J. PARKER.

EVAPORATOR.

APPLICATION FILED FEB. 8, 1910.

989,996. Patented Apr. 18, 1911.

Fig. 1

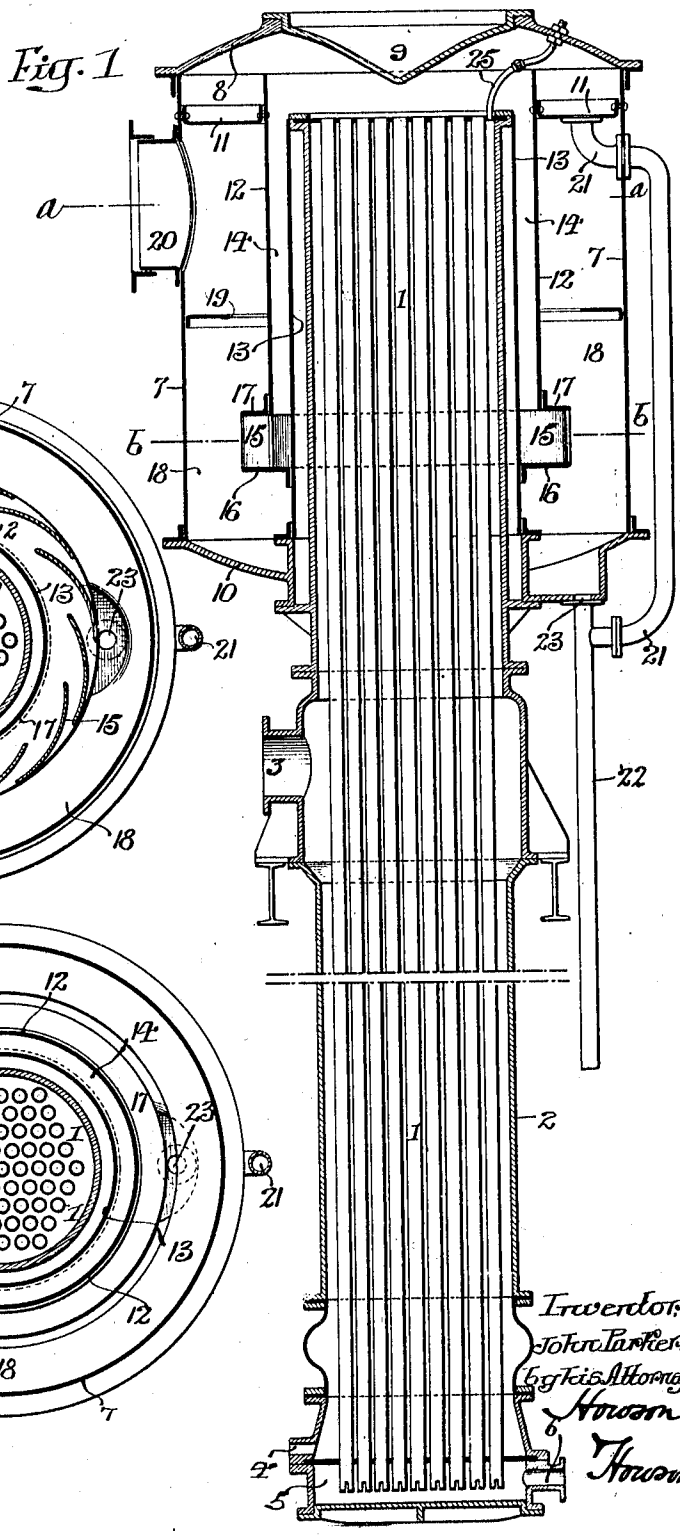


Fig. 3.

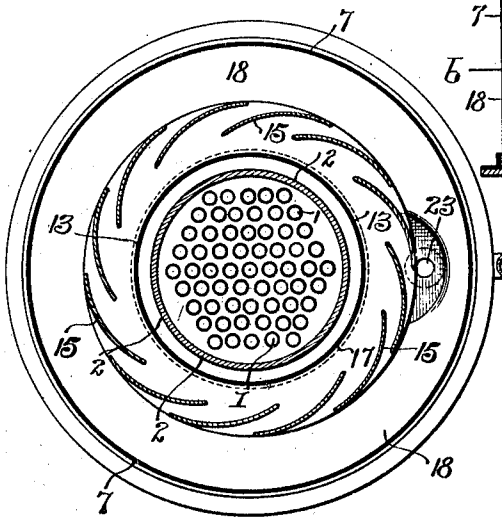
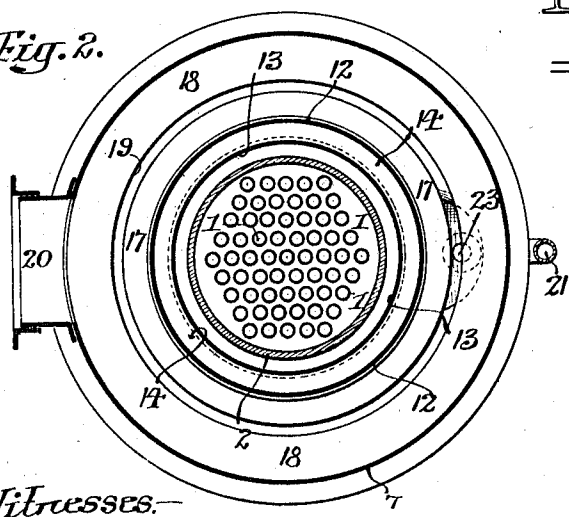


Fig. 2.



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UNITED STATES PATENT OFFICE.

JOHN PARKER, OF PHILADELPHIA, PENNSYLVANIA.

EVAPORATOR.

989,996. Specification of Letters Patent. Patented Apr. 18, 1911.

Application filed February 8, 1910. Serial No. 542,747.

To all whom it may concern:

Be it known that I, JOHN PARKER, a subject of the King of Great Britain and Ireland and the Isle of Man, residing in Philadelphia, Pennsylvania, have invented certain Improvements in Evaporators, of which the following is a specification.

My invention relates to apparatus designed for evaporating liquids; being especially applicable to evaporators of the "climbing film" type, and it consists of certain improvements relating directly to the chamber of such apparatus in which the separation of the steam and liquor issuing from the evaporating tubes is effected. In order to obtain the greatest efficiency from the heating surfaces in evaporators of this class it is essential that the evaporating tubes be of considerable length; and evaporators as usually constructed, with the vapor or separating chamber above the upper or discharge end of the evaporating tubes, constitute a total height for which, in some instances, it is difficult to provide, and one object of my invention is to shorten this total length to meet such a contingency.

A further object of my invention is to so direct vapor and entrained liquor current that a considerable portion of said liquor will be directed into a trough or receiver, thus making the final separation more effective, and a still further object attained by my improved arrangement is that I am enabled to so locate the upper tube sheet of the heating chamber that the tube ends are readily accessible for quick repair in case of leakage, or for replacement, by the removal of a cover above the same.

These and other features of my invention, fully pointed out hereinafter, are clearly shown in the accompanying drawings, in which:

Figure 1, is a sectional elevation of an evaporator embodying the features or improvements forming the subject of my invention; Fig. 2, is a sectional plan view of the same taken on the line *a*—*a*, in Fig. 1, and Fig. 3, is a sectional plan view taken on the line *b*—*b*, Fig. 1.

The evaporating tubes, indicated at 1, are inclosed within a chamber 2, to which steam may be admitted at the point 3, and from which the water of condensation may be discharged through an outlet 4. The liquor to be concentrated is fed to a chamber 5, in open communication with the lower ends of the tubes 1; such chamber having an inlet 6.

Surrounding the upper portion of the evaporating tubes and the heating chamber 2 in which they are disposed, is a shell or casing comprising an annular wall 7, a top 8 having a cover plate 9, and a bottom 10. The cover plate is convex on its under side for a purpose to be described. This shell or casing provides a series of chambers or compartments designed to take care of the liquor and the vapor therewith discharging from the tubes 1 to effect the separation of said elements and insure their delivery to separate outlets when such separation has taken place. Near the top of this shell or casing a trough or receiver 11 is provided, suitably secured thereto and carrying an annular wall 12 surrounding the upper end of the heating chamber 2, and such wall, together with a sheath 13 also surrounding said heating chamber and serving to prevent liquor encrusting upon the shell of the same, forms a chamber or channel 14 for the passage of vapor and any liquor entrained therewith to a separating element. This separating element comprises a series of vanes 15 mounted between a bottom plate 16 of the chamber formed by the wall 12 and sheath 13, and a flange 17 carried by said wall 12, and through this separating element the vapor and entrained liquor passes to a separating chamber 18.

The casing is also provided with a circular flange or baffle 19 secured to the wall 7 of the same, substantially intermediate the top and bottom of said casing, and an outlet 20 for the vapor disposed above said baffle. Suitable discharge pipes 21 and 22 are provided for the liquor; the pipe 21 leading from the trough or receiver 11 and connecting with the pipe 22 which leads from an outlet 23 in the bottom plate 10 of the casing.

In the operation of the structure, the liquor from the feed chamber rises in the evaporating tubes to a level determined by its incoming temperature, and under the influence of the surrounding heat, ascends in the form of a thin film on the inside surface of said tubes, a portion being evaporated, and the resulting vapor and the remaining

liquid is projected at a high velocity into the space above said tubes where it strikes the convex surface of the cover plate 9 and is diverted thereby in a substantially horizontal direction; the heavier part or liquor being thrown outward by its velocity into the trough or receiver 11, while the vapor, and any liquor that may be entrained therewith, flows downward through the annular channel 14 to the separator and through the latter into the separating chamber 18. In its flow down through the channel or chamber 14, the liquor will be thrown against the upper surface of the bottom plate 16 of the chamber and driven out from the surface of said bottom plate into the separating chamber 18 where it falls to the bottom of the same, and from which it can be removed through the outlet 23 communicating with the pipe 22, while the vapor rises and passes out through the outlet 20. It will thus be seen that in separating the liquor and vapor in this manner, there will be no liability of the latter being drawn out of the pan by the vapor current, and in addition, the flange or baffle plate 19 on the inside of the separating chamber prevents any liquid creeping up the sides of the same and entering the outlet pipe 20.

I do not wish to confine myself to any specific means of separation within the casing forming the chamber 18, as various devices may be employed for this purpose. In some cases, for instance where the quantity of liquor passing from the tubes is small in comparison with the volume of vapor therefrom, the trough or receiver 11 may be omitted and the vapor and liquor may be separated in the chamber 18.

The cover plate 9 carried by the top 8 of the casing is of such a size that when removed all of the tubes can be examined, and if such necessity arises, they may be drawn through the opening closed by said plate.

I may provide an escape pipe 25 for any air or gas trapped in the heating space of the chamber 2, and if desired this pipe may be valved.

I claim:

1. In an evaporator, the combination of a heating chamber, vertical evaporating tubes therein, a chamber above the upper ends of said tubes and in communication therewith, said chamber having a wall extending downward and surrounding the upper part of said heating chamber with an outlet at the bottom of said wall, and a separating chamber surrounding said downwardly extending chamber and receiving the discharge therefrom, said separating chamber being provided with separate outlets for vapor and liquor.

2. In an evaporator, the combination of a heating chamber, vertical evaporating tubes therein, a chamber above the upper ends of said tubes and in communication therewith, said chamber having a wall extending downward and surrounding the upper part of said heating chamber with an outlet at the bottom of said wall, and a separating chamber surrounding said downwardly extending chamber and receiving the discharge therefrom, said separating chamber being provided at its upper end with an outlet for vapor and at its bottom with an outlet for liquor.

3. In an evaporator, the combination of a heating chamber, vertical evaporating tubes therein, a chamber above the upper ends of said tubes and in communication therewith, said chamber having a wall extending downward around the upper part of said heating chamber, a separating chamber surrounding said down chamber and receiving the discharge therefrom, the latter chamber having an outlet for vapor at the bottom of same, and means for separating vapor and liquor within said separating chamber.

4. In an evaporator, the combination of a heating chamber, vertical evaporating tubes therein, a chamber above the upper ends of said tubes and in communication therewith, said chamber having a wall extending downward around the upper part of said heating chamber, a separating chamber surrounding said down chamber and receiving the discharge therefrom, the latter chamber having an outlet for vapor at the bottom of the same leading to said separating chamber, and means for separating vapor and liquor disposed within said outlet.

5. In an evaporator, the combination of a heating chamber, vertical evaporating tubes therein, a chamber above the upper ends of said tubes and in communication therewith, said chamber extending downward around the upper part of said heating chamber, a separating chamber surrounding said down chamber, said separating chamber being provided at the top with an outlet for vapor and at the bottom with an outlet for liquor, and a trough or receiver located to receive liquor projected from said tubes and delivered laterally from the vapor in its passage to the separating chamber, said trough having an outlet for the liquor there collected.

6. In an evaporator, the combination of a heating chamber, vertical evaporating tubes therein, a chamber above the upper ends of said tubes and in communication therewith, said chamber extending downward around the upper part of said heating chamber, a separating chamber surrounding said down chamber, said separating chamber being provided at the top with an outlet for vapor and at the bottom with an outlet for liquor, a cover plate for said chamber having a convex surface against which the liquor

is projected from the tubes, and a trough located to receive liquid delivered laterally from the vapor in its passage to the separating chamber, said trough having an outlet for the liquor there collected.

7. In an evaporator, the combination of a heating chamber, vertical evaporating tubes therein, a chamber above the upper ends of heating tubes and in communication therewith, said chamber having a wall extending downward and surrounding the upper part of said heating chamber with an outlet at the bottom of said wall, a separating chamber surrounding said down chamber and receiving the discharge therefrom, with provision for the outlet of vapor and liquor from said separating chamber at top and bottom of the same respectively, and a baffle plate in said separating chamber below the vapor outlet therefrom.

8. In an evaporator, the combination of a heating chamber, vertical evaporating tubes therein, a chamber above the upper ends of said tubes and in communication therewith, said chamber extending downward around the upper part of said heating chamber, a separating chamber surrounding said down chamber and provided at the top with an outlet for vapor and at the bottom with an outlet for liquor, and means for keeping the material undergoing separation away from the shell of the heating chamber.

9. In an evaporator, the combination of a heating chamber, vertical evaporating tubes therein, a chamber above the upper ends of said tubes and in communication therewith, said chamber extending downward around the upper part of said heating chamber and having an outlet at its bottom, curved vanes disposed in said outlet and forming means to impart centrifugal action to the vapor and separate liquor therefrom, a separating chamber surrounding said down passage and provided at the top with an outlet for vapor and at the bottom with an outlet for liquor, and means for keeping the material undergoing separation away from the shell of the heating chamber.

10. In an evaporator of the climbing film type, a tube nest of comparatively long and narrow tubes inclosed in a heating chamber, a crowning chamber receiving liquor and vapor from said tube nest and depending downward around and encircling the upper part of said heating chamber, and heat insulating means between the upper part of the heating chamber and said depending portion of the crowning chamber.

11. In an evaporator of the climbing film type, a tube nest of comparatively long and narrow tubes inclosed in a heating chamber, a crowning chamber receiving liquor and vapor from said tube nest and depending downward around and encircling the upper part of said heating chamber, and a closed chamber constituting an air space interposed between the upper part of said heating chamber and said depending portion of said crowning chamber.

12. In an evaporator of the climbing film type provided with a heating effect, comprising a nest of comparatively long and narrow tubes inclosed in a heating chamber, a crowning chamber for receiving vapor and concentrated liquor from said tubes, said crowning chamber having an annular peripheral gutter located near the upper end of said tubes with a downward extension surrounding said heating chamber and having a discharge at the bottom of the same.

13. An evaporator of the climbing film type having a nest of comparatively long and narrow tubes contained in a heating jacket, and having a crowning chamber for receiving concentrated liquor and vapor encircling the upper part of said jacket, said crowning chamber being provided with an annular peripheral gutter near the upper end of said tubes and with an annular vapor passage leading down around said heating jacket but spaced therefrom by heat insulating means.

14. An evaporator of the climbing film type having a nest of comparatively long and narrow tubes contained in a heating jacket, and having a crowning chamber for receiving concentrated liquor and vapor encircling the upper part of said jacket, said crowning chamber being provided with an annular peripheral gutter near the upper end of said tubes and with an annular vapor passage leading down around said heating jacket but spaced therefrom by an annular air chamber.

In testimony whereof, I have signed my name to this specification, in the presence of two subscribing witnesses.

JOHN PARKER.

Witnesses:
P. HOLLINGSWORTH MOUNT,
A. SAUNDERS MORRIS.