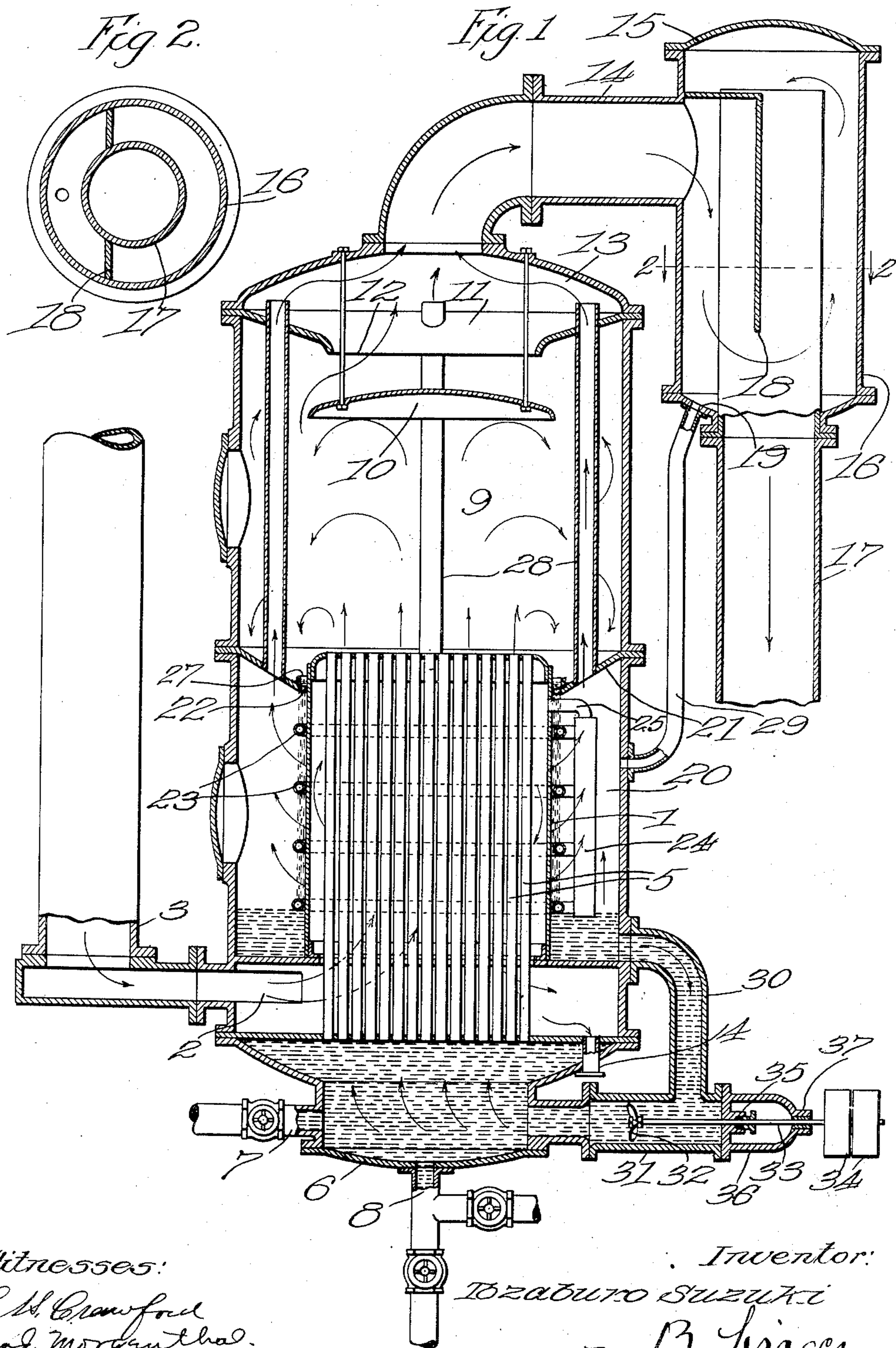


No. 894,407.

PATENTED JULY 28, 1908.

T. SUZUKI.  
EVAPORATOR.

APPLICATION FILED MAY 15, 1907.



Witnesses:  
C. W. Crawford  
J. F. Morganthal.

Inventor:  
TOZABURO SUZUKI  
By B. Singer  
attly.

# UNITED STATES PATENT OFFICE.

TOZABURO SUZUKI, OF SUNAMURA, JAPAN.

## EVAPORATOR.

No. 894,407.

Specification of Letters Patent.

Patented July 28, 1908.

Application filed May 15, 1907. Serial No. 373,835.

*To all whom it may concern:*

Be it known that I, TOZABURO SUZUKI, a subject of the Emperor of Japan, residing at No. 401 Jibeishinden, Sunamura, in the county of Minami-Katsushika, in the Province of Tokyo, in the Empire of Japan, have invented certain new and useful Improvements in Evaporators, of which the following is a full, clear, and exact description.

10 This invention relates to improvements in evaporators and the present invention consists generally in the provision of a steam or heating chamber provided with a plurality of tubes or the like adapted to deliver the liquid to a superposed evaporating chamber.

15 The invention also includes the provision of a container for the liquid to be evaporated which is located in a manner to communicate with said tubes and is provided with means for forcing the liquid from said container through said tubes and into said evaporating chamber. In order to provide means for receiving that portion of the liquid which is not evaporated in its passage through the tubes and evaporating chamber I desirably provide an auxiliary evaporating chamber which is preferably in heating proximity to said steam compartment and desirably derives heat therefrom to assist in the evaporating operation. Desirably the vapor resulting from the action of the auxiliary chamber is carried to an outlet which may if desired be the outlet common to the main evaporating chamber. In order to prevent the auxiliary chamber from filling too rapidly the latter is preferably connected with the container and liquid is drawn from the auxiliary chamber by the action of the circulating means.

40 The invention will be more fully described in connection with the accompanying drawing and will be more particularly pointed out and ascertained in and by the appended claims.

45 Figure 1, is a vertical sectional view, partly in elevation, of an evaporator embodying the main features of my invention. Fig. 2, is a sectional view on line 2—2 of Fig. 1.

50 Like numerals of reference designate similar parts throughout the drawing.

As shown 1 designates a steam or heating compartment provided with an inlet 2 through which the steam or other heating agent is fed from a source of supply such as pipe 3. 4 designates an outlet for the steam which may communicate with the outer air

or connected in any convenient manner. A plurality of tubes 5 are arranged within said compartment 1 and closed to the same in order to convey the liquid through and subject the same to the action of the heat agent without mixing the same. Located below the compartment 1 is a container 6 which is closed to the compartment 1 but which communicates with the tubes 5. Said container is provided with valve inlets and outlets 7 and 8 through which the liquid to be evaporated can be supplied and drawn off.

60 A main evaporating chamber 9 is located in receiving proximity to the tubes 5 and is preferably superposed upon and above the steam compartment 1 by means of any suitable supporting structure. A deflector 10 is located in the evaporating chamber 9 and in the path of the liquid discharging from the tubes 5. Immediately above the deflector 10 is a deflector 11 provided with an opening 12 which is desirably centrally disposed and immediately above the deflector 10. The function of the deflector 10 is to deflect the liquid downwardly after it rises to a certain point in the evaporating chamber and prevent it from escaping through the outlet of the evaporating chamber which will presently be described. The deflector 10 engages the vapors given off by the liquid in its passage through the evaporating chamber and forces the same centrally where said vapors pass through the opening 12. The deflector 11 also forms a chamber 13 adapted to receive vapor discharged from the auxiliary chamber which will be hereinafter more fully described. The main evaporating chamber 9 is provided with an outlet 14 which preferably discharges to a trap drum 15. Said drum comprises an outer casing 16 which incloses the upper end of a discharge pipe 17 and is provided with a deflector 18 which deflects the vapor downwardly in the drum toward the bottom thereof on one side and permits it to rise on the other and seek the open end of the pipe 17. Any water of condensation resulting from passage of the vapor through said drum will be collected by the bottom wall 19.

105 An auxiliary chamber 20 is preferably disposed in heating proximity to the steam compartment 1 so that the heat therefrom may serve to heat the contents of said auxiliary chamber and in the present construction the heating of the contents of the auxiliary chamber 20 is facilitated by arranging the

chamber 20 to surround the compartment 1. The auxiliary chamber 20 is separated from the evaporating chamber 9 by a wall or partition 21. The liquid deflected downwardly by the deflector 10 is directed principally upon the partition 21 and in order to accommodate the unevaporated liquid I provide the partition 21 with one or a series of openings 22 located preferably adjacent the compartment 1 so that the liquid flowing through said openings will engage the wall of the steam compartment and will be subjected to the heating action thereof in an effective manner. In cases where the steam compartment 1 cannot effect a sufficiently rapid evaporation to meet the requirements I desirably provide a plurality of pipes 23 preferably horizontally disposed and surrounding said steam compartments. The steam or other heating agent is supplied to said pipes 23 preferably directly from the compartment 1 and in the present invention the ends of the pipe 23 terminate at a manifold 24 which communicates by means of extensions 25 with compartment 1. An effective heating action could be obtained by the mere presence of the pipes 23 within the chamber 20 but I desirably increase the efficiency of said pipes 23 by providing openings 22 in the partition 21 located in such a manner as to discharge directly upon the pipes 23. In order to insure a continuous flow of liquid through the openings 26 I desirably provide a flange or ledge 27 upon the partition 21 which serves to arrest the liquid adjacent the openings 26 to insure a free flow therethrough. The vapor discharged from the auxiliary chamber 20 is conveyed to an outlet and as shown pipes or tubes 28 are provided and extend from the partition 21 toward and through the deflector 11 delivering to the chamber 13 from whence the vapors discharge through outlet 14. A pipe 29 connects the lower wall 19 with the auxiliary chamber 20 so that water condensation collecting in the drum 15 will not be allowed to accumulate but will be returned and subjected to the action of the heating agent to effect complete evaporation. In order to maintain the water collecting in the chamber 20 at a relatively low level a connection is formed between the auxiliary chamber and the container 6 which connection as shown is in the form of pipes 30 and 31. Means are provided preferably in said connection for effecting circulation of the liquid to be evaporated such circulation including the raising or forcing of the liquid upwardly through said tubes 5 against the liquid deflector 10. In the present construction such means consists of a screw propeller 32 mounted on shaft 33 operated by belt or other means through pulleys 34. At the outer end of pipe 31 there is provided a stuffing box 35 which not only forms one of the bearings for

shaft 33 but also prevents escape of liquid. A bracket 36 mounted on pipe 31 carries a bearing 37 for said shaft.

The operation is as follows: A vacuum is produced in compartment 1 by suitable attachments to outlet 4 whereupon steam is admitted and circulates about tubes 5. When the propeller 32 is started liquid is caused to flow upwardly through tubes 5 in which it is subjected to the action of the steam or other heating agent and outwardly from said tubes toward and against the deflector 10 from which the liquid is directed downwardly upon the partition 21. The vapor arising from the liquid passes upwardly and outwardly as hereinbefore described. The unevaporated liquid falling on the partition 21 is conveyed to the auxiliary chamber 20 wherein it is subjected to an additional application of heat serving to assist in the evaporating operation. That portion of the liquid which is not evaporated in the chamber 20 passes downwardly through pipe 30 and is returned by said propeller 32 through the course just described.

I claim:

1. An evaporator comprising in combination, a heating compartment, a plurality of tubes extending therethrough and closed to said compartment, a main evaporating chamber in receiving proximity to said tubes, a container for the liquid to be evaporated communicating with said tubes, an auxiliary evaporating chamber surrounding said compartment and communicating with said container and evaporating chamber, and mechanical means for effecting circulation of the liquid from said container through said tubes to said main evaporating chamber and from said auxiliary chamber to said container.

2. An evaporator comprising in combination, a heating compartment, a plurality of tubes extending therethrough and closed to said compartment, a main evaporating chamber in receiving proximity to said tubes, an auxiliary evaporating chamber surrounding said compartment, an inclined wall provided with openings permitting passage of water from said main evaporating chamber to said auxiliary chamber, a container for the liquid to be evaporated communicating with said tubes, and means for forcing the liquid from said container through said tubes and into said evaporating chamber and from said auxiliary chamber to said container.

3. An evaporator comprising in combination, a heating compartment, a plurality of tubes extending therethrough and closed to said compartment, a main evaporating chamber in receiving proximity to said tubes, an auxiliary evaporating chamber surrounding said compartment, an inclined wall provided with openings permitting

passage of water from said main evaporating chamber to said auxiliary chamber, a container for the liquid to be evaporated communicating with said tubes, means for forcing the liquid from said container through said tubes and into said evaporating chamber and from said auxiliary chamber to said container, and a deflector directing said liquid upon said inclined wall.

4. An evaporator comprising in combination, a heating compartment, a plurality of tubes extending therethrough and closed to said compartment, a main evaporating chamber in receiving proximity to said tubes, a liquid deflector, a vapor deflector, an auxiliary evaporating chamber surrounding said compartment, said auxiliary chamber receiving water directed downwardly by said deflector, tubes leading from said auxiliary chamber to a point above said vapor deflector, a container for the liquid to be evaporated,

and mechanical means for forcing the liquid from said container through said tubes into said main evaporating chamber.

5. An evaporator comprising in combination, a heating compartment, a plurality of tubes extending therethrough and closed to said compartment, a main evaporating chamber in receiving proximity to said tubes, an auxiliary evaporating chamber in heating proximity to said compartment, a container for the liquid to be evaporated, means for forcing said liquid from said container through said tube, and a plurality of pipes for said auxiliary chamber communicating with said steam compartment.

In testimony whereof I affix my signature in presence of two witnesses.

TOZABURO SUZUKI.

Witnesses:

A. A. WILLIAMSON,  
H. F. HAWLEY.