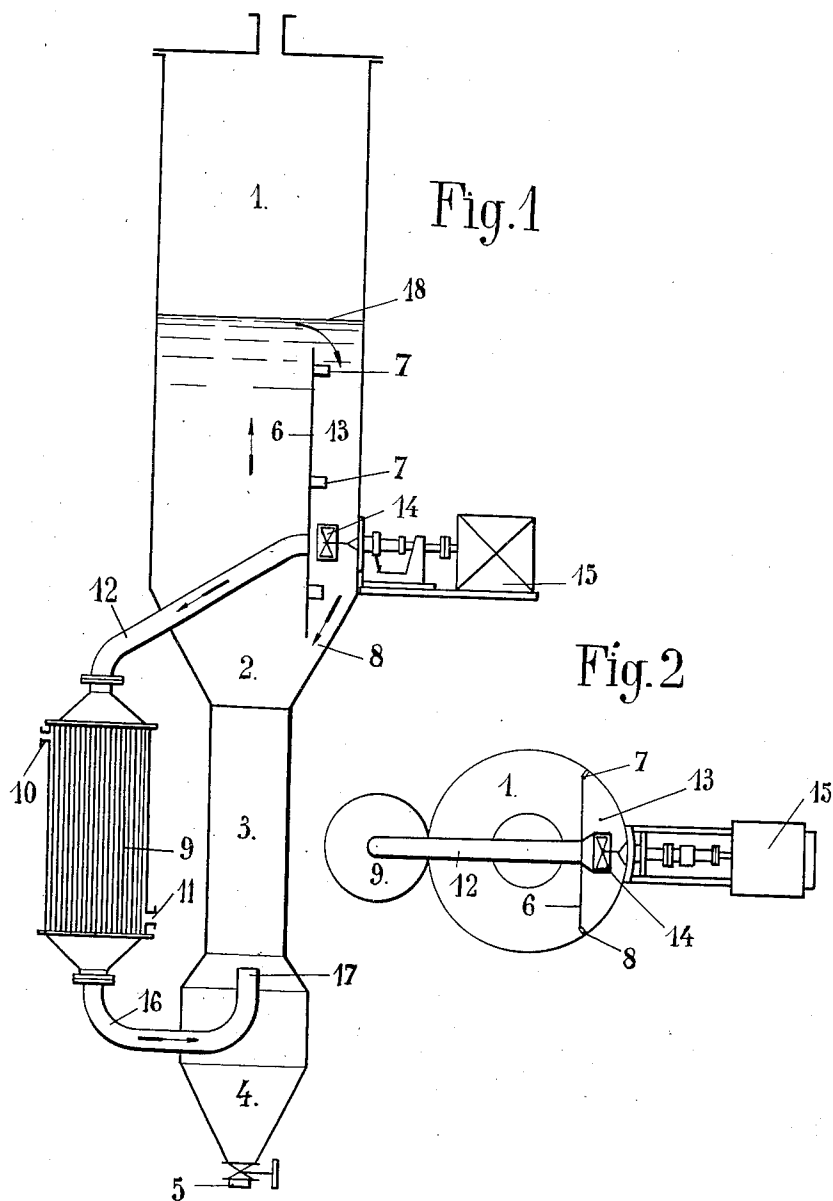


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EVAPORATING AND CRYSTALLIZING-APPARATUS ESPECIALLY ADAPTED FOR OBTAINING
LARGE CRYSTALS.

APPLICATION FILED DEC. 29, 1917.

1,331,373.

Patented Feb. 17, 1920.



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UNITED STATES PATENT OFFICE.

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EVAPORATING AND CRYSTALLIZING APPARATUS ESPECIALLY ADAPTED FOR
OBTAINING LARGE CRYSTALS.

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Specification of Letters Patent.

Patented Feb. 17, 1920.

Application filed December 29, 1917. Serial No. 209,600.

To all whom it may concern:

Be it known that I, CHARLES PRACHE, of 106 Boulevard Haussmann, Paris, France, engineer, have invented new and useful Improvements in Evaporating and Crystallizing Apparatus Especially Adapted for Obtaining Large Crystals, which improvements are fully set forth in the following specification.

10 This invention has for its object an evaporating apparatus intended for the concentration of such saline solutions which while boiling allow crystals to be deposited; for example, brine, electrolytic soda salts, etc.

15 It is known that to obtain a good transmission of heat in vaporizers, the liquid in evaporation should circulate rapidly in contact with the heating surfaces. On the other hand, it is also known that the salt produced in saline solutions by their evaporation while in movement is always in the form of powder; the crystals are very difficult to separate from the mother liquor which surrounds them, and to wash whether by filtration or by drying.

20 The only process actually employed for obtaining large crystals of salt by evaporation consists in slowly evaporating brine in a stationary and boiling liquid, a process which is necessarily wasteful.

30 Apparatus according to this invention allows on the contrary salt to be obtained in well formed crystals from a liquid evaporating at great speed by circulation in contact with the heating surface, an arrangement which allows the heating surface to be employed with great efficiency while obtaining crystals large enough to be easily separated from their mother liquor and easy to wash.

40 Apparatus according to this invention is illustrated in the accompanying drawings, in which Figure 1 is a vertical section and Fig. 2 a horizontal section. In this apparatus 1 is a vertical cylindrical receiver or evaporator connected by a conical portion 2 to a cylindrical portion 3 of suitable diameter but less than that of the receiver 1. The cylindrical portion 3 is connected to a cylindro-conical portion 4 which forms a reservoir for the crystalline products formed in the upper portions; the crystals may be removed through a valve 5. 6 is a vertical partition within the receiver 1 extending for a certain height. It is so arranged as to

leave a free passage 8, and with this object is suspended on the wall of the receiver 1 by lugs 7.

9 is a tubular reheater or superheater whose tubes are heated outwardly by steam admitted through the pipe 10, condensed steam passing out through the pipe 11. The upper portion of this reheater is in communication with the interior of the vaporizer 1 through a sloping pipe 12 which passes centrally through the receiver and then through the partition 6 into a chamber 13 comprised between the partition 6 and the wall of the vaporizer 1. The tube 12 terminates in a horizontal cylindro-conical casing whose open end is situated at some distance from the wall of the vaporizer 1; 14 is a propelling screw arranged centrally within the casing and having a horizontal axis the shaft of which is driven from the outside by an electric motor 15 or in any other manner.

The bottom of the reheater 9 is connected to the lower portion 4 of the apparatus by a bent pipe 16, the pipe being continued by an upwardly rising bent pipe 17 arranged axially within the vaporizer.

The apparatus works as follows:

The apparatus is filled with liquid to be concentrated to the level 18 which is situated a little above the upper portion of the partition 6 and the screw 14 is put into motion; liquid contained in the chamber 13 is drawn therefrom into the pipe 12 so causing a flow of liquid in the rest of the apparatus but mainly in the upper portions as indicated by arrows. Liquid is delivered by the pipe 12 into the tubes of the reheater 9 and then out through the bent pipe 17 vertically upward into the center of the cylindrical portion 3; steam is at the same time admitted into the reheating chamber through the pipe 10. The screw thus causes liquid to travel continuously downward in the reheater and continuously upward in the vaporizer; owing to the large difference of level between the reheater and the level 18 of the liquid in the vaporizer and also owing to the excess of pressure given by the screw the pressure to which such liquid is subjected while passing through the tubes of the reheater 9 allows the liquid to be heated without entering into ebullition to a temperature above that at which it would pass

into ebullition at atmospheric pressure which is assumed to exist above the liquid level 18.

When, however, liquid thus superheated 5 passes out of the reheater into the vaporizer through the bent pipe 17 and when it has risen in the cylindrical portion 3 it boils by reason of the diminution of hydrostatic pressure. The degree to which the liquid 10 should be superheated is regulated so that ebullition commences in the lower portions of the cone 2. The vapor evolved by the liquid in ebullition passes out of the apparatus from the upper portion of the vaporizer 1.

When crystals of salt appear in the mass in ebullition the weight of each crystal formed has the tendency to cause it to pass to the bottom of the vaporizer, but by reason 20 of the conical shape of the portion 2 the speed of the upward vertical circulation of the liquid is greatest in the cylindrical portion 3 and continuously decreases in the upper layers; the descent of the fine crystals 25 is prevented by such upward circulation until they have acquired a certain weight so that the crystals are maintained in suspension in the mass in ebullition and are forced to increase in size until their weight 30 overcomes the dynamic thrust of the ascending current of circulating liquid when they can fall through the cylindrical portion 3 and reach the depositing chamber 4.

The ascending current in the vaporizer 35 and especially in the cylindrical portion 3 acts as a classifier which prevents the entry of the crystals into the depositing chamber 4 so long as these have not attained a sufficient size, which depends moreover on the 40 speed of the liquid in the cylindrical portion 3.

A certain portion of the fine crystals may pass with the liquid into the propelling

pump but its construction, (a screw turning in a circular box), prevents obstruction 45 by the crystals; the pump being entirely submerged in the liquid in ebullition does not possess a suction pipe and its delivery pipe being also mainly submerged in the boiling liquid, it is completely protected 50 from loss of heat.

Deposits of salts, which would take place by the cooling of the pipes if these were outside the apparatus, are thus prevented; deposited crystals would attach themselves to 55 the walls of the pipes and the circulation pump and prevent the apparatus working.

Claim:

In apparatus for evaporating saline solutions and for obtaining large crystals, a vertical receptacle the upper portion of which 60 is adapted to contain the saline solution to be evaporated, the lower portion of which is tubular and of smaller cross-section and serves as a crystal seeding and separating 65 chamber, a conduit, one end of which opens into the lower part of said upper portion and the opposite end opens upward into said tubular portion above the bottom thereof, means external to said receptacle for heating 70 said conduit, and means located in said evaporating portion of said receptacle for forcing liquid in the evaporating portion downward through said heated conduit into said tubular portion against the hydrostatic 75 pressure in said receptacle to effect ebullition therein and sustain in the boiling solution the separating crystals till they grow to a predetermined size and then fall.

In testimony whereof I have signed this 80 specification in the presence of two subscribing witnesses.

CHARLES PRACHE.

Witnesses:

GASTON DE MESTRAL,
CHAS. P. PRESSLY.