No. 872,533. PATENTED DEC. 3, 1907.

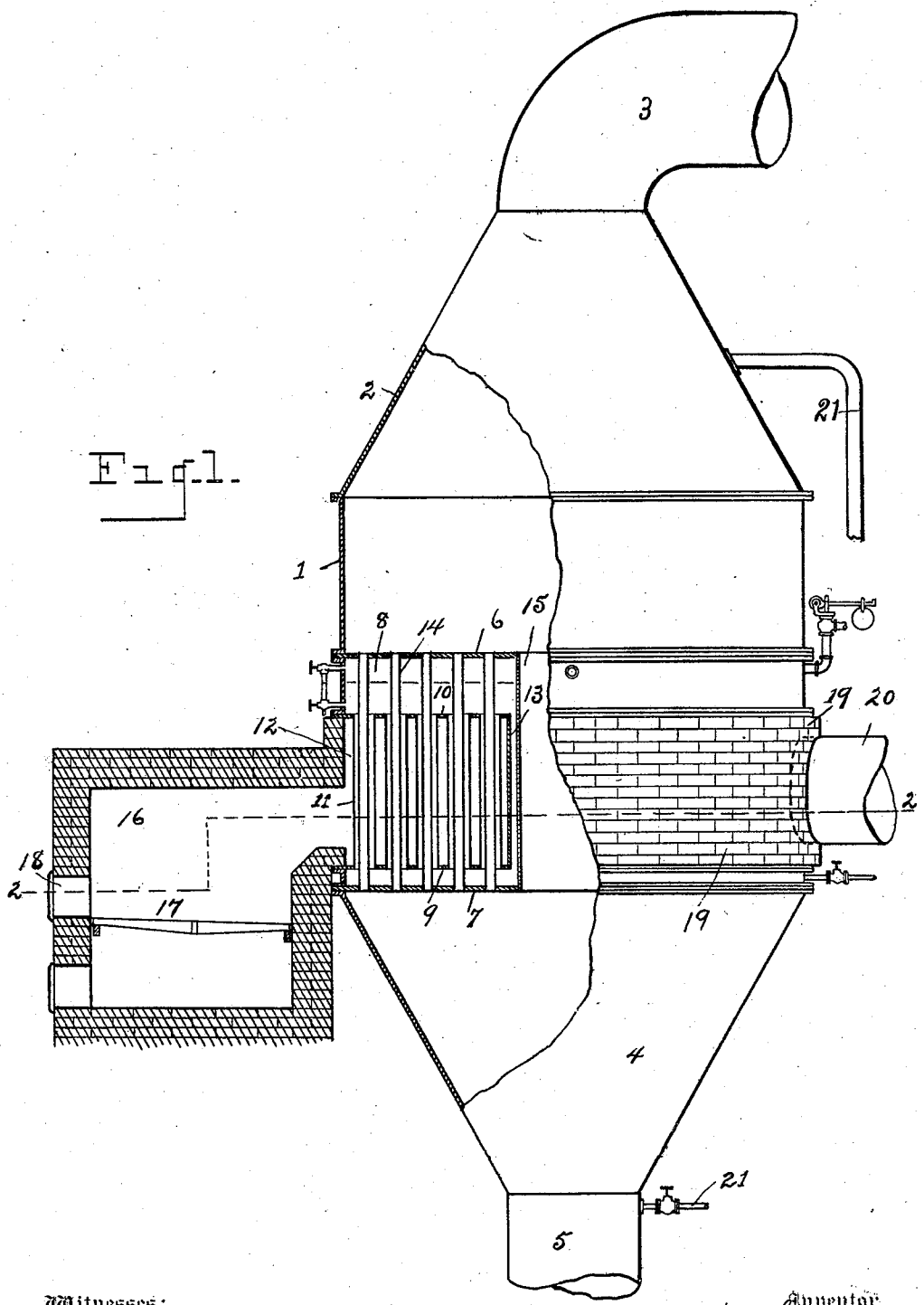
A. H. McDONALD.

EVAPORATING APPARATUS.

APPLICATION FILED JAN. 10, 1906.

2 SHEETS—SHEET 1.

Fig. 1.



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2 SHEETS—SHEET 2.

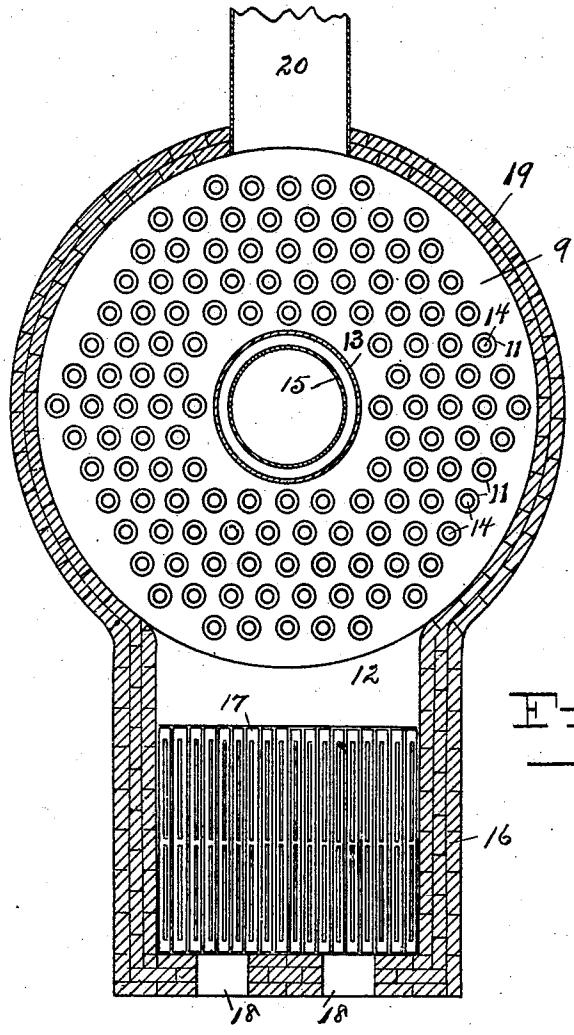


Fig. 2.

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EVAPORATING APPARATUS.

No. 872,533. Specification of Letters Patent. Patented Dec. 3, 1907.

Application filed January 10, 1906. Serial No. 295,337.

To all whom it may concern:

Be it known that I, ALEXANDER H. McDONALD, a citizen of the United States, residing at Wyandotte, in the county of Wayne and State of Michigan, have invented certain new and useful Improvements in Evaporating Apparatus; and I do declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the figures of reference marked thereon, which form a part of this specification.

This invention relates to a combined steam generator and evaporating apparatus more expressly designed for evaporating brine in the manufacture of salt, and for use in connection with the manufacture of sugar and chemicals, being applicable to a vacuum pan, or to a structure wherein evaporation takes place at atmospheric pressure.

The invention consists in the construction and arrangement of parts hereinafter more fully set forth and pointed out particularly in the claims.

The objects of the invention are to provide simple and efficient means for heating the brine without bringing the hot gases directly in contact with the tubes through which the brine circulates, obviating the burning of the tubes or heating surface, due to the formation of scale or incrustation within the brine tubes.

A further object is to provide for a direct transmission of heat by obviating the formation of scale upon the heating surface, thereby economizing in fuel.

A further object is to obviate the expense of a separate steam generator and prevent undue radiation of heat.

A further object is to provide for utilizing the steam generated in the process of evaporating for power purposes, or for initially heating the brine before introduction into the evaporator pan or grainer.

The above objects are attained by the structure illustrated in the accompanying drawings, in which:—

Figure 1 is an elevation, partly in section, of a combined steam generator and evaporating apparatus of the vacuum type, involving my invention. Fig. 2 is a horizontal section as on line 2—2 of Fig. 1.

Referring to the characters of reference, 1 designates the heating belt of a vacuum pan crowned by a suitable dome 2, wherein a partial vacuum is maintained through the connecting pipe 3 in a manner well understood in the art. The bottom 4 of the pan is funnel-shape for collecting and concentrating the precipitated crystals which are discharged through the connecting pipe 5 and are conveyed in a suitable manner to the dripping bins or other drying apparatus.

The body of the structure is preferably cylindrical in form and is divided at a point above its central portion by a transverse plate or head 6. At the juncture of the central portion with the funnel-shape bottom, is a second transverse plate or head 7. These heads form between them a steam generating space 6 which is entirely separated by said heads from the brine spaces of the pan. Crossing the steam generating space a short distance above the head 7 is a head 9, and also crossing said steam generating space a short distance below the upper head 6 is a head 10. Connecting the heads 9 and 10 and expanded therein, are the tubes 11 which are disposed in any suitable manner throughout the fire space 12 which is formed between the heads 9 and 10, the central tube 13 extending between said heads being of a much larger diameter than the tubes 11, as more clearly shown in Fig. 2

Establishing communication in the vacuum pan between the brine space above the head 6 and the brine space below the head 7 are the relatively small circulatory brine tubes 14 and the relatively large central brine tube 15. The tubes 14 are expanded at their ends in the heads 6 and 7 and pass centrally through the tubes 11 while the central tube 15 is also expanded at its ends in said head and passes freely through the central tube 13 connecting heads 9 and 10. The tubes 14 and central tube 15 establish communication between the upper and lower portions of the evaporating pan for the circulation of the brine, and are surrounded by the water in the steam generating space which occupies the tubes 11, thereby forming a water jacket around the brine tubes 14 and 15 where they pass through the combustion chamber or fire-space.

Communicating with the fire space 12 is a furnace 16 having the usual grate 17 and the stoke openings 18. Surrounding the fire space is an embracing wall 19 of brick which prevents undue radiation of heat, and passing through said wall and communicating

with said fire space is the flue pipe 20 which leads to a suitable stack, not shown.

The products of combustion from the furnace pass through the fire space around the tubes 11 and 13, thereby heating to a high degree the fresh water within said tubes which transmit said heat to the brine within the brine tubes, thereby imparting to the brine sufficient heat to induce the required evaporation. By this arrangement, the hot gases from the furnace are prevented coming directly in contact with the brine tubes, thereby obviating the formation of scale within said tubes due to the presence of lime, gypsum and salt, which, were it not for the water space surrounding the brine tubes, would form upon the inner wall of said tubes a scale so thick as to greatly retard the transmission of heat to the brine and ultimately result in the burning out of said tubes. By this arrangement, the water in the steam generating space being fresh, the tubes 11 are subjected only to the same conditions that are present in every boiler or generator of the water tube type. The hot gases from the furnace readily generate steam within the steam space, which serves to heat the body of brine lying against the plates 6 and 7 said brine being fed into the evaporating pan through the pipe 21.

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

1. In an evaporating apparatus, the combination of the evaporating pan divided by transverse plates into independent brine spaces, brine tubes secured at their opposite ends in said plates respectively and passing therethrough to establish communication between the brine spaces of the pan, said evaporating pan having a fire space therein located between the divided plates of the pan and crossed by said brine tubes, a water jacket around each of the brine tubes within said fire space, said water jackets being intercommunicable and entirely separated from the brine spaces of the pan, and a wall of non-conducting material surrounding the fire space between the divided brine spaces.

2. In an evaporating apparatus, the combination of the evaporating pan, transverse plates dividing said pan into independent brine spaces superimposed, a relatively large central brine tube having its ends secured in said dividing plates and establishing communication between the brine spaces, a plurality of relatively small brine tubes secured at their ends in said dividing plates and establishing communication between the brine spaces, a fire space located between said dividing plates and crossed by said brine tubes, transverse plates crossing the fire space to form a steam generating space entirely separated from the fire space, and from the brine spaces, tubes surrounding the brine tubes within the fire space and communicating at their ends with the steam generating space, and a wall of non-conducting material surrounding the fire space.

3. In an evaporating apparatus, the combination of the evaporating pan, the transverse plates dividing said pan into brine spaces and forming between them a steam generating space entirely separated from said brine spaces, brine tubes connecting said plates and establishing communication between the divisions of the pan, transverse plates dividing the steam generating space and forming a fire space between them, and water tubes passing through said fire space and connecting said last-mentioned plates to form circulatory tubes for the steam generator, said water tubes embracing the brine tubes which pass centrally therethrough.

4. In an evaporator and steam generator, the combination with the evaporating pan having brine spaces at its ends, of a steam generator entirely separated from said brine spaces centrally disposed within said pan and having a fire space, water tubes within the fire space of said generator around which the hot gases may pass, brine tubes communicating at their ends with the brine spaces of the pan and passing centrally through said water tubes, and a wall of non-conducting material surrounding the fire space for preventing undue radiation of heat.

In testimony whereof, I sign this specification in the presence of two witnesses.

ALEXANDER H. McDONALD.

Witnesses:
F. H. NICKLE,
C. W. O'BRIEN.