

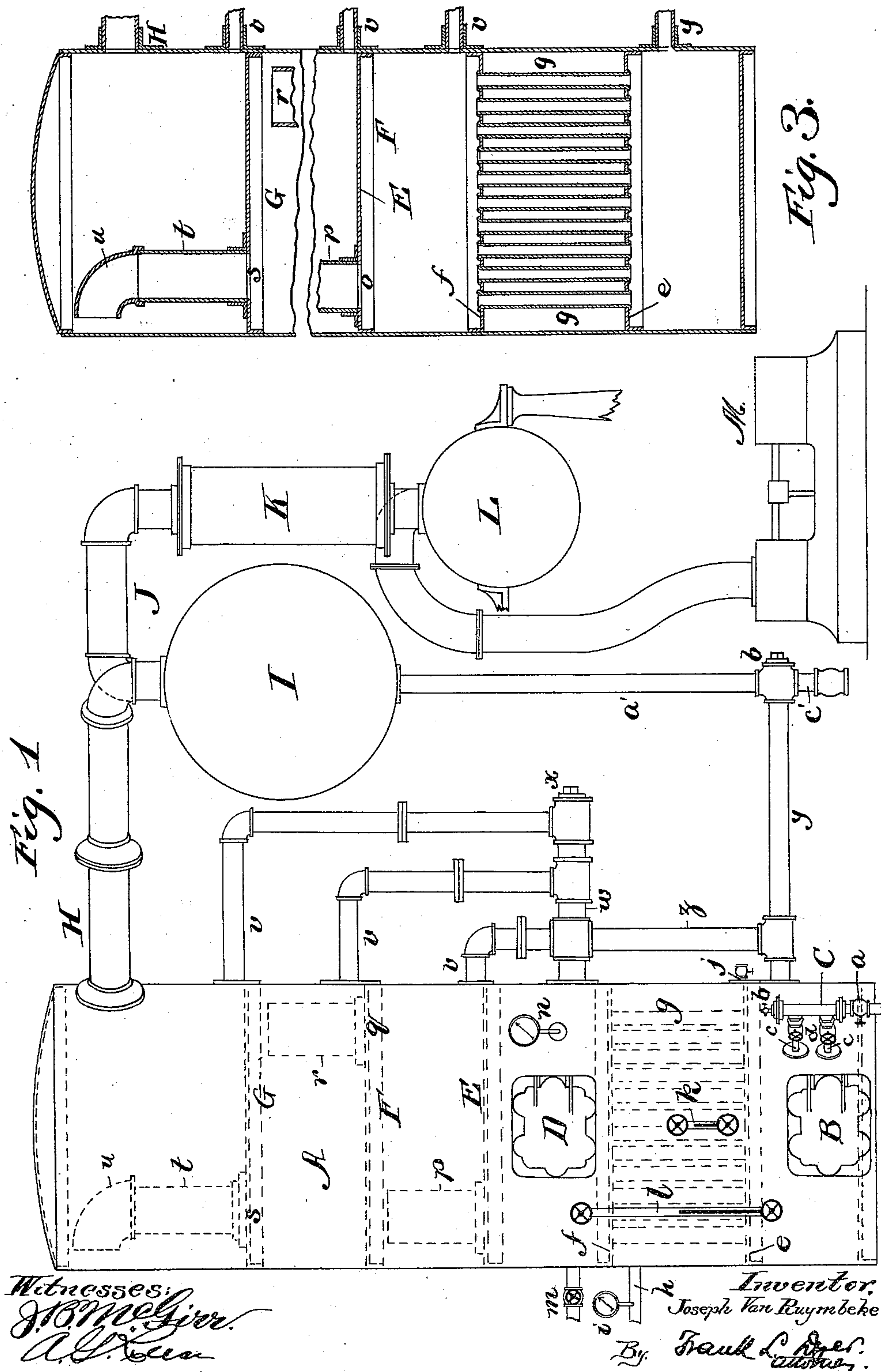
(No Model.)

2 Sheets—Sheet 1.

J. VAN RUYMBEKE.
EVAPORATOR.

No. 542,907.

Patented July 16, 1895.



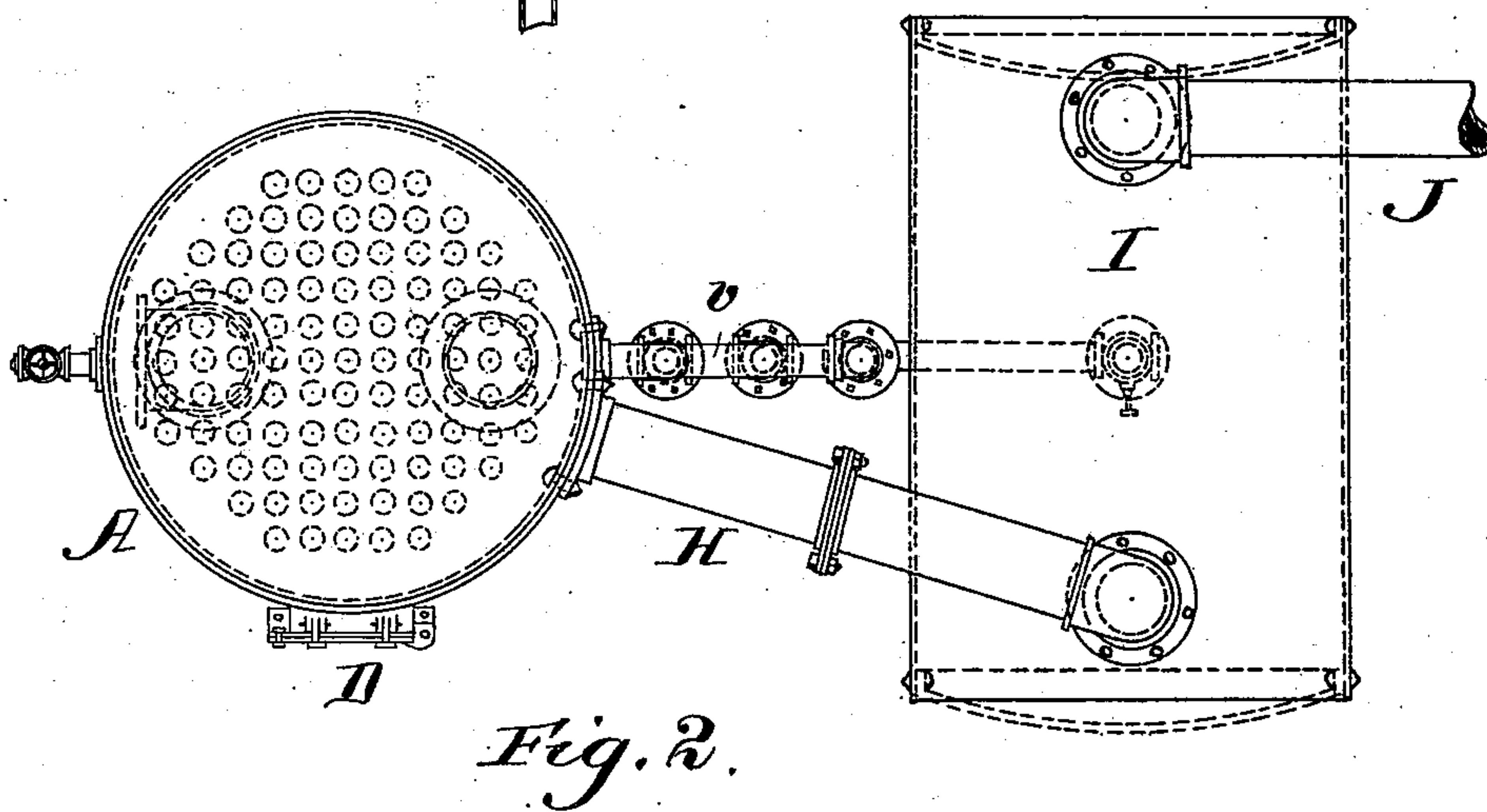
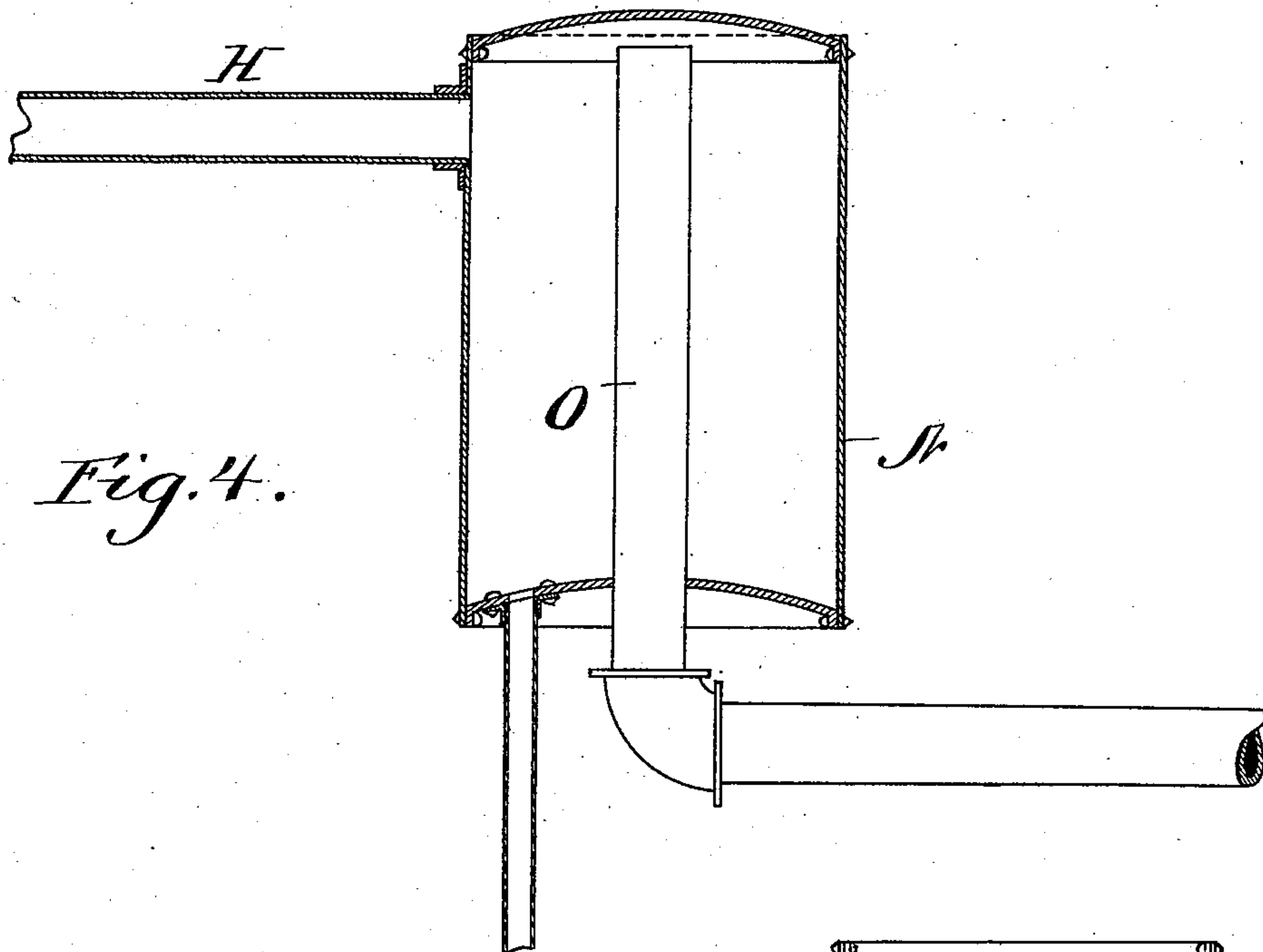
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2 Sheets—Sheet 2.

J. VAN RUYMBEKE.
EVAPORATOR.

No. 542,907.

Patented July 16, 1895.



Witnesses:

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By *Faulk L. Dyer*
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UNITED STATES PATENT OFFICE.

JOSEPH VAN RUYMBEKE, OF CHICAGO, ILLINOIS, ASSIGNOR OF ONE-HALF TO
WILLIAM F. JOBBINS, OF SAME PLACE.

EVAPORATOR.

SPECIFICATION forming part of Letters Patent No. 542,907, dated July 16, 1895.

Application filed January 21, 1895. Serial No. 535,715. (No model.)

To all whom it may concern:

Be it known that I, JOSEPH VAN RUYMBEKE, a subject of the King of Belgium, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Evaporators; and I do hereby declare the following to be a full, clear, and exact description of the invention, which will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to various improvements in evaporators which are designed particularly for the evaporation of waste soap-lyes, but which are also well adapted for the evaporation of other solutions.

The particular points of novelty in the invention will be pointed out in the following description and claims.

In the accompanying drawings, Figure 1 is a side elevation of the evaporating apparatus; Fig. 2, a plan view thereof with the condenser and vacuum-pump removed; Fig. 3, a vertical sectional view of the evaporator, and Fig. 4 a sectional view of a modified form of catch-all.

In all of the above views corresponding parts are designated by the same letters of reference.

The evaporator A is preferably made of the general cylindrical shape shown, of proper dimensions, according to the desired amount of material to be evaporated, and of a height depending on the number of dash-plates which it may be necessary to use with the particular solutions treated.

B is a door in the lower part of the evaporator for the removal of the salt or material deposited therein, the said door being suitably packed in order that a vacuum may be maintained within the apparatus.

Mounted on the side of the evaporator to one side of the door B is a draw-off tube C, provided with the valve *a* at its lower end and with a petcock *b* at its upper end. The draw-off tube C connects with the interior of the evaporator by pipes *c*, two of which are shown mounted one above the other. These pipes are provided with valves *d* therein. This draw-off tube is used for the purpose of drawing off a small quantity of the liquid for the purpose of testing the same. This is done by closing the valve *a* and petcock *b* and by opening the valves *d d*, whereby the

tube C will be filled with the liquid. The valves *d d* are now closed and the valve *a* opened, air being admitted by opening the petcock, and the small quantity of liquid drawn into the tube C flows out of the same and may be tested in any suitable way.

Mounted within the evaporator directly above the door B is a flue-sheet *e*, and *f* is a similar flue-sheet mounted within the evaporator a suitable distance above the flue-sheet *e*. These flue-sheets *e* and *f* are perforated and are connected by vertical flues *g*, arranged in any suitable way. The flue-sheets *e f* and flues *g* constitute a steam-drum, and the space beneath the same constitutes the salt-chamber when saline liquids are evaporated. Steam is admitted into the space between the flue-sheets *e* and *f* through a pipe *h*, the pressure of which steam is indicated by a gage *i*, and condensed water is removed from the steam-drum through a valved pipe *j*, mounted directly above the lower flue-sheet *e*. An ordinary water-gage *k* indicates the amount of condensed water in the steam-drum, and a longer water-gage *l* communicating with the interior of the evaporator above and below the steam-drum indicates the height of the liquid in the evaporator.

The material to be concentrated is introduced into the evaporator through a valved pipe *m*, mounted preferably directly above the flue-sheet *f*.

D is a door mounted on the side of the evaporator directly above the steam-drum, and through which the interior of the evaporator may be reached for the purpose of cleaning or repairing the same.

The degree of vacuum within the apparatus is indicated by a vacuum-gage *n*, placed on the side of the evaporator above the normal level of the liquid therein.

E is a dash-plate mounted within the evaporator above the door D and provided at one side with an opening *o*. Extending up from this opening *o* and secured to a flange riveted directly to the dash-plate E is a vertical pipe *p*.

F is a second dash-plate mounted within the evaporator a short distance above the upper open end of the pipe *p*, and which is provided with an opening *q* therein diametrically opposite from the opening *o* in the dash-

plate E. Extending up from the opening *q* and riveted to the dash-plate F is a flange with pipe *r*, which corresponds to the pipe *p*.

G is a third dash-plate mounted immediately above the upper open end of the pipe *r*, and which is provided with an opening *s* therein diametrically opposite from the opening *q* of the dash-plate and in line with the opening *o* of the dash-plate E. Extending up from the opening *s* is a pipe *t*, which extends into the upper part of the evaporator and may be of any desirable height. This pipe *t* is provided at its upper end with a curved pipe or elbow *u*, which faces the shell of the evaporator and is a short distance therefrom.

While I have shown and described three dash-plates E, F, and G, it is to be understood I am not to be limited to this number, since with some liquids good results may be obtained by using only one dash-plate, while with others the use of more than three dash-plates may be desirable.

Extending out from the side of the evaporator near the top thereof is a vapor-pipe H, which connects with the upper end of a horizontal catch-all drum I near one end thereof. J is a pipe which extends from the upper end of said catch-all drum near the other end thereof, and which connects with the condenser K, having the receiving-tank L beneath the same.

Instead of making use of a condenser and receiving-tank of the type shown the vapors from the evaporator, when of no value, may be condensed by an ordinary jet-condenser and thence be allowed to run to waste in the sewer or elsewhere.

M is a vacuum-pump for maintaining a partial vacuum in the interior of the apparatus.

Instead of making use of an ordinary horizontal catch-all drum, such as I, a modified form, such as that illustrated in Fig. 4, may be employed, the latter consisting of a vertical drum N, supported in any suitable manner, and having a vertical pipe O extending up through the bottom to a point near the top of the drum N. The lower end of the pipe O connects with the condenser K, (or jet-condenser of the vacuum-pump, if used,) either directly or through a receiving-drum. (Not shown.) The vapor-pipe H leads into the drum N at a point below the upper open end of the pipe O.

v v v are pipes connecting the interior of the evaporator immediately above the dash-plates E, F, and G with a horizontal pipe *w*, which extends out from the evaporator immediately above the steam-drum. A plug *x* is screwed into the end of the pipe *w*, which plug may be removed and the pipe *w* cleaned.

Extending out from the evaporator beneath the steam-drum is a horizontal pipe *y*, which is connected with the pipe *w* by a pipe *z*, and said pipe *y* is also connected near its end with the catch-all drum I (or N, Fig. 4) by a pipe *a'*. The pipe *y* is provided at its end with

the screw-plug *b'*, like the plug *x*, which may be removed and the interior of the pipe *y* cleaned. The valved pipe *c'* connects with the pipe *y*, and through which the liquid above the deposited salt and also the accumulated liquid above the dash-plates or within the catch-all drum may be removed.

In the concentration of soap-lyes for obtaining crude glycerin the vacuum-pump is started and creates a high vacuum, preferably above twenty-eight inches, within the evaporator. By reason of this vacuum the liquid is drawn into the evaporator through the valved pipe *m* until it about covers the steam-drum, when the supply is cut off. Steam of the proper temperature is now introduced through the valved pipe *h* and surrounds the flues *g*, which are of course filled with the liquid, and the heat thus imparted to the liquid by the flues *g* and the flue-sheets *e* and *f* causes the water contained to vaporize off. The steam as it condenses within the steam-drum may be removed from time to time through the valved pipe *j*. The water thus evaporated passes up through the opening *o* in the dash-plate E and pipe *p*, thence through the opening *q* in the dash-plate F and pipe *r*, thence through the opening *s* in the dash-plate G, pipe *t*, and curved pipe *u*, thence through the opening H into and through the catch-all drum I, (or N, Fig. 4,) thence through the pipe J to the condenser, in which the vapors are condensed, and pass to sewer or are collected in the receiving-tank L. The salt crystallized from the liquid deposits in the salt-chamber beneath the steam-drum, and may be removed therefrom through the door B and be freed of any liquid contained therein in any suitable way. By reason of the arrangement of dash-plates shown by arranging the mouth of the curved pipe *u* in close proximity to the interior wall of the evaporator and by using the catch-all drum I any heavy or less volatile substances mechanically carried or entrained by the vapors by reason of a sudden increase in the vacuum or in the heat applied will be projected against the dash-plates E, F, and G, or against the sides if the evaporator adjacent to the mouth of the elbow *u* or within the catch-all drum I, and these heavier and less volatile substances will be thereby condensed and caught on the dash-plates or within the catch-all drum, from which they will be returned back into the lower part of the evaporator through the pipes *v*, *w*, *z*, *y*, and *a'*. In this way the water will be separated from the waste soap-lye, leaving a concentrated product in the evaporator with most of the salt precipitated therefrom.

By making use of the system of return-pipes shown, and particularly by connecting the space above and below the steam-drum by a pipe *z*, the liquid within the evaporator is allowed to circulate through said pipe, and the heat will be more rapidly imparted to the entire volume of liquid, whereby evaporation is accelerated.

By making use of a catch-all like that shown in Fig. 4 the danger of extraneous substances being carried over with the vapors is further decreased, as any less volatile matters in being projected rapidly through the eduction-pipe H will strike against the pipe O, and will be condensed on the latter and collected at the bottom of the drum N, returning to the evaporator through the pipe a' . The volatile matter will pass up into the upper open end of the pipe O and thence to the condenser, where it is condensed and collected, if desired, or be allowed to run to waste.

Should the flues and flue-sheets become caked with salt a suitable liquid, such as lye not saturated with salt, may be introduced into the evaporator and allowed to remain therein until all of the salt has been dissolved out.

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

1. An evaporating apparatus, consisting of an evaporating chamber, means for heating the liquid therein, two or more dash plates within the evaporator above the level of the liquid therein, the openings in said dash plates being so arranged as to interrupt the free passage of the vapors, and independent return pipes placed externally connecting the spaces above said dash plates with the lower part of the evaporating chamber, whereby the vapors condensed on said dash plates will be returned for re-evaporation, substantially as set forth.

2. An evaporating apparatus, consisting of an evaporating chamber, means for heating the liquid therein; two or more dash plates within the evaporator above the level of the liquid therein, the openings in said dash plates being so arranged as to interrupt the free passage of the vapors; independent return pipes placed externally connecting the spaces above said dash plates with the lower part of the evaporating chamber, whereby the vapors condensed on said dash plates will be returned for re-evaporation, and a catch-all on one side of the evaporator and connected therewith, substantially as set forth.

3. An evaporating apparatus, consisting of an evaporating chamber, means for heating the liquid therein, two or more dash plates within the evaporator above the level of the liquid therein, the openings in said dash plates being so arranged as to interrupt the free passage of the vapors, independent return pipes placed externally connecting the spaces above said dash plates with the lower part of the evaporating chamber, whereby the vapors condensed on said dash plates will be returned for re-evaporation, a catch-all at one side of the evaporator, and connected therewith, and a condenser connected with said catch-all, substantially as set forth.

4. An evaporating apparatus, consisting of an evaporating chamber, means for heating the liquid therein; two or more dash plates

within the evaporator above the level of the liquid therein, the openings in said dash plates being so arranged as to interrupt the free passage of the vapors, independent return pipes placed externally connecting the spaces above said dash plates with the lower part of the evaporating chamber, a catch-all at one side of the evaporator and connected therewith; a condenser connected with said catch-all, and a vacuum pump connected with said condenser for maintaining a vacuum in the apparatus, substantially as set forth.

5. An evaporating apparatus, consisting of an evaporating chamber, a steam drum in said evaporator, a salt chamber beneath said drum, a door for said salt chamber, two or more dash plates within the evaporator, the openings in said dash plates being so arranged as to interrupt the free passage of the vapors, and return pipes connecting the spaces above said dash plates with the lower part of the evaporating chamber, whereby the vapors condensed on said dash plates will be returned for re-evaporation, substantially as set forth.

6. An evaporating apparatus, consisting of an evaporating chamber, a steam drum in said evaporator, a salt chamber beneath said drum, a door for said salt chamber, two or more dash plates within the evaporator, the openings in said dash plates being so arranged as to interrupt the free passage of the vapors, and independent return pipes placed externally leading from the spaces above said dash plates into the lower part of the evaporator for the purpose mentioned, substantially as set forth.

7. An evaporating apparatus, consisting of an evaporating chamber, means for heating the liquid therein, a dash plate mounted in said evaporator, an opening in said dash plate, a pipe extending up from said opening and a curved pipe at the upper end of said pipe, the mouth of said curved pipe being adjacent to the interior wall of the evaporator, substantially as set forth.

8. An evaporating apparatus, consisting of an evaporating chamber, means for heating the liquid therein, two or more horizontal dash plates arranged one above the other in said evaporator, the openings in said dash plates being so arranged as to interrupt the free passage of the vapors, pipes extending up from said openings with their upper open ends adjacent to the dash plates immediately above the same, and a curved pipe on the end of the upper pipe, the mouth of said curved pipe being adjacent to the interior walls of the evaporator, substantially as set forth.

9. An evaporating apparatus, consisting of an evaporating chamber, means for heating the liquid therein, two or more dash plates within the evaporator above the level of the liquid therein, the openings in said dash plates being so arranged as to interrupt the free passage of the vapors, return pipes v, v, v leading from the spaces above said dash plates, a pipe w with which the pipes v are connected,

a screw plug x in the pipe w , a pipe y leading into the lower part of the evaporator, and a pipe z connecting the pipes w and y , substantially as set forth.

- 5 10. An evaporating apparatus, consisting of an evaporating chamber, means for heating the liquid therein, two or more dash plates within the evaporator above the level of the liquid therein, the openings in said dash
10 plates being so arranged as to interrupt the free passage of the vapors, return pipes v, v, v leading from the spaces above said dash plates, a pipe w with which the pipes v are connected,
15 a pipe y leading into the lower part of the evaporator, a pipe z connecting the pipes w and y , and a catch-all to one side of the evaporator and connected with the same, substantially as set forth.

- 20 11. An evaporating apparatus, consisting of an evaporating chamber, means for heating the liquid therein, two or more dash plates within the evaporator above the level of the

liquid therein, the openings in said dash plates being so arranged as to interrupt the free passage of the vapors, return pipes v, v, v leading from the spaces above the said dash plates, a pipe w with which the pipes v are connected, a pipe y leading into the lower part of the evaporator, a pipe z connecting the pipes w and y , a vertical catch-all drum N to one side
25 of the evaporator and connected therewith, a pipe O extending into said catch-all drum with its upper open end above the vapor pipe from the evaporator and with its lower end connected with a condenser, and a pipe a'
30 connecting said condenser with the pipe y , substantially as set forth.

This specification signed and witnessed the 21st day of December, 1894.

JOSEPH VAN RUYMBEKE.

Witnesses:

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WILLIAM F. FORBES.