

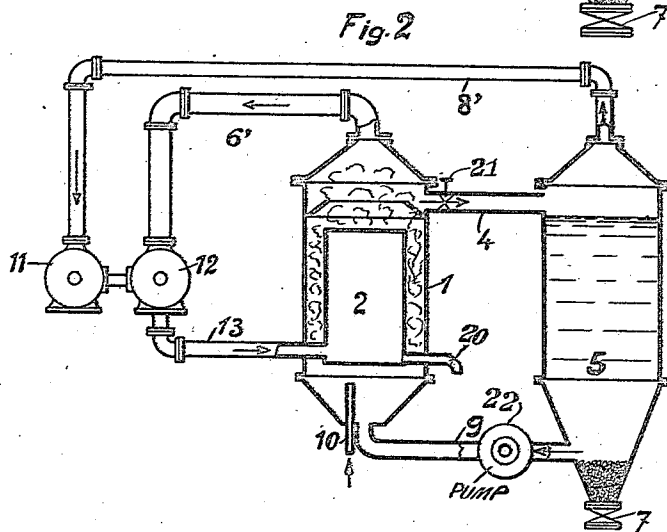
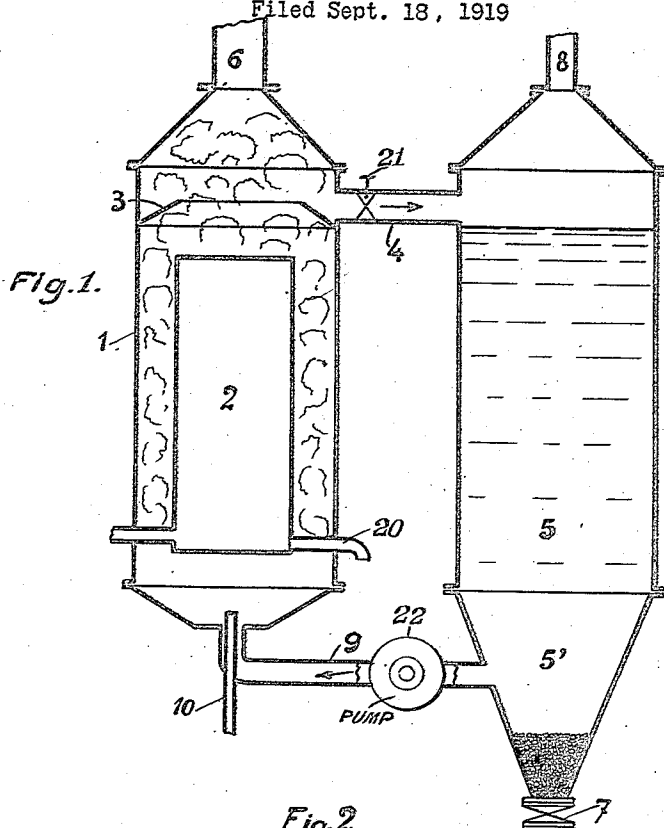
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E. WIRTH-FREY

METHOD OF EVAPORATION AND APPARATUS THEREFOR

Filed Sept. 18, 1919



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METHOD OF EVAPORATION AND APPARATUS THEREFOR.

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(GRANTED UNDER THE PROVISIONS OF THE ACT OF MARCH 3, 1921, 41 STAT. L., 1313.)

To all whom it may concern:

Be it known that I, ELIAS WIRTH-FREY, a citizen of the Swiss Confederation, and residing at Aarau, Switzerland, have invented certain new and useful Improvements in Methods of Evaporation and Apparatus Therefor (for which I have filed application in Switzerland August 21st, 1918), of which the following is a specification.

The present invention has reference to certain new and useful improvements in methods of evaporation and in apparatus therefor, and it relates more particularly to an improved process and apparatus for inspissating brine for obtaining the salts therefrom.

In the treatment of brine for this purpose it is a well known step to prevent the formation of salts on the heating surfaces by removing the evaporation from the proximity of these heating surfaces, which is generally done by only superheating the brine by contact with these surfaces and by then finishing the evaporation in an additional chamber. In practice this is obtained by positioning the heating surfaces rather low below the level of the liquid so that the liquid pressure prevents the evaporation on the heating surfaces and the evaporation can then only take place higher up; or by keeping the passage through the heating chamber relatively narrow and forcing the liquid therethrough by natural or artificial, for instance pump pressure, whereby in the heating chamber a superpressure is set up which tends to prevent the evaporation within this chamber.

All these procedures, however, render the evaporation on the heating surfaces more difficult for the reason that the liquid is under a higher pressure than is really absolutely necessary, which means that the heating steam also must be under correspondingly higher tension. Furthermore, the heat exchange with non-boiling liquids is lower than in the case of boiling liquids, so that the installation then requires more heating surface.

According to my invention, which effectively obviates all these drawbacks, the brine is first conducted through a heated evaporating chamber and is then conducted for after-evaporation and separating-out of salt into a secondary chamber in which a lower

pressure is maintained than in the primary evaporating chamber, and the then more or less saturated brine is finally reconducted into the primary evaporator, thus completing a cycle through the two evaporating chambers.

My invention will best be understood when described in connection with apparatus suitable for carrying out the improved process and I have illustrated in the accompanying drawing, by way of example, two more or less diagrammatical sectional views of such apparatus. Like parts in the two figures are denoted by the same reference numerals.

Referring first to Fig. 1, the numeral 1 refers to a boiler, the primary evaporating chamber, within which is arranged the steam heater 2 having the discharge pipe 20 for the exhaust of the condensate from the heater. Above the latter is located an annular liquid gutter or collector 3 of truncated cone shape, designed to catch the liquid entrained by the rising vapor, and from where the liquid is carried through the conduit 4 into the secondary or after-evaporating chamber 5. Arranged in the conduit 4 is a valve 21 to control the relative pressures in the chambers 1 and 5. The exhaust steam leaves the chambers 1 and 2 through the top vents 6 and 8 respectively. In the secondary evaporator 5 a pressure is maintained which is lower than that obtaining in the main evaporator 1, which allows of the liquid readily flowing through the conduit 4 into the second evaporator where it is subjected to an after-evaporation. The pressure ratio in the two evaporators is to be so chosen that the elimination of the salts is effected mainly in the second evaporator. The salt is deposited in the lower funnel shaped part 5' of the chamber 5 and can be withdrawn thereout through the discharge member 7. The concentrated brine is then led back into the primary evaporator through a conduit 9. To assure the return flow of the brine from the chamber 5 to the chamber 1 I preferably provide a pump 22 of any suitable construction in the reflux conduit 9. This reconduction of the saturated brine into the first chamber meets with no difficulty in spite of the pressure differences for the reason that the liquid column in the second chamber is materially heavier than the steam-liquid mix-

ture in the first chamber. By now again heating the brine it is undersaturated to some extent so that it again yields water and is then treated once more in the after-evaporator. Fresh brine is conducted from below through the supply pipe 10 into the primary evaporator near the point of influx of the pretreated brine, causing thereby a dilution of this concentrated brine and at the same time preventing or retarding the separating-out of salts within the primary evaporator.

Whilst in this arrangement the exhaust steam can be utilized, depending upon its pressure, as heating medium in preheaters or like apparatus of lower pressure than that in the chambers 1 and 5, it is reconducted in the installation illustrated in Fig. 2 into the heater. Through the conduits 6' and 8' the exhaust steam is sucked respectively into the compressors 11 and 12, is compressed therein and then forced through the common conduit 13 into the heater 2. The compressors are so regulated that in the evaporator chambers 1 and 5 the required pressure difference is maintained. The operative effect of this latter arrangement is identical to that of the first above described type of apparatus. Separation of the salt from the brine is prevented on the heating surfaces because on such surfaces the brine is not concentrated beyond the point of saturation, and there is thus no salt separation which might result in the formation of crusts. The separation is effected by subjecting the brine to lower pressure in the receptacle 5. In consequence of the decrease in pressure evaporation in the receptacle 5 will occur, but the resulting steam is used as a heating medium in the container 5 so that all loss is eliminated.

What I claim is:—

1. The herein described two-stage method of obtaining salt from brine, which consists in subjecting an enclosed body of brine in the first stage to heat and pressure to partially evaporate the brine, thereupon in the second stage, subjecting the enclosed body of brine without the application of heat thereto to a lower pressure than that prevailing in the first stage to cause salt to freely separate out of the brine, and separately drawing off steam from the body of brine in the two stages, the former at a higher pressure than the latter.

2. The hereinbefore described evaporating apparatus, which comprises in combination, a primary evaporator, a heating element therein, means for supplying fresh brine from below into said primary evaporator, an exhaust steam vent in the top of said primary evaporator and a brine collector in the upper part of said primary evaporator; a secondary evaporator, an exhaust steam vent and a salt discharge member in the top and bottom respectively, of said secondary evaporator, conduit connection between the said two evaporators at the level of said brine collector and cooperating therewith, and conduit connection between the lower parts of said two evaporators, the said means for supplying fresh brine to said primary evaporator and said lower conduit connection arranged in close cooperative position, and means in connection with said exhaust steam vents for withdrawing the exhaust steam from out of said two evaporators, for compressing the withdrawn exhaust steam and forcing it into the said primary evaporator heating element.

ELIAS WIRTH-FREY.