J. Howarth,

Evaporator.

No. 112,347. Patented Mar. 7. 1871.

Fig. 2.

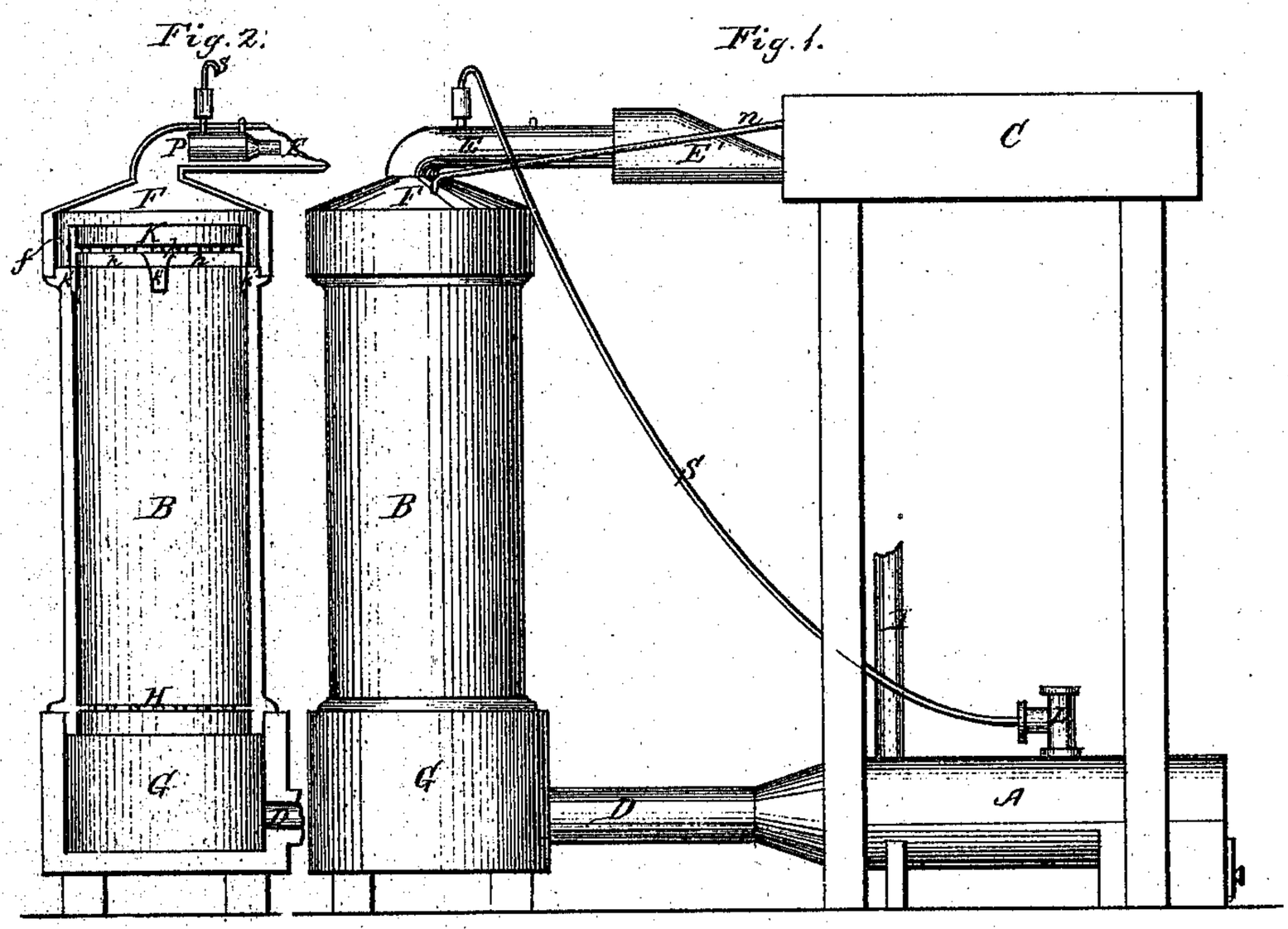
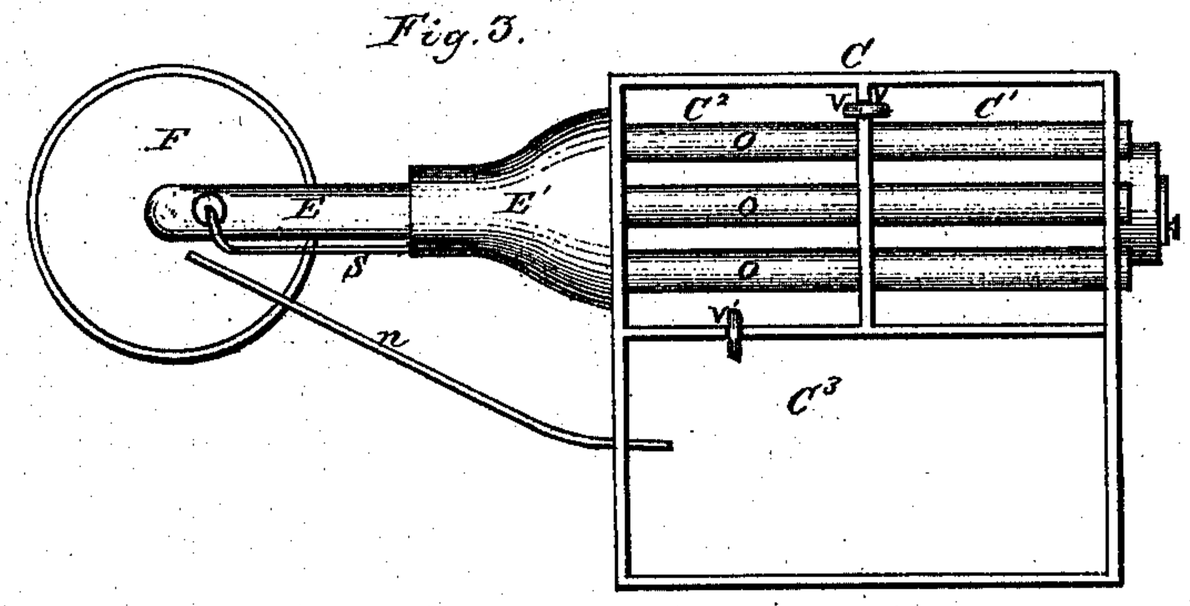


Fig. 1.

Fig. 3.



WITNESSES.

Charles F. Brown,

J. O. Hayden

INVENTOR.

John Howarth.

by his attorney—

Cawd D. Wright

UNITED STATES PATENT OFFICE.

JOHN HOWARTH, OF SALEM, MASSACHUSETTS.

IMPROVEMENT IN APPARATUS FOR EVAPORATING AND CONCENTRATING LIQUIDS.

Specification forming part of Letters Patent No. **112,347**, dated March 7, 1871; antedated March 1, 1871.

I, JOHN HOWARTH, of Salem, in the county of Essex and State of Massachusetts, have invented certain Improvements in Apparatus for Evaporating and Concentrating Liquids, of which the following is a specification:

Figure 1 is a side elevation of my invention. Fig. 2 is a sectional elevation of the column B, and Fig. 3 a plan view.

The object of this invention is to produce a rapid concentration and evaporation of liquids, such as sulphate of iron, sulphate of copper, &c., with a view to the crystallization of the same by the utilization of the utmost amount of heat employed; and it consists, mainly, of a vertical column or reservoir provided with two perforated transverse partitions and filled between the same with coke or other porous material, below which is a chamber or cistern connected with a pipe or flue from the smoke-box of a steam-boiler, the products of combustion from which pass upward through the coke into a horizontal tube containing an injector, to which steam is admitted from a boiler, and, passing through said injector, is forced, together with the products of combustion, from the furnace through the tubes passing through tanks containing the fluid to be treated.

In the drawing, A represents a steam-boiler, provided with safety-valve L and smoke-pipe D, which latter communicates with a circular chamber or cistern, G, which is surmounted by a cylindrical column or tower, B. This latter is provided with a cap, F, from which passes a horizontal pipe, E.

H represents the perforated bottom of column B, and K represents a circular pan or vessel, provided with a perforated bottom, *k*, and legs *k'*, which rest on the top of column B, leaving spaces *h* between the vessel K and column B. The space between perforated bottom H and vessel K is filled with coke or other porous material. Between the vessel K and cap F is an annular space, *f*.

P represents an injector patented by me March 1, 1870, inclosed in the pipe E, and connected with the boiler A by a pipe, S.

The pipe E terminates in the flaring portion E', which communicates with the parallel pipes O. These latter are located in the bottom of the tank C, and pass through the same, as shown in Fig. 3. The tank C is divided into three compartments, C^1 C^2 C^3, the part C^1 being connected to C^2 by a siphon-pipe, V, and C^2 to C^3 by siphon-pipe V'.

Operation.

The steam generated in the boiler A is transmitted through the pipe S to the injector P, and, rushing through the same and tube E, exhausts the air from the column B, the latter being partially filled with coke, as above described. The exhaustion of the column B will cause the heated products of combustion from boiler A to rush through pipe D into chamber G and upward through column B into pipe E, where it mingles with the steam from injector P, and is forced through pipes O, superheating the steam, and passing out of the opposite ends of said pipes into the air. The fluid to be treated is placed in the compartment C^1 of tank C, from whence it flows through siphon V into compartment C^2. In these two compartments it is heated by the pipes O, and then flows into compartment C^3, from whence it flows through the pipe *n* into the vessel K in the upper part of column B, through the perforated bottom of which it falls into the coke or other porous filling of the column B, and, percolating through the same, its volatile portions are evaporated by the heated products of combustion which are passing upward, as above described. After passing through the column the concentrated fluid falls through the perforated bottom H into the chamber G, from whence it may be drawn into suitable vessels for crystallization. In case, however, the fluid is not sufficiently concentrated, it may be pumped back into the compartment C^3 and be allowed to pass through the column again. This operation may be repeated as often as the nature of the fluid requires.

The porous filling in the column B presents a wide extent of heated surface to the falling liquid, while the material readily absorbs heat from the products of combustion. Charcoal, pumice-stone, brick, wood chips, or shavings, &c., may be used in place of coke; but I prefer the latter.

The object of the subdivision of the tank C is to insure the uniform heating of the fluid to

a given degree, and the division C^1, being nearer the outer ends of pipes O, does not receive as much heat as the division C^2, at which point the temperature is highest, and wherein the fluid is heated to the temperature which it is necessary to have before it flows into the column B.

The apparatus is designed for the treatment of fluids which are not injured by contact with the products of combustion, such as sulphate of iron, sulphate of copper, &c., while for fluids which are liable to injury from such contact, I employ an apparatus which is the subject of a separate application of the same date.

It will be seen that from this arrangement I derive a twofold use of the heated products of combustion: first, in heating the fluid as it percolates through the porous filling of the column B, and, second, in heating the fluid in the divisions C^1 C^2 of tank C by passing, together with the steam from injector P, through pipes O.

The tank C must be constructed of sufficient length to derive all the heat from the waste products passing through pipes O that can be practically absorbed.

The transferring of the liquid from one division of the tank C to another by means of the siphons serves to precipitate impurities contained therein before passing into the evaporating-column.

Having thus fully described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. The combination of the boiler A, pipe D, and cistern G, substantially as described.

2. The combination of the boiler A, pipe D, cistern G, and column B, substantially as described.

3. The column B, having perforated bottom H and perforated vessel K, and cap F, as and for the purpose set forth.

4. The combination of the injector P, pipe S, boiler A, pipe D, cistern G, and column B, substantially as described.

5. The combination of the last combination with the pipes E E′ and tank C, substantially as described.

6. The tank C, constructed in compartments C^1 C^2 C^3, connected by siphon-pipes V V′, and having pipes O running through the bottom, substantially as described.

7. The combination of the tank C, constructed substantially as described, pipe *n*, and column B, by which means I precipitate the impurities contained in the hot liquid to be evaporated, and whereby this liquid is purified before passing to and through the evaporating-column, thus securing the greatest economy of the evaporating agent.

8. The combination of the steam and the waste products of combustion, and by the means substantially as described, for heating and evaporating liquids.

9. The process described, whereby I am enabled to use the heat from the waste products of combustion twofold—that is, in heating the liquid in tank C and in evaporating or concentrating the same liquid when passing through the column B, the porous filling of which is first heated by the products of combustion passing through the coke or other agent on its way to the pipes in the bottom of tank C, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

JOHN HOWARTH.

Witnesses:
CARROLL D. WRIGHT,
CHARLES F. BROWN.