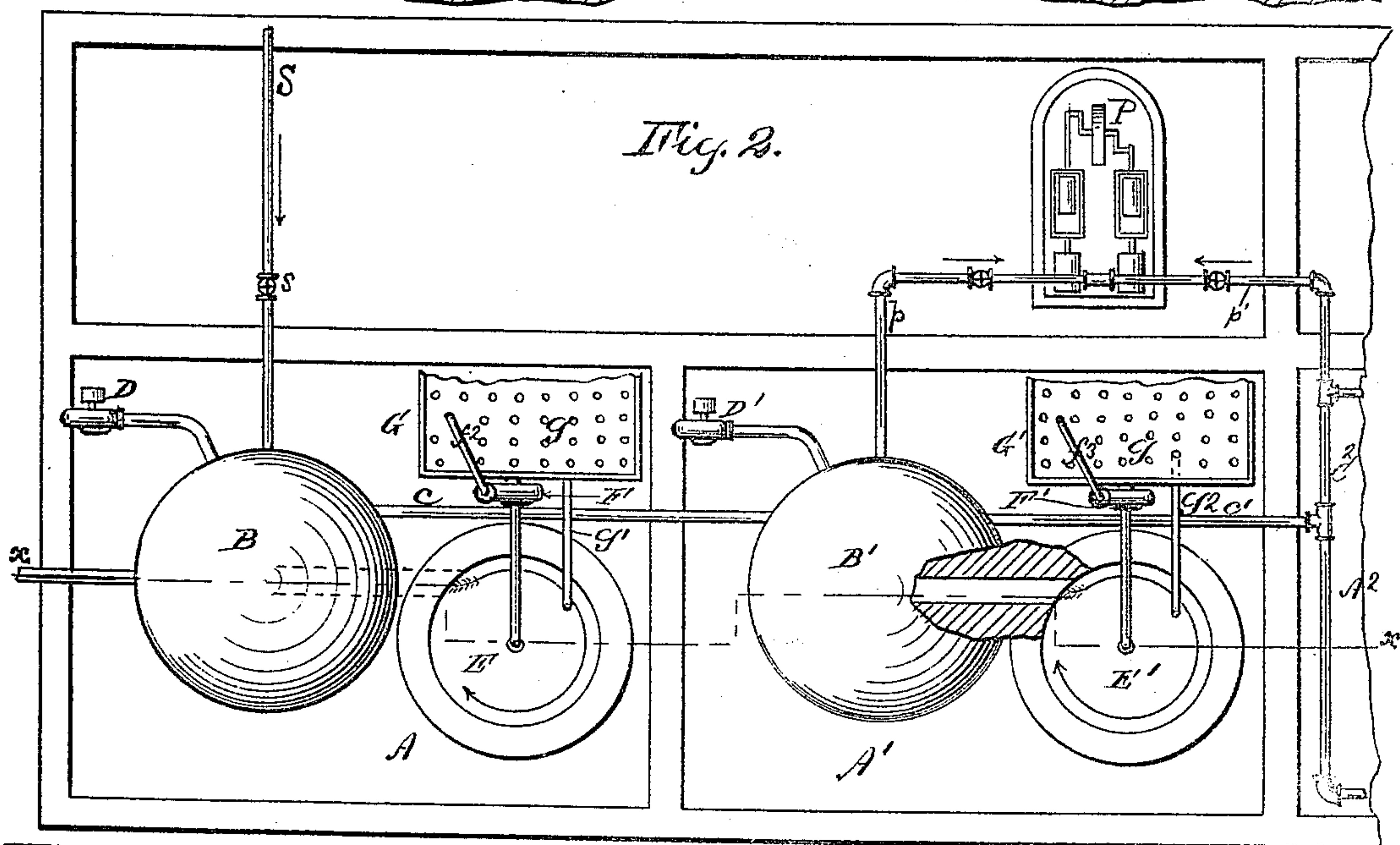
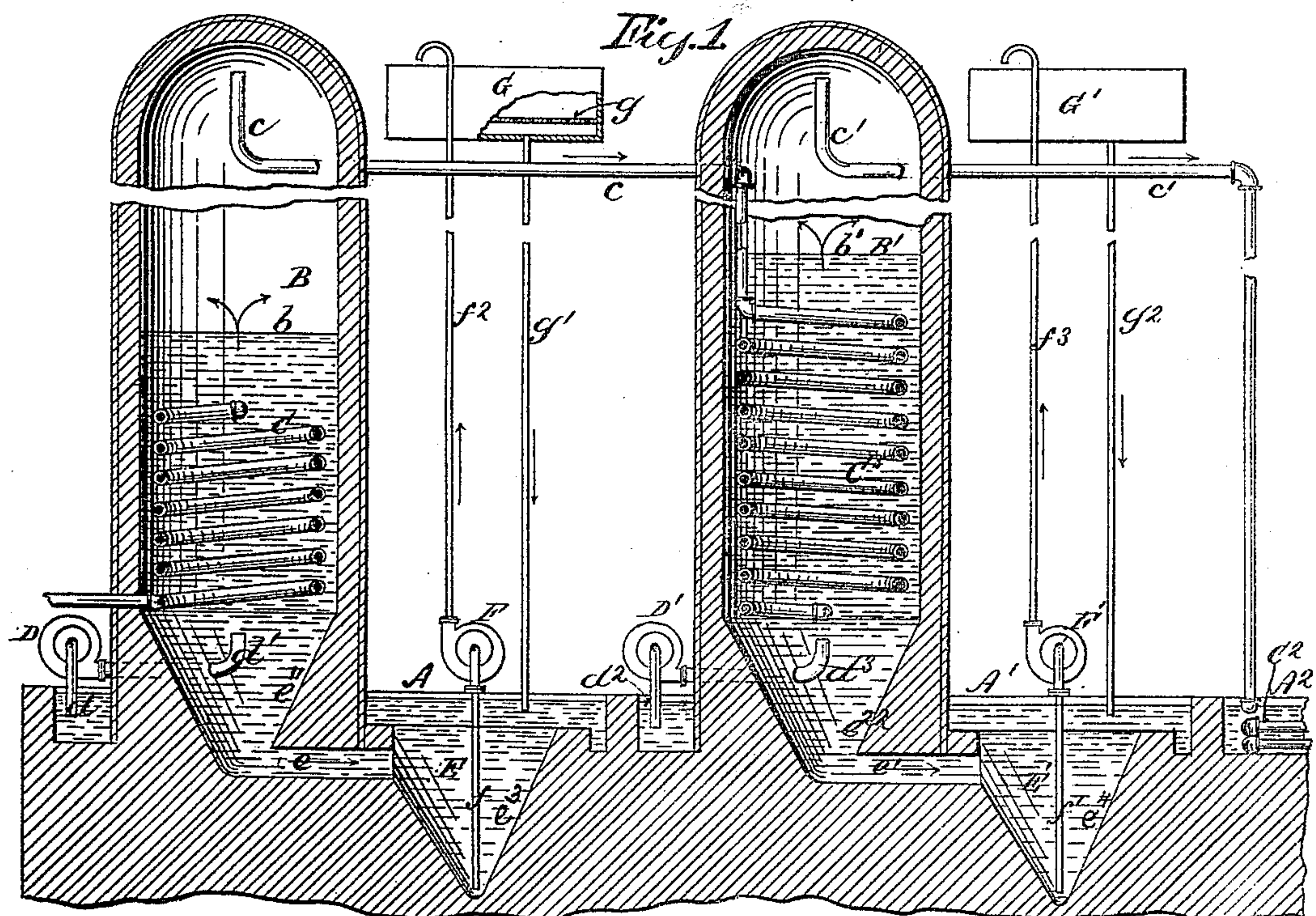


(No Model.)

C. C. PECK.  
EVAPORATING APPARATUS.

No. 438,384.

Patented Oct. 14, 1890.



Witnesses:  
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# UNITED STATES PATENT OFFICE.

CASSIUS C. PECK, OF WARSAW, NEW YORK.

## EVAPORATING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 438,384, dated October 14, 1890.

Application filed December 23, 1889. Serial No. 334,666. (No model.)

*To all whom it may concern:*

Be it known that I, CASSIUS C. PECK, a citizen of the United States, residing at Warsaw, in the county of Wyoming and State of New York, have invented certain new and useful Improvements in Evaporating Apparatus, of which the following is a specification.

My invention is applicable to vacuum apparatus for effecting the evaporation and concentration of liquids generally, although, as shown herein, it is designed primarily for the evaporation of brine in the manufacture of salt or analogous processes—such as precipitate, granular, or other solid matter—as the evaporation proceeds.

The first object of my improvement is to render the heating-surface arranged within the vacuum-chamber as effective as possible, and this object is attained by a forced circulation of the liquid which is being evaporated, whereby the liquid is made to flow rapidly over the said interior heating-surface. Incidentally in this connection it consists in the combination and arrangement, substantially as hereinafter set forth, of a vacuum-chamber provided with an interior steam-coil or other form of heater, said vacuum-chamber being situated in or communicating with an exterior supply-tank, and of means for effecting a forced circulation of the liquid to be evaporated between said exterior supply-tank and the interior of the vacuum-chamber; but it is to be understood that this arrangement is not absolutely essential to the carrying out of my process of augmenting the evaporation of the liquid for a given amount of heating-surface within the vacuum-chamber, since the forced circulation may be used for that purpose entirely within a closed vacuum-chamber having no continuous supply of liquid.

The second object of my invention is to provide for an automatic and continuous discharge of the precipitated material and its separation from the liquid under treatment; and it consists in the thorough washing out from the vacuum-chamber of the solid products of evaporation by means of the forced circulation aforesaid into a circular basin, the delivery into said basin being so arranged that a comparatively slow rotary or vortex motion is given to the liquid, to the end that the solid matter may be collected centrally

within the said basin. The speed of the forced circulation of the liquid under treatment is so regulated that the rotary or gyratory movement thus imparted to the products of evaporation as discharged into the collecting-basin is insufficient to throw the heavier or solid matter outward against the sides of the chamber by centrifugal force, as would be the result if the gyratory movement attained a comparatively high rate of speed. Practically with a slow speed of rotation the crystals and concentrated liquid collect in the comparative quiet of the axial line of rotation, down which they sink to the open lower end of the suction discharge-pipe, the vortex created being sufficient to counteract the slight centrifugal force involved.

The third object of my invention is to automatically convey away and drain the solid products of evaporation from the separating-basin; and it consists in the construction and arrangement of parts by which the concentrated solid and liquid contents of the basin are elevated into and drained in an elevated tank, from which the liquid constituent is returned to the supply-tank, while the solid matter is retained therein.

In the accompanying drawings I show apparatus adapted to the carrying out of my invention practically, although I do not wish to confine myself to the identical form of construction of parts shown, since various modifications in detail may be made without departing from the spirit and intent of my invention.

Figure 1 is a vertical section of the apparatus, taken upon the zigzag line  $x x$ , Fig. 2. Fig. 2 is a plan of the apparatus, portions of which are shown as broken away.

In Figs. 1 and 2,  $A A'$  are tanks containing vacuum-chambers  $B B'$ , constructed of any suitable material, the design being that of a double-effect apparatus. The interiors of the vacuum chambers or cylinders  $B B'$  are fitted with heating-coils  $C C'$  or equivalent heating devices for supplying heat for evaporating the liquid contents of the chambers, the level of which is shown at  $b b'$ . Centrifugal pumps  $D D'$  create a comparatively slow circulation of the liquid under treatment through the pipes  $d d'$  and  $d^2 d^3$  and chambers  $B B'$ . Basins  $E E'$  collect the solid products of evaporation, and centrifugal pumps  $F F'$  serve to



lift said products into draining-tanks G G'. Arrows show the direction in which the currents move. Reference to other parts will be best made in describing this operation, which is as follows: The open tanks A A' are nearly filled with the liquid to be evaporated, as is also the condensing-tank A<sup>2</sup>, a portion only of which is shown. After the vacuum-pump P has exhausted the air in chambers B B', through its connections with said chambers by pipes p p' and coils C' C<sup>2</sup>, to such extent as to raise the liquid-level in the vacuum-chambers to the required height, steam is admitted by valve s in pipe S to heating-coil C. As the liquid in chamber B becomes heated, it gives off vapor, which is drawn through pipe c into coil C', and any vapor which remains uncondensed in flowing through this coil passes out through pipe p to be discharged by vacuum-pump P. In like manner, vapor arising from liquid in chamber B', heated by coil C', is drawn through pipe c' into condensing-coil C<sup>2</sup> in tank A<sup>2</sup>, and thence through pipe p' into pump P. Centrifugal pumps D D' are employed for the double purpose of creating a circulation over heating-coils C C', so as to promptly carry away heat from the coils and to prevent collection of solid matter thereon, and also to carry away all precipitated matter into basins E E', by means of the current thereby created, through the passages e e'. The converging sides e<sup>11</sup> e<sup>22</sup> of the lower portion of the chambers serve to collect at the point of discharge all deposited material. As the latter is flushed through passages e e' into basins E E', it is gradually gathered to the centers of the basins by the rotary or vortex motion of the liquid, and here subsides to the bottom by reason of the comparatively quiet condition of the liquid at the centers of the basins. This slow circular motion of the liquid, creating a vortex or whirlpool action, is contributed to by both the shape of the basins and the position of the passages which discharge into them.

As shown by dotted lines to the left and in section on the right of Fig. 2, the discharge-openings are at one side of the circular basins, which arrangement has the effect of injecting the liquid around the sides of the basins, thereby giving it a whirling motion. As is well known, such motion when sufficiently slow always draws floating solid matter to the center of revolution and at the same time sucks it downward. In this case the walls e<sup>3</sup> e<sup>4</sup> of the basins E E' converge toward the bottom, assisting to bring the solid matter within the influence of suction-pipes f f', by which said matter is drawn up through pumps F F' and delivered through pipes f<sup>2</sup> f<sup>3</sup> into draining-tanks G G'. The latter are provided with double bottoms, as shown at g in tank G. The mingled liquid and solid matter is separated by draining the former through the double bottom (which is fitted with holes of suitable size) and returned to tanks A A' by pipes g' g<sup>2</sup>.

I am aware that in my patent, No. 426,140, dated April 22, 1890, I set forth the use of a forced circulation of brine for augmenting evaporation for a given amount of heating-surface; but in that case the heating-surface is situated outside of the vacuum-chamber, whereas in the present case I expressly limit myself to the use of the forced circulation of the liquid in contact within the vacuum-chamber.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. In apparatus substantially as and for the purpose set forth, the combination of a supply-tank, a vacuum-chamber situated in or opening directly into said supply-tank, a heater situated in the interior of said vacuum-chamber, and means for maintaining a forced circulation of the liquid to be evaporated between said exterior supply-tank and the interior heating-surface in the vacuum-chamber.

2. In apparatus substantially as and for the purpose described, the combination, with a vacuum-chamber, of a collecting-basin communicating therewith by a passage which enters said basin in substantially a tangential line for the purpose of imparting a vortex movement to the liquid discharged from the vacuum-chamber.

3. In apparatus substantially as and for the purpose described, the combination, with a vacuum-chamber, of a collecting-basin formed with converging side walls and communicating with said vacuum-chamber by a passage which enters said basin in a line substantially tangential thereto for the purpose of collecting the heavier products of evaporation centrally in said basin.

4. In apparatus substantially as and for the purpose described, the combination of a vacuum-chamber, a heater situated therein, and a collecting-basin communicating with said vacuum-chamber by a passage which enters said basin in a line substantially tangential thereto for the purpose of imparting a slow rotary movement to the liquid discharged from the said vacuum-chamber.

5. In apparatus substantially as and for the purpose described, the combination of a vacuum-chamber, a collecting-basin communicating therewith by means of a passage which enters the said basin in substantially a tangential line, and means for maintaining a forced circulation of liquid between the interior of the said vacuum-chamber and said collecting-basin.

6. In apparatus substantially as and for the purpose described, the combination of a vacuum-chamber, a surface-heater contained therein, a collecting-basin connected with said vacuum-chamber by means of a passage which enters said basin in a line substantially tangential thereto, and means for maintaining a circulation of liquid between the said heating-surface in the vacuum-chamber and the said collecting-basin.



7. In apparatus substantially as and for the purpose described, the combination of a vacuum-chamber, a collecting-basin communicating therewith by means of a passage which discharges the contents of the vacuum-chamber into the said collecting-basin in a line which is substantially tangential thereto, and means for removing the heavier products of evaporation from the central portion of said collecting-chamber.

8. In apparatus substantially as and for the purpose described, the combination of a vacuum-chamber, a collecting-basin connecting therewith by means of a passage which discharges the contents of the vacuum-chamber into the said collecting-basin in a line which is substantially tangential thereto, and a discharge-pipe situated centrally in said collecting-basin and connected with means for drawing off the heavier products of evaporation.

9. In apparatus substantially as and for the purpose described, the combination of a vacuum-chamber, a collecting-basin communicating therewith by means of a passage arranged to discharge the contents of the vac-

um-chamber into said collecting-basin in a line which is substantially tangential thereto, an elevated draining-tank, means for drawing off and transferring the heavier products of evaporation from said collecting-basin and into said draining-tank, and means for returning the liquid constituent to the liquid-supply for the said vacuum-chamber. 30

10. In apparatus substantially as and for the purpose described, the combination of a vacuum-chamber communicating with an exterior supply-tank, a collecting-basin situated in said exterior supply-tank, means for heating the liquid to be evaporated and creating a forced circulation thereof between said exterior tank and the vacuum-chamber, an elevated draining-tank, and means for transferring the heavier products of evaporation thereto, and a conduit for returning the liquid constituent from said draining-tank to said exterior supply-tank. 40 45

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