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L. D. HOBSON & H. E. BLAIR.

EVAPORATING APPARATUS.

(Application filed Nov. 1, 1897.)

(No Model.)

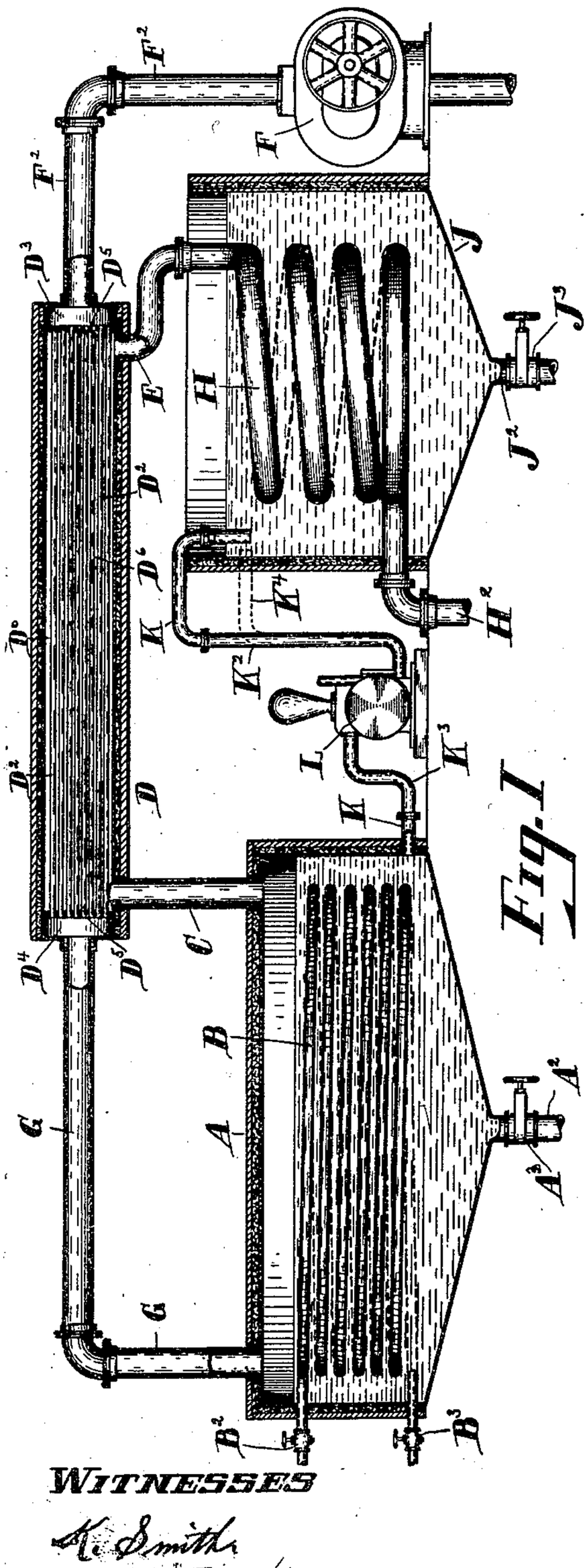

Fig. 1

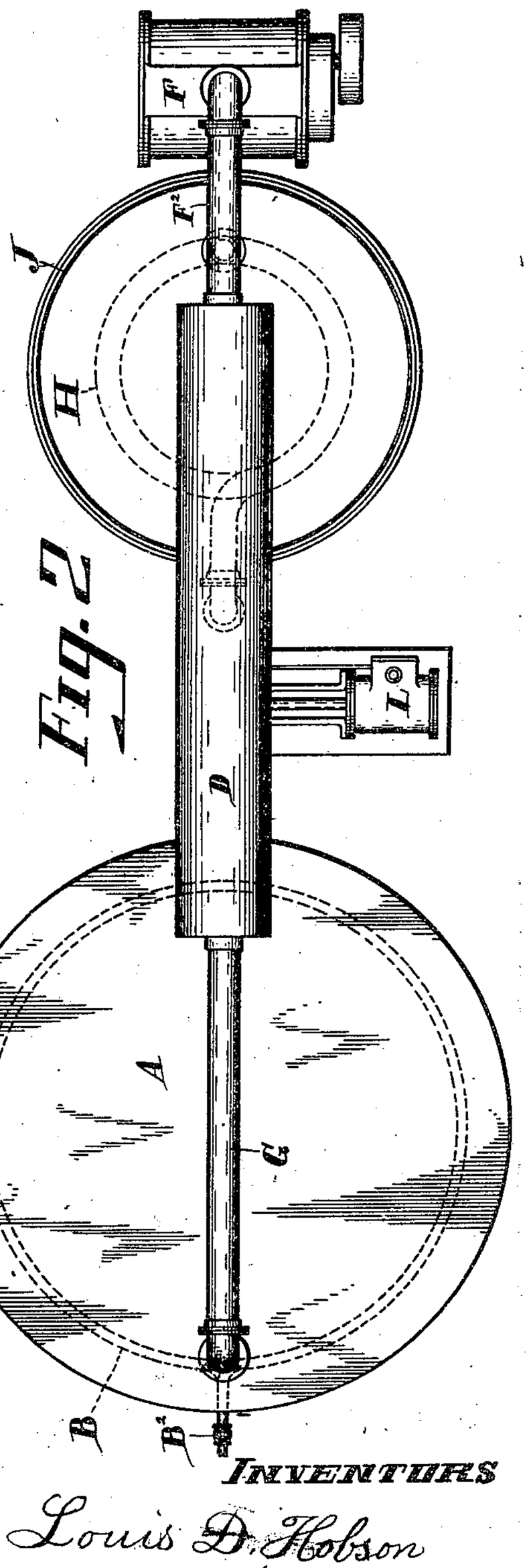

Fig. 2

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UNITED STATES PATENT OFFICE.

LOUIS D. HOBSON AND HERMAN E. BLAIR, OF CINCINNATI, OHIO.

EVAPORATING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 616,187, dated December 20, 1898.

Application filed November 1, 1897. Serial No. 657,024. (No model.)

To all whom it may concern:

Be it known that we, LOUIS D. HOBSON and HERMAN E. BLAIR, citizens of the United States, and residents of the city of Cincinnati, in the county of Hamilton and State of Ohio, have invented certain new and useful Improvements in Mechanism for the Manufacture of Salt, of which the following is a specification.

The several features of our invention and the various advantages resulting from their use conjointly or otherwise will be apparent from the following description and claims.

In the accompanying drawings, making a part of this application and in which similar letters of reference indicate corresponding parts, Figure 1 is a view, partly in side elevation and partly in vertical central section, of an apparatus illustrating our invention. Fig. 2 is a plan view of the apparatus.

The primary object of our invention is to economize heat employed in the evaporation of the liquid of the brine, and we accomplish this by the utilization of the heat which would otherwise be wasted.

We accomplish our object by our invention, which is as follows:

A indicates the vessel in which the evaporation of the water or liquid from the salt brine is effected. This vessel has a bottom inclined, preferably, from all sides downward toward the center, and there at its lowest point is provided with a large exit-pipe A^2, having a valve A^3, which latter controls the passage of salt, &c., through this pipe A. To facilitate this evaporation and cause the same to take place rapidly, we provide a series or coil of pipes B, which we locate in the vessel A below the height at which the liquid is maintained in said vessel. We transmit steam through this pipe. We provide this heating-pipe B with a valve B^2, outside of the entrance of the pipe into the vessel A, and we also provide this pipe B with a valve B^3 outside of the point where the pipe leaves the vessel. Thus the amount of steam to enter the pipe is regulated by the valve B^2, and the steam and any condensation of water in the pipe are held back in the pipe, as desired, by the valve B^3. In the ordinary process of evaporating brine the vapor therefrom is allowed to pass into the open air and disappears therein. When the vessel is an open one, the vapor passes directly into the open air above; but where the vessel is closed the vapor passes out through the free end of an escape or exit pipe C into the open air.

In our invention the vessel A is closed, and we provide an exit-pipe C and connect it to the upper part of the vessel A, but we do not allow the vapors therefrom to pass into the open air. On the contrary, we employ the heat of these vapors and the air which we introduce purposely therewith to heat the brine preparatory to introducing it into the vessel A and also to heat the air, which we introduce into vessel A for a purpose hereinafter obvious. To the aforementioned ends we provide a drum or heater containing a case or cylinder D containing numerous parallel pipes or flues D^2. At each end of the cylinder D is a chamber, one of which is indicated by the character D^3 and the other by D^4. These chambers are formed by diaphragms D^5, extending across the cylinder as does a head and separating the space on one side of the diaphragm from that on the other side. The ends of the tubes or flues D^2 are at their respective ends connected to perforations in these diaphragms after the manner of a tubular boiler, and thus establish communication between the chamber D^3 and the chamber D^4. Between the diaphragms D^5 is formed a long chamber D^6, whose area is to an extent occupied by these flues. We establish communication between this chamber and the vapor, &c., area of the vessel A, and we do this by connecting what would otherwise be the free end of the exit-pipe C with this chamber D^6. To the other end of this chamber we connect an exit-pipe E. In order to establish a definite and reliable and uniform circulation as desired of vapor, &c., from the vessel A into and through the chamber D^6 and thence out of the same by way of an exit, as E, we connect the chamber D^3 with an air-pump F by means of an air-pipe F^2 and we connect the chamber D^4 with the vapor-space of the vessel A by means of a conduit G. The place where this conduit G enters the vessel A is preferably for obtaining the most advantageous results located at a point farthest from where the conduit-tube C is connected to the vessel A. Thus air en-

tering from conduit G is compelled to travel across the chamber before entering the tube C. When the blower is started, the waste heat from the vapor and air passed through exit-pipe C and filling the chamber D^6 and surrounding the tubes D^2 heats them, and consequently have given off much of their heat before passing out through exit-pipe E. These heated pipes D^2 communicate their heat to the air passing from the blower through them, and thus the heat in vessel A is increased by the heat thus introduced. This fact will be the better appreciated when we state, as we now do, that by accurate tests when the temperature of the air entering the chamber D^3 is 40° Fahrenheit the temperature of the same air when entering chamber D^5 (at the other end of the heater D) is 170° Fahrenheit; but we utilize the heat yet remaining in this vapor, &c. We connect the exit-pipe E with the upper end of a worm H, located in a vessel J, the lower end of the worm passing out of the lower portion of the vessel in an exit-pipe H^2. The bottom of this vessel has preferably an inclined bottom similar to that of vessel A, and in the lowest point thereof is an exit or delivery pipe conduit J^2, controlled by a valve J^3.

In the process of evaporating the brine a certain amount of salt will be deposited in the vessel J, and this will at proper intervals of time be withdrawn through the conduit J^2.

The top of the worm is below the line where the upper surface of the liquid in the vessel J is maintained. This liquid is brine.

A conduit-pipe K has its inlet or mouth in the upper part of vessel J below the level where the brine reaches and has its outlet end connected to the lower portion of vessel A, as shown. A pump L (shown conventionally) is located in the pipe K and operates to draw the brine from vessel J through the first portion K^2 of pipe K and force it through the second portion K^3 of pipe K into the vessel A. The vapors, &c., coming through pipe E pass through worm H and give off their heat, and then in a comparatively cold condition pass out into the waste exit-pipe H^2.

In case the vessel J be located at an altitude above the vessel A the brine from vessel J can be conducted to vessel A by means of gravity and the pump L be dispensed with. In such event the branch pipe K^2, unless employed as a siphon, will take the course indicated by dotted lines K^4, and a controlling-valve will take the place of the pump.

A summary of the entire process is as follows: Both of the vessels A and J are filled with brine to their regulation height. Steam is then admitted to the heating-coil B. The blower F and the pump L are started. The steam in the coil gradually heats the brine A to the boiling-point. In the meantime the air introduced by the blower F through the pipe G comes in contact with the vapor rising from the brine. This air also itself absorbs a certain amount of the liquid of the brine in the vessel, and thus it moves, carrying whatever liquid it has itself taken up and blowing along with it the vapors it cannot thus absorb, and entering the drum. To the latter by contact is imparted much of the heat present in the vapor and air, and the temperature of the drum is raised. The fresh air entering and passing through the drum D is consequently raised in temperature and carries this heat into the vessel A. Meantime the air carries the vapor not condensed in the drum on into vessel J and through the coil H. There it gives off its remaining extra heat and issues from the waste exit-pipe H^2. The temperature of the brine in vessel J is thus raised. As the liquid of vessel A decreases in bulk by reason of evaporation the deficiency thus occurring is supplied from the vessel J, the warm brine in the latter being supplied so as to keep the vessel A full to the regulated height. As these various processes are continued the temperature of the drum rises and so does that of the brine in vessel J until all parts are as hot as their maximum working capacity will permit. As fast as the salt forms in sufficient quantities in the lower portion of vessel A it is withdrawn.

Where a steam-engine is employed to operate the blower and pump, (when latter is present,) we preferably utilize the waste steam from the engine by passing it through the piping B of vessel A, and so far as obtainable waste steam is desirable for heating this piping.

While the drum or heater is preferably of the description shown, it may be of other constructions, so long as it performs the function of utilizing the waste heat of the vapor and air from the vessel A.

Of course that feature of our invention which consists of the drum and blower and their connections and their combination with vessel A may be used without the worm H, &c., of vessel J, and the worm H might be used without the drum and blower, being connected directly to the vessel; but such an omission would largely reduce the advantages of our invention, which primarily includes all of the apparatus, combined substantially as we have shown and described it.

What we claim as new and of our invention, and desire to secure by Letters Patent, is—

1. The combination of the brine-evaporating vessel, and steam-piping therein, and a vapor and gas exit pipe C, and an air-inlet pipe G and an air-drum or air-heater D, having tubes, and connected to the pipes C and G, so located that both pipes C and G enter the vessel A in planes above where the surface of the liquid therein is maintained, and a blower connected to the air-heater, substantially as described, and an exit-pipe E from the blower, all adapted for enabling the heater to carry air through the air-heater to the evaporating vessel A and thereby reconvey to vessel A and its contents the heat pass-

ing out from vessel A in its vapors and gas through the outlet-pipe C, such heat being communicated to the air-heater and said air from the blower as it passes through the air-heater, and before said vapors and gas pass out of the air-heater through exit-pipe E, substantially as and for the purposes specified.

2. The combination of the brine-evaporating vessel, and steam-piping therein, and a vapor and gas exit pipe C, and an air-inlet pipe G and an air-drum or air-heater D, having tubes, and connected to the pipes C and G, so located that both pipes C and G enter the vessel A in planes above where the surface of the liquid therein is maintained, and a blower connected to the air-heater, substantially as described, and an exit-pipe E from the heater, all adapted for enabling the blower to carry air through the air-heater to the evaporating vessel A and thereby reconvey to vessel A and its contents the heat passing out from vessel A in its vapors and gas through the outlet-pipe C, such heat being communicated to the air-heater and said air from the blower as it passes through the air-heater, and before said vapors and gas pass out of the air-heater, through exit-pipe E, and a brine vessel J, having a conduit of piping through it, this piping being connected to the exit-pipe E, from the heater, and means for conveying the brine from vessel J to vessel A, substantially as and for the purposes specified.

3. The combination of the vessel A, having interior steam-piping, and having the air-inlet pipe G, and the vapor and air exit pipe C, and the drum or heater D, having diaphragms D^5, and end chambers D^3, D^4, and tubes from diaphragm to diaphragm, and the chamber D^6 between the diaphragm, into which conduit C enters, the blower, and tube F^2 connecting the blower and chamber D^3, chamber D^4 being connected to pipe G, and the exit-pipe E from chamber D^6, and a vessel J, having the piping H with exit, the outlet end of pipe E being connected to the inlet of pipe H and a conduit from the brine-chamber J to the vessel A, substantially as and for the purposes specified.

4. The combination of the vessel A having interior steam-piping, and having the air-inlet pipe G, and the vapor and air exit pipe C, and the drum or heater D, having diaphragms D^5, and end chambers D^3, D^4, and tubes from diaphragm to diaphragm, and the chamber D^6 between the diaphragm, into which the conduit C enters, the blower, and tube F^2 connecting the blower and chamber D^3, chamber D^4 being connected to pipe G, and the exit-pipe E from chamber D^6, and a vessel J, having the piping H, connected to the outlet of pipe E, and itself provided with exit H^2, and a conduit from the upper portion of the brine-chamber J to the lower portion of vessel A, and a pump L in said conduit, substantially as and for the purposes specified.

5. The combination of the brine-evaporating vessel, and steam-piping therein, and vapor and gas exit pipe C therefrom, and an air-inlet pipe G thereto both conduits C and G being connected to the upper portion of the vessel, and an air-heater distinct from the brine-evaporation vessel, and a blower, the air-heater having a compartment connected with the blower and with the air-inlet pipe G, and a second compartment connected to the exit-pipe C, and having an exit-pipe, the first two compartments arranged in conjunction for enabling the air passing through the first compartment to receive heat by transmission from the hot vapor and gas in the second compartment, substantially as and for the purposes specified.

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Attest:
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