

(No Model.)

2 Sheets—Sheet 1.

J. P. R. POLK.

APPARATUS FOR EVAPORATING ALKALINE SOLUTIONS.

No. 305,631.

Patented Sept. 23, 1884.

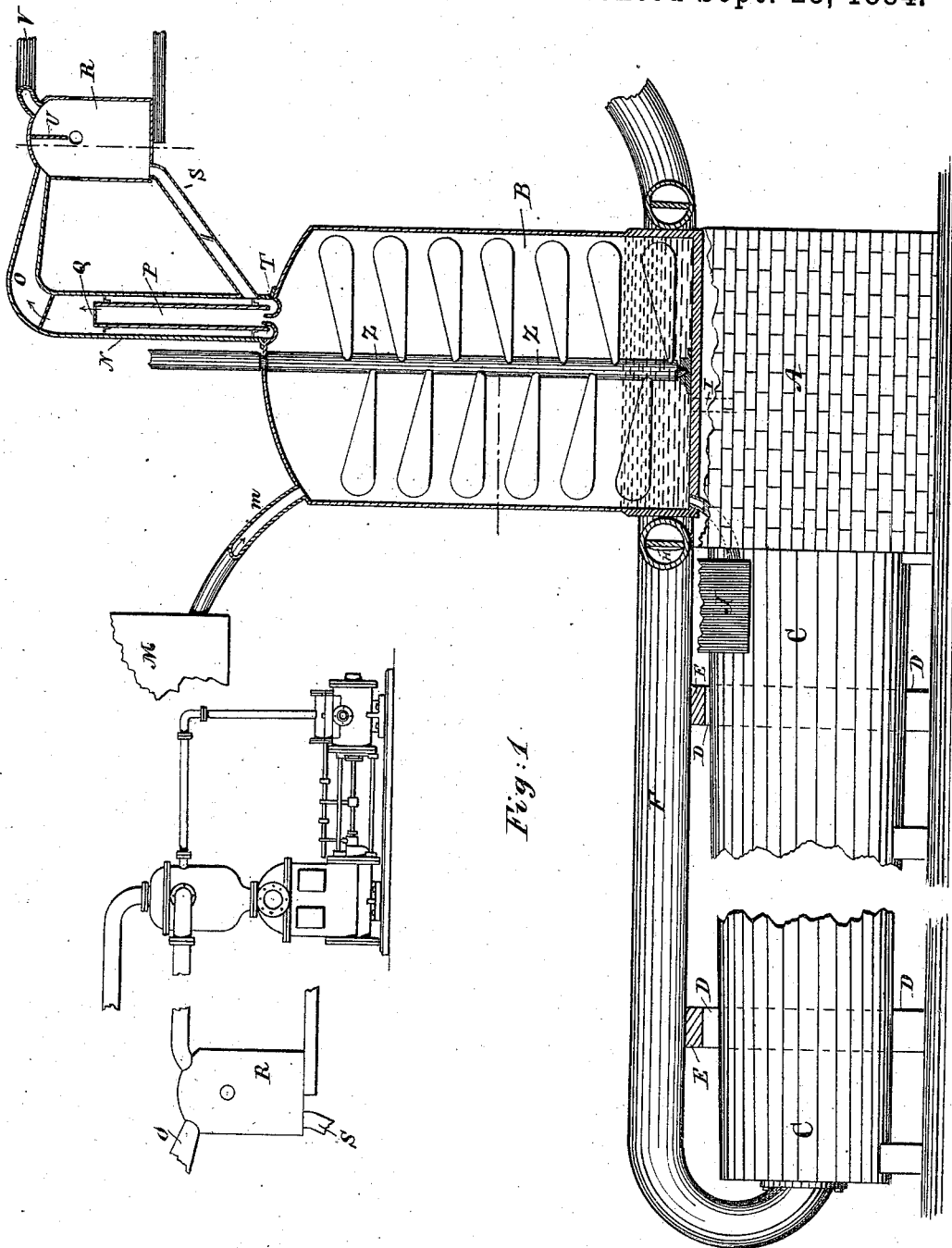


Fig. 1.

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(No Model.)

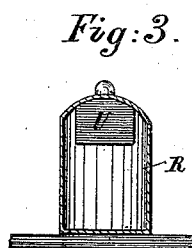
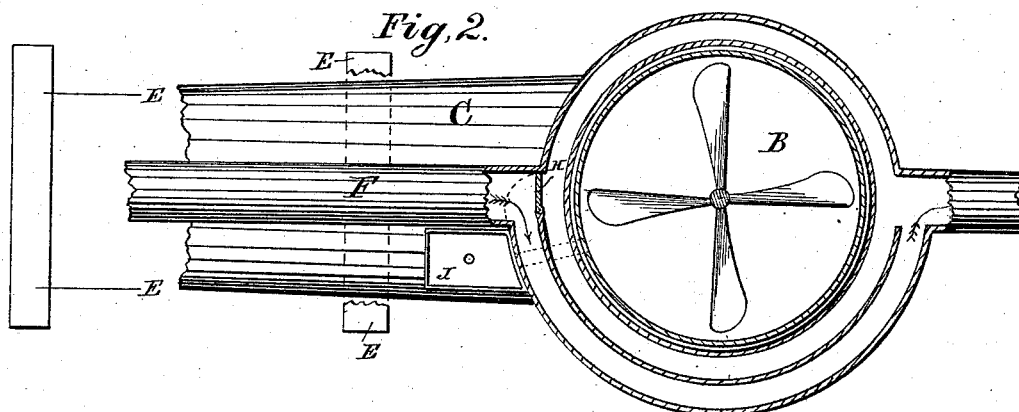
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2 Sheets—Sheet 2.

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# UNITED STATES PATENT OFFICE.

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## APPARATUS FOR EVAPORATING ALKALINE SOLUTIONS.

SPECIFICATION forming part of Letters Patent No. 305,631, dated September 23, 1884.

Application filed April 28, 1883. (No model.)

*To all whom it may concern:*

Be it known that I, JOHN P. R. POLK, a citizen of the United States, residing at Wilmington, in the county of New Castle and State of Delaware, have invented certain new and useful Improvements in Vacuum-Pans and Apparatus for Evaporating Alkaline and other Solutions, and the Desiccation of any Materials Containing Moisture, of which the following is a specification.

My invention relates to improvements in apparatus intended more especially for the evaporation and concentration of alkaline solutions, though it is applicable to any furnace or apparatus employed for the expulsion or evaporation of water or other liquid from any material.

My invention relates, primarily, to an improvement on the calcining-furnace of H. S. Firman, described in an application for patent contemporaneous herewith, by means of which the liquid-reservoir or evaporating-pan is maintained at a greater heat by means of surrounding the evaporating-pan, preferably as high as the liquor therein contained, with a flue carrying off the waste products of combustion from the igniting and calcining furnaces.

My invention also relates to means, herein-after more fully described, for preventing the liquid from being forced over by ebullition into the condenser.

In order that my invention may be more fully understood, I will first describe it with reference to the accompanying drawings, and then point it out more particularly in the claims.

In the drawings, Figure 1 represents a side elevation of my improved apparatus, part being in vertical section. Fig. 2 is a plan view thereof, partly in section; and Fig. 3 is a sectional view of the boil-over reservoir detached.

A may represent any suitable furnace, here shown as being employed both for the purpose of heating the liquid in evaporating-pan B and at a latter period of the process of recovery of soda-ash or other alkali, igniting and aiding the combustion of material in the calcining-furnace C. On each side of the fur-

nace C are placed standards D, supporting 50 girders E, which carry a flue, F, of suitable refractory material. Through the flue F the waste products of combustion issuing from the calcining-furnace are led, as shown, over the furnace and around the vacuum-pan B. Upon 55 one side of the pan the flue is double, and a damper, H, permits the direction of the heated gases either against or around and away from the pan.

Instead of the girder-supports shown, I may 60 employ a simple arched support, or, if a horizontal stationary furnace be used, may support the flue directly on top of the furnace. From the flue F the gases are led to the stack.

The vacuum-pan B may be either vertical, 65 as shown, or horizontal, and is preferably provided within with agitators Z, of any approved construction—perpendicular or horizontal. It may either connect immediately with the furnace through pipe I, or may connect with an 70 intermediate reservoir, J, from which the material may be discharged into the furnace. The pan is charged through pipe m from reservoir M, in ordinary manner. On top, at any suitable part of the pan, I place the vapor-discharge pipe N, and within this pipe, to 75 prevent the carrying over by ebullition of bubbles of the liquid into the condenser, I place a diaphragm, O, or system of diaphragms of wire-gauze, which break the bubbles, while 80 allowing free passage of the vapor and facilitate the return of the liquid to the evaporating-pan. To facilitate the return of the liquid on the bursting of the bubbles against the upper diaphragm, O, I place within the pipe N a 85 second pipe, P, having upon its upper end a second diaphragm, Q, of wire-gauze to still further arrest the bubbles. The liquor from bubbles bursting against the upper diaphragm (or diaphragms, if a number be employed,) is 90 returned around the pipe P to the vacuum safe or trap T, whence it flows back into the pan. The pipe N is led into a boil-over chamber, R, whence the liquid is returned to the pan through pipe S. A circular flange, 95 around the bottom of pipe N, into which pipe P dips, arrests sufficient of the return liquid to make a vacuum-safe at this point, and pre-

vent the drawing of the vapor through pipe S.

To further interrupt the course of any liquid material which may be drawn over, I employ a flange, U, depending from the top of the  
5 boil-over reservoir, and having at each side space to allow sufficient vapor to pass, whatever may be the height of the liquid in the reservoir. This is shown more clearly in Fig. 3. From the boil-over reservoir a pipe, V,  
10 leads through a condenser, W, of any construction, to the vacuum-pump, or other suitable exhaust, *v*. This combination of evaporating-pan with a forced exhaust, with or without  
15 agitators and with or without condensers, and an interposed bubble-breaker produces a strong and effective evaporator, working with great speed without the passage of any liquid  
20 over into the condenser. An agitator should generally be employed, as it greatly increases the rapidity of evaporation, and is an important  
25 improvement over the ordinary vacuum-pan. By my method the heat from the calcining-furnace and lighting-furnace heats the bottom of the evaporating-pan, while the  
30 return-flue heats the sides thereof to the height of the liquor therein contained, thus more fully utilizing the waste heat, and saving all  
35 coal expenditure for boiling the soda in the process of evaporation, a larger portion of the waste heat from the incinerating-furnace resulting from the combustion of organic matter in the soda. The vacuum-pump also takes  
40 the place of a large quantity of coal by utilizing to the highest degree the heat generated. Having thus described my invention, the following is what I claim as new therein and  
desire to secure by Letters Patent—

1. The combination, with a suitable evaporating and calcining furnace, of the return-  
40 flue having branches surrounding the sides of the evaporating-pan, substantially as set forth.

2. The combination, with a suitable evaporating and calcining furnace, of a return-flue

having branches surrounding the evaporating-pan, said branches being divided centrally  
45 and provided with a suitable damper, as set forth.

3. In combination with a direct vapor-discharge pipe, the ebullition-guard consisting  
50 of one or more diaphragms of wire-gauze placed transversely in said pipe, substantially as described.

4. The combination, with an evaporating-vessel or vacuum-pan, of the vapor-discharge  
55 pipe, having one or more perforated diaphragms arranged therein, and an interior pipe concentric therewith and having a similar diaphragm, and the flange forming a vacuum-safe, in the manner set forth.

5. In combination with the vapor-discharge  
60 pipe and a boil-over reservoir, the pendent flange therein, serving to arrest and precipitate liquid passing through the reservoir, whence it is returned to the evaporating-pan  
65 by a suitable pipe emptying into a vacuum-safe, substantially as set forth.

6. The combination of an evaporating-pan, an ebullition-guard in the exhaust-pipe thereof,  
70 and vacuum-pump, or other force-exhaust mechanism, substantially as set forth.

7. The combination of an evaporating-pan having suitable means of agitation, an ebullition-guard in the vapor-exhaust pipe thereof,  
75 and a vacuum-pump, or other force-exhaust mechanism, substantially as set forth.

8. The process herein described of concentrating alkaline solutions, consisting in first  
80 evaporating the solution *in vacuo* until it attains the consistency of molasses, and then conducting it to a calcining-furnace for the incineration of the organic matter, substantially in the manner herein set forth.

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Witnesses:

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