sheets—Sheet 5.

—FIGX—



—FIGX—

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UNITED STATES PATENT OFFICE.

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OSMOGENE.

SPECIFICATION forming part of Letters Patent No. 665,116, dated January 1, 1901.

Application filed April 2, 1900. Serial No. 11,104. (No model.)

To all whom it may concern:

Be it known that I, JOSEPH E. KOHN, a resident of Cleveland, in the county of Cuyahoga and State of Ohio, have invented certain new and useful Improvements in Osmogenes; and I do hereby 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 pertains to make and use the same.

My invention relates to improvements in osmogenes or apparatus for utilizing the principles of osmose for purifying molasses and other liquids.

One object of this invention is to provide a machine or apparatus wherein the liquid or solution to be osmosed and the boiling water or osmosing liquid are caused to pass through the osmogene in vertical counter-streams, so that the portion of the liquid to be osmosed that has the greatest purity will come directly in contact with the portion of the water that has the greatest purity.

Another object of the invention is to provide the apparatus with means whereby the boiling water is maintained in a boiling or hot condition during the operation of the machine, so that the process carried out in the machine is facilitated as much as possible, because the effectivity of the process is dependent upon the temperature of both liquids.

A further object of the invention is to prevent clogging or choking of the membranous or porous partitions of the apparatus.

Another object of the invention is to provide a more efficient lateral support for the membranous partitions.

With these objects in view and to the end of realizing other advantages hereinafter appearing the invention consists in certain features of construction and combinations of parts hereinafter described, and pointed out in the claims.

In the accompanying drawings, Figure I is a top plan, partly in section, of apparatus embodying my invention. Fig. II is a side elevation, partly in section, of the apparatus. Figs. III and IV are elevations of opposite ends, respectively, of the apparatus. Fig. V is a view in perspective of several compartment-forming frames and interposed porous partitions. Fig. VI is a top plan in section

on line VI VI, Fig. V. Fig. VII is a bottom plan in section on line VII VII, Fig. V. Fig. VIII is a top plan in section on line VIII VIII, Fig. V. Figs. IX and X are side elevations of alternating compartment-forming frames.

My improved apparatus comprises a row of narrow upright compartments *a* and *a'*, (see Figs. II, V, VIII, IX, and X,) that are arranged in line laterally and extend transversely of the apparatus. As many frames *b* and *b'* as there are compartments *a* and *a'* are employed in the formation of the said compartments. The frames *b* and *b'* are comparatively thin and composed, respectively, of wooden bars suitably assembled and secured together, and very thin membranous partitions *c* of parchment or other suitably porous paper or material are tightly interposed between the said frames and form the walls between adjacent compartments. The frames *b* and *b'* and the partitions *c* are preferably arranged vertically and transversely of the apparatus, and preferably the quadrangular and compartment-forming portion of each frame is as long transversely of the apparatus as it is high, and each frame (see Figs. V, IX, and X) consists, preferably, of a horizontally-arranged top piece 10, a correspondingly-arranged bottom piece 11, two vertical end pieces 12 and 12, arranged at opposite ends, respectively, of the top and bottom pieces, and three vertical upwardly-projecting members 13, 13, and 13, arranged equidistant apart longitudinally of the frame—that is, transversely of the apparatus—and each of the said parts of a frame at each side of the frame is flush with the other aforesaid parts of the frame, so that adjacent frames *b* and *b'* and the interposed partition *c* can be fitted nicely together. The upwardly-projecting members 13 of the frames form, when the frames are assembled, two troughs or chambers *d* and *d'*, that are arranged side by side and extend longitudinally of and above the row of compartments formed by the assembled frames *b* and *b'* and the partitions *c*. The frames *b* and *b'* are supported from and movable endwise of the two parallel rails *e* and *e* of a horizontally-arranged track that extends longitudinally of the apparatus at a suitable elevation. The

rails *e* and *e* are arranged at opposite sides, respectively, and externally of the row of frames *b* and *b'* and are rigidly secured at one end of the track formed thereby to an upright standard *f* and are rigidly secured at the other end of the track to a vertically-arranged head-forming standard *g*. The two standards *f* and *g* are suitably connected together and braced apart at the lower ends in any approved manner. The head-forming standard *g* is in the main a solid wall that completely covers one end of the row of frames *b* and *b'*, and the said row of frames is confined between the said wall or stationary head and a movable head or follower *h*, that completely covers the other end of the row of frames, and the head or follower *h* is supported from and movable endwise of the aforesaid track. The frames *b* and *b'* as well as the heads *g* and *h*, between which the row of frames *b* and *b'* is confined, as already indicated, extend below as well as above the aforesaid track, and the movable head or follower *h* is provided with two arms or flanges 25 and 25, that are preferably integral with the said head and project outwardly from opposite side edges, respectively, of the head and overlap the different rails, respectively, of the aforesaid track, and each flange 25 is provided with rollers or wheels 26, that engage the rail overlapped, as aforesaid, by the said flange or arm and are movable endwise of the rail. Each of the frames *b* and *b'* is provided with two arms or brackets 14 and 14, that are rigid with the frame and project outwardly from the different end members 12 and 12, respectively, of the frame and overlap the different rails, respectively, of the aforesaid track. The said brackets or arms 14 of the frames *b* and *b'* constitute slides, and the rails of the aforesaid track form slideways that are engaged by the said slides. The row of compartment-forming frames *b* and *b'* and the interposed porous partitions *c* are therefore tightened against the stationary head *g* by actuating the movable head or follower *h* toward the said stationary head, and the means employed for actuating the said movable head comprises, preferably, a screw 27, that is arranged horizontally and longitudinally of the apparatus at the outer side of the head *h*. The screw 27 has its inner end arranged to engage the outer side of the head *h*, and the said screw's outer end a suitable distance from the outside of the head *h* engages and extends through a nut 28, that is fixed to the standard *f* in any approved manner. The screw 27 has its outer end provided with a hand-wheel 29 for turning the same. Obviously the screw is shifted endwise in the one direction or the other, according as it is turned in the one or the other direction, and the movable head or follower *h* is actuated toward the stationary head *g*, so as to squeeze together the frames *b* and *b'*, interposed between the said heads, or is loosened relative to the said frames, according as the aforesaid

screw is shifted inwardly and outwardly to the extent required. The screw 27 is arranged, furthermore, preferably exactly centrally of the row of compartments formed by the frames *b* and *b'* and the partitions *c*, so that the joints between all parts of the compartment-forming portions of adjacent frames shall be uniformly tight when the row of frames is squeezed against the stationary head, as aforesaid.

The partitions *c* do not extend between the trough-forming upwardly-projecting members 13 of the frames *b* and *b'*, but as the said partitions are very thin, as already indicated, the joints between contiguous trough-forming members 13 of adjacent frames *b* and *b'* can be rendered positively tight without difficulty by means that when the movable head *h* is in its inwardly-actuated or operative position is capable of clamping the upper extremities of the said upwardly-projecting members of the frames between the cooperating heads *g* and *h*. Hence the said heads extend upwardly to or above the upper extremities of the members 13 of the frames *b* and *b'*, and two parallel and horizontally-arranged bolts 30 are arranged at the top and longitudinally of and near the outer side of the different troughs, respectively, formed by the said members 13. The bolts 30 extend through recesses 31, formed in the upper edges of the heads *g* and *h*. The heads 32 of the bolts are arranged to bear against the outer surface of the stationary head *g*, and nuts 33 are mounted upon the correspondingly-threaded shanks of the bolts at the outer side of the movable head *h*. By tightening the said nuts any leakage incurring looseness between the trough-forming members 13 of the frames *b* is effectually avoided.

The row of compartments *a* and *a'*, that are formed by the frames *b* and *b'*, respectively, and the partitions *c*, is divided into two series of compartments arranged with the compartments *a* of one series alternating with the compartments *a'* of the other series. The trough *d* is in open relation at the bottom with the upper ends of the compartments *a*. The trough *d'* is in open relation at the bottom with the upper ends of the compartments *a'*. Two passage-ways *k* and *k'* are formed within the bottom walls of the compartments *a* and *a'* and are arranged a suitable distance apart parallel with each other and extend from end to end of the row of compartments *a* and *a'*, and each of the said passage-ways *k* and *k'* is formed by registering holes (see Figs. V, VII, IX, and X) that extend laterally through the bottom pieces 11 of the frames *b* and *b'*, below the porous partitions *c*. The passage-way *k* is located below the trough *d*, and the passage-way *k'* is located below the trough *d'*; but the passage-way *k'* is in open relation with the compartments that communicate with the trough *d'*, and the passage-way *k* communicates with the compartments that are in open relation with the

trough d . As already indicated, the heads g and h form opposite end walls, respectively, of the troughs d and d' . The passage-ways k and k' are closed at one end by the head h .

By the construction hereinbefore described it will be observed that when water or the osmosing liquid is supplied to the trough d and the molasses or liquid that is to be osmosed is supplied under pressure to the passage-way k' , that is in open relation with the trough d' , the liquid that is to be osmosed and the osmosing liquid will pass in vertical counter-streams through alternating compartments, respectively—that is, the molasses or liquid to be osmosed will pass from the passage-way k' upwardly through the compartments a' within the frames b' into the trough d' and the water or osmosing liquid will gravitate from the trough d through the compartments a within the frames b into the passage-way k . Of course the water or osmosing liquid may be supplied to the trough d' , in which case the molasses or liquid that is to be osmosed is supplied to the passage-way k' . The provision of the two troughs d and d' in open relation with alternating compartments in conjunction with the two passage-ways k and k' in open relation with the compartments that communicate with the different troughs, respectively, is important in order to avoid choking or clogging of the porous partitions that form the walls between the compartments and render the apparatus operative at all times, for when during the flow of the water or osmosing liquid downwardly through the compartments of one of the series of compartments and the upward passage of the molasses or liquid to be osmosed through the compartments of the other series of compartments the porous partitions become reduced in efficiency from a partial choking or clogging of the partition's side exposed to the molasses or liquid to be osmosed by matter settling thereon from the molasses or liquid to be osmosed the operation is reversed by causing the water or osmosing liquid to run into the compartments into which the molasses or liquid to be osmosed was next previously introduced, and thereby wash the partially clogged or choked side of the partition and by causing the molasses or liquid to be osmosed to run into the compartments into which the water or osmosing liquid was next previously introduced. Obviously, therefore, the apparatus can be kept in service substantially continuously.

Several alternating compartment-forming frames b and b' are illustrated in Figs. V, VI, VII, and VIII, and the porous partitions c are illustrated by heavy black lines and have their thickness somewhat exaggerated. Each trough is placed in open relation with the upper end of each compartment with which the said trough communicates by a series of vertically-arranged ports 15, that are formed in the top piece 10 of the frame that is instrumental in the formation of the said compart-

ment and trough at suitable intervals transversely of the bottom of the trough. Each trough is placed in open relation with the upper ends of the compartments with which the said trough communicates by a groove or channel 16, that is formed in the said top piece 10 and extends from the said trough longitudinally of the said top piece 10 below the other trough and has several branches 17 communicating with the said compartment below the last-mentioned trough.

Each passage-way of the passage-ways k and k' is placed in open relation with the lower end of each compartment with which the said passage-way communicates by a system of grooves or channels 18, formed in the bottom piece 11 of the frame that is instrumental in the formation of the said compartment and opening into the compartment at equal intervals longitudinally of the said bottom piece, as shown at 19 in Figs. V, VIII, IX, and X.

Improved means for supporting opposite porous side walls of each compartment is provided and consists, preferably, of metallic lattice-work or open-work i , that is arranged centrally and vertically within the frame instrumental in the formation of the said compartment and supported from or attached to the top piece, bottom piece, and end pieces of the said frame, as shown in Figs. VIII, IX, and X.

The stationary head g is provided at its upper end and centrally between the sides of the apparatus with a bracket g' , that is instrumental in supporting the water-supply pipe l , the steam-supply pipe m , and the pipe o for supplying the molasses or liquid to be osmosed. The pipes l , m , and o are arranged parallel, and the water-supply pipe l is arranged between the steam-supply pipe m and the pipe o . The water-supply pipe l has a depending branch l' , to which is attached a flexible tube l'' , that is long enough to enable it to reach into the one or the other of the troughs d and d' according as the one or the other of the said troughs is to have its chamber employed in supplying the water or osmosing liquid in the operation of the apparatus, and the branch l' is provided with a valve l^3 for controlling the supply of liquid to the said tube l'' .

The process carried out by my improved apparatus is increased in effectiveness by the use of hot or boiling water, and hence the steam-supply pipe m is provided with a depending branch m' , that is connected by a flexible tube m^2 with a heating-coil m^3 , removably placed upon the bottom of the water-receiving trough. By means of the heating-coil m^3 the water within the said trough can be boiled and maintained in a boiling condition. The branch pipe m' is provided with a valve m^4 for controlling the supply of steam to the heating-coil, and the tube m^2 is long enough to accommodate the transfer of the heating-coil from trough d to trough d' , or vice versa, according as the one or the other

of the said troughs is used as the water-supply chamber during the operation of the apparatus. Two pipes n and n' are arranged at the outer side of the head g , adjacent to and in open relation with the different passage-ways k and k' , respectively. Each of the said pipes is supported from the head g and is in open relation with a port or passage-way 34, that is formed in and extends laterally through the head g and communicates at its inner end with the connected passage-way k or k' . The pipe n' is in open relation, therefore, with the passage-way k' , and the pipe n is in open relation with the passage-way k . The passage-ways 34 and 34 are shown by dotted lines in Figs. I and II. Each of the pipes n and n' is provided with a depending branch n^3 , that is provided with a valve n^4 . The branches n^3 of the pipes n and n' are arranged to discharge into a trough or channel r , that extends transversely of the apparatus at the bottom and outer side of the head g . Each of the pipes n and n' extends to the top of head g and has its upper end provided with an internally-screw-threaded sleeve n^7 , that is arranged vertically and mounted upon and engages the corresponding externally-threaded upper end of the said pipe, and the said sleeve is lowered or elevated according as it is turned in the one or the other direction, and the pipe a suitable distance below the path of the engaging sleeve n^7 is provided with a cup or receptacle n^8 , that surrounds the pipe and is diametrically larger than the said sleeve n^7 , so that any overflow of liquid from the upper end of the said sleeve shall be caught by the said cup or receptacle that is provided with a depending or downwardly-extending pipe n^9 , that has its lower end extending and arranged to discharge into the trough or channel r . Each of the pipes n and n' is provided and in open relation with an upright glass gage n^2 , that extends upwardly to and above the head g . The pipe o has a depending branch o' , to which a flexible tube o^2 is attached. The branch o' is provided with a valve o^3 for controlling or interrupting the supply of molasses or liquid that is to be osmosed to the tube o^2 , that is long enough to render it capable of reaching into the sleeve n^7 of pipe n or pipe n' according as the said liquid is to be supplied to the passage k or to the passage-way k' . Two pipes t and t' are arranged at the outer side of the head g , adjacent to and in open relation with the different troughs d and d' , respectively. The communication between each of the pipes t and t' and the chamber of the connected trough is formed, as shown in dotted lines, Figs. I and II, by a port or passage-way 35, formed in and extending laterally through the head g . Each of the pipes t and t' is provided with a valve t^2 for controlling or interrupting the supply of liquid through the said pipe. Each of the said pipes has its outer end portion comprising a vertically-arranged and externally-screw-threaded pipe-

section t^3 , that is engaged by a corresponding internally-threaded sleeve t^4 , that is elevated or lowered according as it is turned in the one direction or the other, and the said upright sleeve-bearing member t^3 is provided externally with a cup or receptacle t^5 , that surrounds the said member t^3 and is larger diametrically than the aforesaid sleeve t^4 and provided with a depending or downwardly-extending pipe t^6 , that has its lower end extending and arranged to discharge into a trough or channel s , that is formed alongside of the trough or channel r .

The operation of the apparatus is as follows: The molasses or liquid that is to be osmosed is, as already indicated, supplied to the passage-way k or to the passage-way k' according as the water or osmosing liquid is supplied to the chamber d or to the chamber d' , so that the molasses or liquid to be osmosed passes upwardly through one series of compartments into one of the troughs while the water or osmosing liquid passes from the other trough downwardly through the other series of compartments, and so that the rising liquid that is being osmosed during the operation of the apparatus and the descending or osmosing liquid move in vertical counter-streams, and the uppermost and purest portion of the rising liquid is treated with the purest portion of the water or osmosing liquid. If, as shown, tube o^2 is in position to conduct molasses into the pipe n' and tube m^2 is in position to conduct water into the trough d , then during the operation of the apparatus upon the closing of the valves n^4 of the branches n^3 of the pipes n and n' and upon leaving the valve t^2 of the pipe t' open and the valve t^2 of the pipe t closed the molasses will pass from the pipe n' into passage-way k' to and through compartments a' into trough d' , and from the trough d' through the pipe t' , overflowing at the upper end of the sleeve t^4 of the said pipe t' into the latter's cup t^5 , and thence to the channel s , and the water will pass from trough d into and through the compartments a to passage-way k and conducted by the latter to the pipe n , through which it passes and overflows at the upper end of the sleeve n^7 of the said pipe n into the latter's cup n^8 , and thence is conducted to the channel r . If tube o^2 were arranged to conduct molasses into the pipe n and tube m^2 were in position to conduct water into the trough d' , then during the operation of the apparatus after closing the valves n^4 of the branch pipes n^3 and valve t^2 of the pipe t' and opening the valve t^2 of the pipe t the molasses would pass from the pipe n into passage-way k to and through compartments a into trough d , and thence through pipe t to the cup t^5 of the said pipe t , and thence to the channel s , and the water would pass from the trough d' into and through the compartments a' to passage-way k' , and thence to and through the pipe n' to the cup n^8 of the said pipe n' , and thence to the channel r .

A pan *w* (see Figs. I, II, III, and IV) is arranged below and longitudinally of the row of frames *b* and *b'*. The pan *w* is supported from the standards *f* and *g*. The pan declines toward the standard *g* and extends from side to side of the apparatus, so as to catch any drip resulting from leakage between frames *b* and *b'*. The pan has its lower end provided with a spout *w'*, that extends through the standard *g*, and has its outer end overhanging and arranged to discharge into the trough *r*.

By opening the valves *m*⁴ of the branches *m*³ of the pipes *n* and *n'* the compartments and the said pipes *n* and *n'* and the connected passage-ways *k* and *k'* can be drained as may be required for making repairs and other purposes.

The partitions *c* may or may not extend around the passage-ways *k* and *k'*; but preferably the said partitions extend from the upper edge of the top piece 10 of the adjacent frames *b* and *b'* to the lower edge of the bottom piece 11 of the said frames and are cut away, as at *c'*, as shown in Fig. V, around the passage-ways *k* and *k'* to avoid interrupting continuity in the said passage-ways.

What I claim is—

1. Osmose apparatus, comprising two series of upright parallel compartments arranged in a row laterally with the compartments of one series alternating with the compartments of the other series; membranous partitions forming the walls between adjacent compartments, two chambers arranged side by side at the top and longitudinally of the row of compartments and in open relation, at the bottom, with the upper ends of the compartments of the different series of compartments, respectively, and two passage-ways arranged at the bottom of the row of compartments and in open relation with the lower ends of the compartments of the different series of compartments, respectively, substantially as and for the purpose set forth.

2. Osmose apparatus, comprising two series of upright parallel compartments arranged in a row laterally with the compartments of one series alternating with the compartments of the other series; membranous partitions forming the walls between adjacent compartments; two chambers arranged side by side at the top and longitudinally of the row of compartments and in open relation, at the bottom and at intervals transversely of the said row, with the upper ends of the compartments of the different series of compartments, respectively, and two passage-ways arranged at the bottom of the row of compartments and in open relation, at intervals transversely of the said row, with the lower ends of the compartments of the different series of compartments, respectively, substantially as and for the purpose set forth.

3. Osmose apparatus, comprising two series of narrow vertically-arranged compartments arranged in a row laterally with the compartments of one series alternating with the com-

partments of the other series; membranous partitions forming the walls between adjacent compartments; a passage-way arranged below and longitudinally of the row of compartments and in open relation with the compartments of one of the series of compartments, and a chamber arranged at the top and longitudinally of the row of compartments and in open relation with the compartments of the said series of compartments; another chamber formed above and longitudinally of the row of compartments and in open relation with the compartments of the compartments of the last-mentioned series of compartments, substantially as and for the purpose set forth.

4. Osmose apparatus, comprising two series of upright compartments arranged in a row laterally with the compartments of one series alternating with the compartments of the other series; membranous partitions forming the walls between adjacent compartments; a chamber and a passage-way arranged at the top and bottom, respectively, and longitudinally of one of the said series of compartments and arranged, furthermore, diagonally opposite each other and in open relation with the said compartments, and another passage-way and chamber arranged at the bottom and top, respectively, and longitudinally of and in open relation with the other series of compartments, which last-mentioned chamber and passage-way are arranged, furthermore, diagonally opposite each other, substantially as and for the purpose set forth.

5. Osmose apparatus, comprising two series of upright compartments arranged in a row laterally of each other with the compartments of one series alternating with the compartments of the other series; membranous partitions forming the walls between adjacent compartments; a passage-way and a chamber arranged at the bottom and top, respectively, and longitudinally of one of the afore-said series of compartments, which chamber and passage-way are in open relation with each compartment of the said series of compartments at different points longitudinally of the said compartments, and another chamber and another passage-way arranged at the top and bottom, respectively, and longitudinally of the other series of compartments and in open relation with each compartment of the said series of compartments at suitable intervals longitudinally of the respective compartment, substantially as and for the purpose set forth.

6. Osmose apparatus, comprising two series of narrow upright compartments arranged in a row laterally with the compartments of one series alternating with the compartments of the other series; membranous partitions forming the walls between adjacent compartments; a passage-way and a chamber formed at the

bottom and top, respectively, of and in open relation with the compartments of one of the said series of compartments; another chamber and another passage-way arranged at the top and bottom, respectively, of and in open relation with the compartments of the other series of compartments, and metallic open-work supported within each compartment between the opposite porous side walls of the said compartment, substantially as and for the purpose set forth.

7. Osmose apparatus, comprising two series of narrow upright compartments arranged in a row laterally with the compartments of one series alternating with the compartments of the other series, and with membranous partitions forming the walls between adjacent compartments; a passage-way and a chamber formed at the bottom and top, respectively, of and in open relation with the compartments of one of the said series of compartments; another chamber and another passage-way arranged at the top and bottom, respectively, of and in open relation with the compartments of the other series of compartments, and lattice-work arranged within each compartment and extending from end wall to end wall and from the top wall to the bottom wall of the compartment and supported from the said walls of the said compartment, substantially as and for the purpose set forth.

8. Osmose apparatus, comprising two series of upright compartments with the compartments of one series alternating with the compartments of the other series, with membranous partitions forming the walls between adjacent compartments, and with the remaining walls of each compartment formed by a comparatively thin frame; a passage-way and a chamber formed at the bottom and top, respectively, and extending longitudinally of one of the series of compartments, which passage-way is in open relation with the said compartments and formed within the lower portion of the aforesaid frames, and arranged diagonally opposite the said chamber, another chamber and another passage-way formed at the top and bottom, respectively, and arranged longitudinally of the other series of compartments and in open relation with the said compartments, which last-mentioned passage-way is formed within the lower portion of the aforesaid frames and arranged diagonally opposite the last-mentioned chamber.

9. Osmose apparatus, comprising upright frames arranged in a row laterally, and membranous partitions interposed between the said frames and forming the side walls of the compartments formed within the frames; two troughs arranged side by side at the top and longitudinally of the row of compartments; ports or channels establishing open relation between the chamber of one of the said troughs and every other compartment, and a passage-way arranged at the bottom and in open relation with the compartments connected with the said chamber; ports or chan-

nels establishing open relation between the chamber of the other trough and the remaining compartments, and another passage-way arranged at the bottom and in open relation with the last-mentioned compartments, substantially as and for the purpose set forth.

10. Osmose apparatus, comprising upright frames arranged in a row laterally, and membranous partitions interposed between the said frames and forming the side walls of the compartments formed within the frames; two passage-ways formed in the lower portions of the said frames and arranged a suitable distance apart and longitudinally of the row of compartments; channels establishing open relation between one of the said passage-ways and every other compartment; and channels establishing open relation between the other of the aforesaid passage-ways and the remaining compartments, and two chambers arranged side by side above and extending longitudinally of the row of compartments, one of the said chambers being in open relation with the compartments connected with one of the aforesaid passage-ways, and the other of the said chambers being in open relation with the compartments that are connected with the other of the aforesaid passage-ways, substantially as and for the purpose set forth.

11. Osmose apparatus, comprising upright frames arranged in a row laterally and membranous partitions interposed between the said frames and forming the side walls of the compartments formed within the frames; two chambers arranged side by side above and longitudinally of the row of compartments and having their side walls formed by upwardly-projecting members of the aforesaid frames; ports or channels establishing open relation between the different chambers and alternating compartments, respectively, and two passage-ways formed within the lower portions of the frames and arranged a suitable distance apart and longitudinally of the row of compartments, one of the said passage-ways being in open relation with the compartments connected with one of the aforesaid chambers and the other of the said passage-ways being in open relation with the compartments connected with the other of the aforesaid chambers, substantially as and for the purpose set forth.

12. A vertically-arranged frame for osmose apparatus, constructed so as to form a narrow compartment therein and the following: three upwardly-projecting trough-forming members formed at the top of the frame and arranged so as to form two trough-forming spaces above opposite end portions, respectively, of the top wall of the aforesaid compartment; channels formed in the said top wall and establishing open relation between one of the said trough-forming spaces and the aforesaid compartments; two holes formed in and extending laterally through opposite end portions, respectively, of the bottom wall of the said compartments; a system of channels

establishing open relation between one of the said holes and the aforesaid compartment, and lattice-work arranged within the compartment-forming space and supported from the frame, substantially as and for the purpose set forth.

13. For osmose apparatus, a compartment-forming frame comprising a top piece 10 having the system of ports or channels 15, 16 and 17, a bottom piece 11 having two holes extending laterally therethrough a suitable distance apart and having the system of channels 18 and 19, and the end pieces 12 and 13, all arranged and operating substantially as shown, for the purpose specified.

14. Osmose apparatus, comprising a track composed of two parallel rails arranged horizontally or approximately horizontally, and a suitable distance apart; a row of compartment-forming frames supported from and movable endwise of the track and extending between, below and above the rails of the track and having their upper portions forming two troughs arranged side by side and longitudinally of the row of compartments; membranous partitions between the said frames; the stationary wall or head arranged at one end of the row of frames and forming an end wall of the aforesaid troughs; a head or follower supported from and movable endwise of the track at the opposite end of the row of frames and forming the opposite end wall of the aforesaid troughs, and means for actuating the movable head toward and from the stationary head.

15. Osmose apparatus, comprising two rails arranged horizontally or approximately horizontally, and a suitable distance apart; a row of compartment-forming frames supported from and movable endwise of the rails and extending between and above the rails, and having their upper portions forming two troughs arranged side by side and longitudinally of the row of compartments; membranous partitions between the said frames; the stationary wall or head arranged at one end of the row of frames and forming an end wall of the aforesaid troughs; a head supported from and movable endwise of the rails at the opposite end of the row of frames and forming the opposite end wall of the aforesaid troughs; means for actuating the movable head toward and from the stationary head; two bolts extending longitudinally of and above the different troughs, respectively, through the aforesaid heads and having heads or members overlapping and arranged to bear against the outer side of one of the aforesaid heads and nuts upon the bolts at the outer side of the other head, substantially as and for the purpose set forth.

16. Osmose apparatus, comprising upright frames arranged in a row laterally; membranous partitions between the said frames and forming the side walls of the compartments formed within the frames; two chambers arranged side by side and above and longitudinally

of the row of compartments and having their side walls formed by upwardly-projecting members of the aforesaid frames, ports or channels establishing open relation between the different chambers and alternating compartments, respectively; two passage-ways formed within the lower portions of the frames and arranged a suitable distance apart and longitudinally of the row of frames, one of the said passage-ways being in open relation with the lower ends of the compartments connected with one of the aforesaid chambers, the other of the said passage-ways being in open relation with the lower ends of the compartments connected with the other of the aforesaid chambers, an inclined drip-pan arranged below and extending longitudinally and transversely of the aforesaid row of frames and having an outlet, and a trough or channel arranged to receive the discharge from the said outlet, substantially as and for the purpose set forth.

17. Osmose apparatus, comprising a row of compartments divided into two series of compartments arranged with the compartments of one series alternating with the compartments of the other series; membranous partitions forming the walls between adjacent compartments; two chambers arranged side by side and at the top and longitudinally of the aforesaid row of compartments; channels establishing open relation between one of the said chambers and the compartments of one of the aforesaid series of compartments; channels establishing open relation between the other chamber and the compartments of the other series of compartments; two passage-ways formed below and longitudinally of the row of compartments, one of said passage-ways being in open relation with the lower ends of the compartments of one of the series of compartments and the other passage-way being in open relation with the compartments of the other series of compartments; a pipe for supplying the osmosing liquid and means for conducting liquid from the said pipe to the one or the other of the aforesaid chambers, and a pipe for supplying the liquid to be osmosed and means for conveying the liquid from the said pipe to the one or the other of the aforesaid passage-ways.

18. Osmose apparatus, comprising a row of compartments divided into two series of compartments arranged with the compartments of one series alternating with the compartments of the other series; membranous partitions forming the walls between the compartments; two chambers arranged side by side and at the top and longitudinally of the aforesaid row of compartments and in open relation with the compartments of the different series of compartments, respectively; two passage-ways formed below and longitudinally of the row of compartments and in open relation with the compartments of the different series of compartments, respectively; means for conducting osmosing liquid to the

one or the other of the aforesaid chambers; and means for conducting the liquid to be osmosed under pressure to the one or the other of the aforesaid passage-ways; means whereby
 5 by liquid entering one or the other of the aforesaid chambers from within the connected compartments can be conducted from the respective chamber, and means whereby liquid entering one or the other of the aforesaid
 10 passage-ways from the connected compartments can be conducted from the respective passage-way, substantially as and for the purpose set forth.

19. Osmose apparatus, comprising a row of
 15 compartments that is divided into two series of compartments arranged with the compartments of one series alternating with the compartments of the other series; membranous
 20 partitions forming the walls between the compartments; two chambers arranged side by side at the top and longitudinally of the aforesaid row of compartments and in open relation
 25 with the compartments of the different series of compartments, respectively; two passage-ways formed below and longitudinally of the row of compartments and in open relation
 30 with the compartments of the different series of compartments, respectively; a pipe for supplying the osmosing liquid; means for conducting the liquid from the said pipe
 35 to the one or the other of the aforesaid chambers; two upright pipes connected with the different aforesaid passage-ways, respectively; a pipe for supplying the liquid to be
 40 osmosed; means for establishing open relation between the last-mentioned supply-pipe and the one or the other of the aforesaid upright pipes, and two valved pipes leading
 45 from and in open relation with the different aforesaid chambers, respectively, substantially as and for the purpose set forth.

20. Osmose apparatus, comprising a row of
 compartments that is divided into two series
 45 of compartments arranged with the compartments of one series alternating with the compartments of the other series; membranous partitions forming the walls between the compartments;
 50 two chambers arranged side by side at the top and longitudinally of the aforesaid compartments and in open relation with the compartments of the different series
 55 of compartments, respectively; two passage-ways formed below and longitudinally of the row of compartments and in open relation with the compartments of the different series
 60 of compartments, respectively; a pipe for supplying the osmosed liquid, which pipe is arranged above the aforesaid chambers; means for conducting the liquid from the said pipe
 65 to the one or the other of the said chambers; two upright pipes connected with the different aforesaid passage-ways, respectively, a pipe for supplying the liquid to be osmosed,
 which pipe is arranged above the aforesaid chambers; means for establishing open relation
 between the last-mentioned supply-pipe and the one or the other of the aforesaid up-

right pipes, and two valved pipes leading from and in open relation with the lower portion
 70 of the different aforesaid chambers, respectively, substantially as and for the purpose set forth.

21. Osmose apparatus, comprising a row of
 compartments *a* and *a'* that is divided into two
 75 series of compartments arranged with the compartments *a* of one series alternating with the compartments *a'* of the other series; membranous partitions *c* forming the walls between
 80 the compartments; two chambers *d* and *d'* arranged side by side at the top and longitudinally of the aforesaid compartments and in open relation with compartments *a*
 and compartments *a'*, respectively; two passage-ways *k* and *k'* formed below and longitudinally of the row of compartments and in
 85 open relation with compartments *a* and *a'*, respectively; a pipe for supplying the osmosing liquid, which pipe is arranged above the aforesaid chambers; means for conducting
 the liquid from the said pipe to the one or the
 90 other of the said chambers; two upright pipes *n* and *n'* connected with the passage-ways *k* and *k'*, respectively, and provided, respectively, with a cup *n^s* having a discharge-pipe
n⁹; a pipe for supplying the liquid to be osmosed, which pipe is arranged above the
 95 aforesaid chambers; means for establishing open relation between the last-mentioned supply-pipe and the one or the other of the aforesaid upright pipes, and two valved pipes
 100 *t* and *t'* leading from and in open relation with the lower portion of the chambers *d* and *d'*, respectively, and provided, respectively, with a cup *t^s* having a discharge-pipe *t⁹*, substantially
 105 as and for the purpose set forth.

22. Osmose apparatus, comprising the row
 of alternating compartments *a* and *a'* having
 110 the walls between them composed of membranous material; the two troughs *d* and *d'* in open relation with the compartments *a* and *a'*, respectively; the two passage-ways *k* and
k' in open relation with the compartments *a*
 115 and *a'*, respectively; the supply-pipe *m* having the valved branch *m'* and the flexible tube *m²*; the supply-pipe *o* having the branch *o'*
 and the flexible tube *o²*; the upright pipes *n*
 and *n'* in open relation with the passage-ways
 120 *k* and *k'*, respectively, and the valved pipes *t* and *t'* in open relation with the troughs *d* and *d'*, respectively, all arranged and operating substantially as shown, for the purpose
 specified.

23. Osmose apparatus, the combination,
 with the two troughs *d* and *d'* arranged side
 125 by side, of the heating-coil *m^s* transferable from one trough to the other trough, and the steam-supply pipe *m* having the valved
 branch *m'* and the flexible tube *m²*, substantially as shown, for the purpose specified.

24. Osmose apparatus, comprising the row
 130 of alternating compartments *a* and *a'* having the walls between them composed of membranous material; the troughs *d* and *d'* in open relation with the compartments *a* and

a', respectively; the two passage-ways *k* and *k'* in open relation with the compartments *a* and *a'*, respectively; the supply-pipe *m* having the valved branch *m'* and the flexible tube *m*²; the supply-pipe *o* having the branch *o'* and the flexible tube *o*³; the upright pipes *n* and *n'* in open relation with the passage-ways *k* and *k'*, respectively, and provided, respectively, with the vertically-adjustable sleeve *n*⁷ and having the cup *n*⁸ that is provided with a discharge-pipe *n*⁹, and the valved pipes *t* and *t'* in open relation with the troughs *d* and *d'*, respectively, and comprising, re-

spectively, an upright pipe-section *t*⁸ that has the vertically-adjustable sleeve *t*⁴, and having the cup *t*⁵ that is provided with the discharge-pipe *t*⁶, all arranged and operating substantially as shown, for the purpose specified.

Signed by me at Cleveland, Ohio, this 29th day of July, 1899.

JOSEPH E. KOHN.

Witnesses:

C. H. DORER,
A. H. PARRATT.