G. C. WESTBY.

EVAPORATOR.

APPLICATION FILED AUG. 17, 1915.

1,250,258.

Patented Dec. 18, 1917.

2 SHEETS—SHEET 1.

Fig. 1.

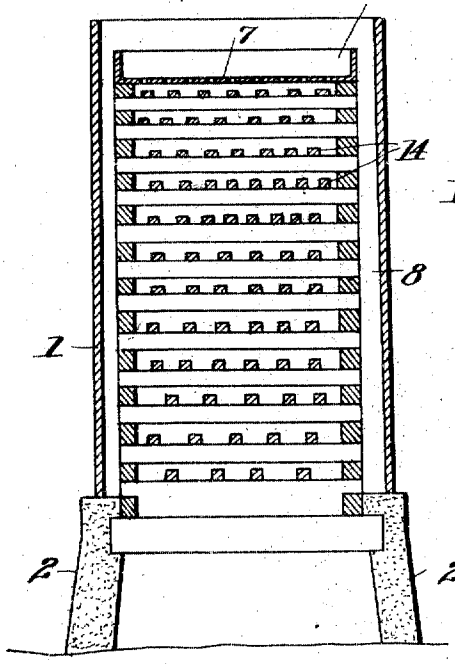


Fig. 3.

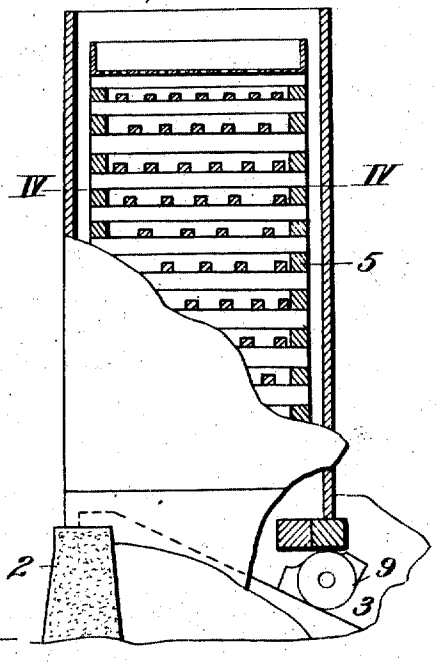


Fig. 2.

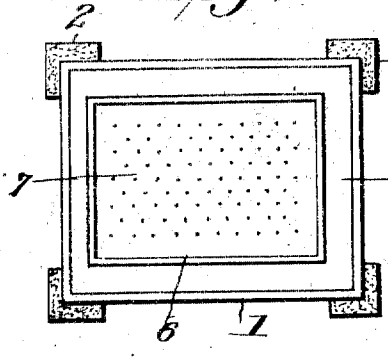
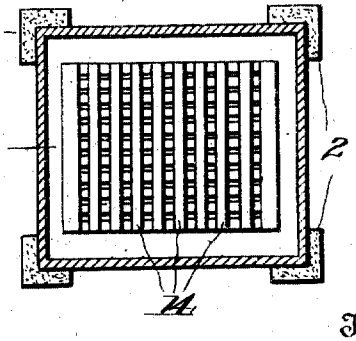


Fig. 4.



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2 SHEETS—SHEET 2.

Fig. 5.

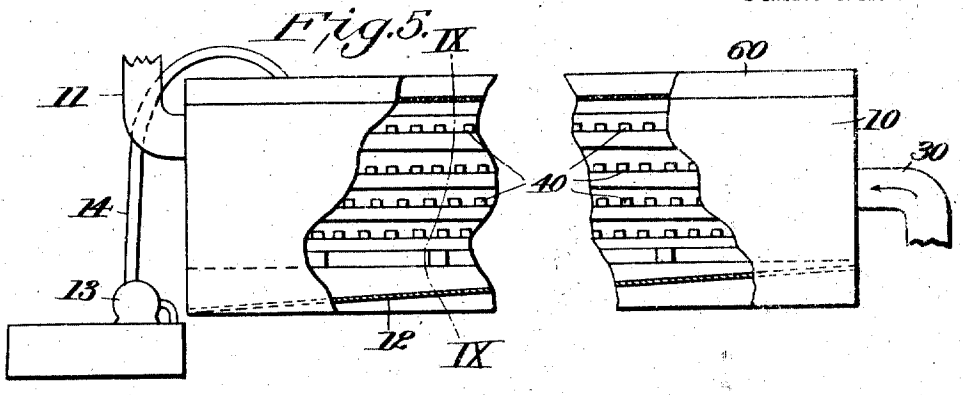


Fig. 6.

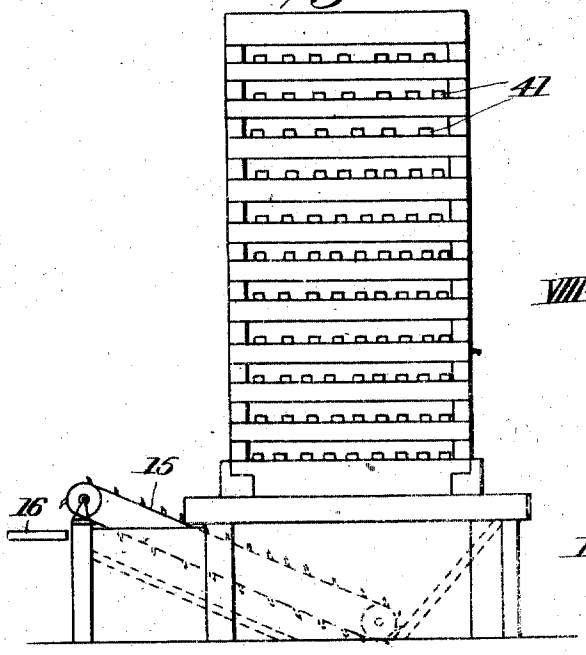


Fig. 7.

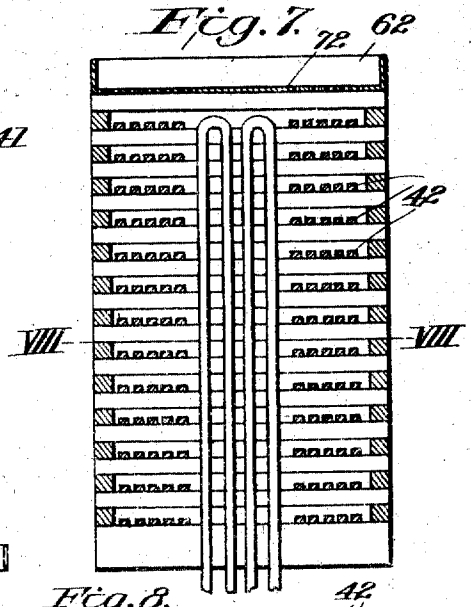


Fig. 8.

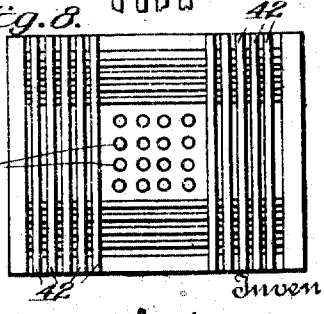
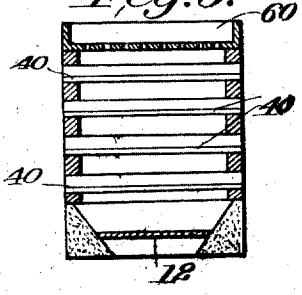


Fig. 9.



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UNITED STATES PATENT OFFICE.

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EVAPORATOR.

1,250,258. Specification of Letters Patent. Patented Dec. 18, 1917.

Application filed August 17, 1915. Serial No. 45,918.

To all whom it may concern:

Be it known that I, GEORGE C. WESTBY, a citizen of the United States, residing at Ludwig, in the county of Lyon and State of Nevada, have invented certain new and useful Improvements in Evaporators, of which the following is a full, clear, and exact specification.

This invention relates to a device for evaporating solutions of chemical salts, bases or acids, and has for its object to provide means for this purpose adapted to utilize circulating air, winds, heated gases of combustion, or sulfurous furnace smoke as the evaporating or vaporizing medium, whereby the desired result may be economically attained.

The peculiar value of this device in metallurgy is due to the fact that it is constructed principally of wood, a substance which is easily secured and which, when kept wet, permits of contact by such solutions as copper sulfate, iron sulfate, and even sulfuric acid without appreciable deterioration. Hitherto, where it has been desirable to evaporate dilute salt solutions, or in fact any solution used in hydro-metallurgy, to a state of concentration, the cost of evaporators made of iron or of materials resistant to such chemicals as sulfuric acid or copper sulfate, has been prohibitive of general use. Aside from this, the cost of the fuel necessary for operating such evaporators has rendered them inapplicable to those cases where large quantities of solutions must be cheaply evaporated in order to render the process commercially possible.

This invention contemplates the provision of an extremely large surface, over which thin, flowing films of the liquor are urged by gravity against air or gaseous currents. It is very desirable although not vitally necessary that the air or gases be heated so that their capacity for absorbing moisture be at the economic maximum, and that the heated air or gases be admitted at some point in the apparatus near the area of discharge of concentrated solution so that the concentration should proceed to a maximum in the lower zones of the apparatus through the increase of the solubility of the salt under treatment by means of heat, with a consequent removal from the solid phase and more rapid vaporization of water.

In operation, the solution which is to be concentrated is taken by means of a pipe or flume to a distributing device at the top of the apparatus. The liquor then falls into a grid or net-work of wooden slats, over the surface of which it spreads as a thin film as it falls in an interrupted shower to the bottom of the evaporator. The action of the wind or induced gaseous currents from heater or furnace flues blowing through the net-work causes rapid evaporation or vaporization of the film. In this manner the solution becomes more and more concentrated as it descends through the net-work. The amount of concentration depends, of course, on the height of the apparatus or the number of times the solution is passed through it, the physical and chemical constitution of the solution, its temperature, the heat and saturation of the gas currents, and the rate of flow of the solution and gases.

In the evaporation of $FeSO_4 \cdot 7H_2O$ to solid or crystalline form, the increasing concentration near the bottom of the apparatus results in the separation of fine crystals which are carried by the vaporizing current of mother liquor to a receiving tank from which they may be conveyed for further treatment if desired. If the water of crystallization is to be removed, a sufficient temperature must be maintained at the lower zone of the apparatus to insure the decomposition and vaporization of the water crystals. This, of course, may require the use of earthen ware slats at such points in the apparatus where charring might otherwise occur, and may also require mechanical cleaning of the bottom slats if the evaporation is complete.

The invention will be first hereinafter described in connection with the accompanying drawings, which constitute a part of this specification, and then more specifically defined in the claims at the end of the description.

In the accompanying drawings, wherein similar reference characters are used to designate corresponding parts throughout the several views:

Figure 1 is a vertical section through a

vertical type of evaporator constructed substantially in accordance with this invention and designed for utilizing heated air or smoke as the vaporizing medium.

Fig. 2 is a plan view thereof.

Fig. 3 is a side elevation of this evaporator, partly in section,

Fig. 4 is a horizontal section on the line IV—IV of Fig. 3,

Fig. 5 is a broken side elevation, partly in section, of a horizontal type of evaporator,

Fig. 6 is an elevation of a vertical evaporator designed for utilizing wind or circulating atmospheric currents as the vaporizing medium,

Fig. 7 is an elevation of another modified form of evaporator in which pipes are arranged for circulating steam, hot water or hot air through the net-work of slats,

Fig. 8 is a section of the line VIII—VIII of Fig. 7, and

Fig. 9 is a section on the line IX—IX of Fig. 5.

Referring first to Figs. 1 to 4, inclusive, 1 designates the outer casing or sheath which is mounted upon a suitable foundation 2 through which heated air or smoke is admitted at 3, Fig. 3. Arranged within the casing 1 and spaced from its sides are superimposed horizontal series of slats 4 which form the principal evaporating surface. These slats are cut to the smallest cross section consistent with that required to prevent appreciable bending by their own weight between supports. The horizontal series of slats are arranged to extend alternately at right angles to each other, and slats of alternate series which extend in the same direction are arranged out of vertical alinement so that the dripping of the solution from each of the upper series or layers of slats will splash onto and spread over and around the slats of the layers immediately below them. It is designed to include the greatest possible evaporating surface within the smallest space consistent with sufficient aerification and practical construction.

The horizontal layers of slats are spaced apart by blocks 5. At the top of the superimposed series of slats there is arranged a shallow box or tank 6 having a perforated bottom 7 for distributing the solution over the entire area of the top layer of slats. In some cases inlet flue 3 may also serve as a channel through which the residuum passes to the furnace (not shown) from which the drying air or smoke is derived. It will be noted that this heated air or smoke is hottest when it first enters the bottom of the evaporator, and that it may circulate freely up through the superimposed series of slats and around them in the space 8 within the casing 1. If desired, a fan or blower 9 may be used for forcing the heated gases through the apparatus. It is obvious that either reducing, oxidizing, or neutral gases may be conveniently driven into the evaporator in this way for maintaining or modifying the chemical constitution of certain solutions. As the greatest heating effect is nearest the bottom and progressively decreases as the gases pass upward in this form of apparatus, the solubility of most salts will be raised as the concentration of the solution increases.

In Figs. 5 and 9 a horizontal type of evaporator is shown, the same having a perforated pan 60 of greater relative area than the one shown in Figs. 1, 2 and 3. Each horizontal grid or series of slats 40 is of relatively greater area in this form of apparatus, so that it is not necessary to use as many of the superimposed layers as in the vertical type of evaporator. The heated air or smoke enters one end of the casing 10 via a pipe or flue 30 and escapes at the other end of said casing through a pipe 11 entering the same just below the distributing pan 60. In this instance, the residue is conveyed by an inclined trough 12 to an outlet at one end of the casing 10, instead of being discharged into the flue leading to the furnace or to a tank or vessel from which the crystals are later removed, as in the vertical form of apparatus previously described. In Fig. 5, 13 designates a suitable pump for forcing the solution through a pipe 14 into the distributing tank 60.

The apparatus illustrated in Fig. 6 is quite similar to that shown in Fig. 1, except that the outer casing is omitted, leaving the superimposed series of slats 41 open to the circulation of winds or atmospheric currents which may thus be utilized as the evaporating medium instead of heated air or smoke, although heated gases or smoke may be used also in this case. This form of apparatus is especially useful for recovering salt (NaCl) from sea water, where it is usually desirable that the solution be exposed directly to the wind and the separate crystals transferred by a suitable conveyer 15 to a drying floor 16 when the mother liquor containing impurities may be discharged.

As illustrated in Fig. 7, one or more spaces may be left up through the superimposed layers of slats, and pipes 17 arranged therein for the purpose of circulating steam, hot water, or hot air through the apparatus for accomplishing the vaporization of the solution more quickly and completely. The slats 42 in this form of the invention may be arranged as already described in connection with the other forms, except for the space or spaces in which the pipes 17 are placed. The distributing pan or tank 62 has its bottom 72 perforated only above the slats, the portion thereof above the space in which the pipes 17 are arranged being imperforate.

We do not confine ourselves to exact form of slats or arrangement of slats shown in

drawings. The drawings are merely to illustrate the general principles involved in the apparatus.

Having thus described my invention what I desire to secure by Letters Patent is:

1. In an apparatus of the character described, the combination with superimposed spaced layers of slats arranged with an open space extending through them, means for discharging a solution upon the slats, and pipes for the circulation of a heated fluid arranged in said open space for the purpose specified.

2. In an apparatus of the character described, the combination with superimposed spaced layers of slats arranged with an open space extending through them, of a distributing tank arranged above the slats and having its bottom perforated above the slats and imperforate above said space, and pipes for the circulation of a heated fluid arranged in said open space for the purpose specified.

3. In an apparatus of the character described, the combination with superimposed spaced layers of slats arranged with an open space extending through the lower layers, of a distributing tank above said slats, and means for supplying heat to said space for distribution between the layers of slats.

4. In an apparatus of the character described the combination with superimposed spaced layers of slats, arranged with an open space extending through them, means for distributing a solution upon the slats, and means for supplying heat to said space for distribution between the layers of slats.

In testimony whereof I have signed my name to this specification.

GEORGE CUTLER WESTBY.