R. R. ROW.

EVAPORATOR.

APPLICATION FILED JUNE 7, 1912.

1,131,738.

Patented Mar. 16, 1915.

3 SHEETS—SHEET 1.

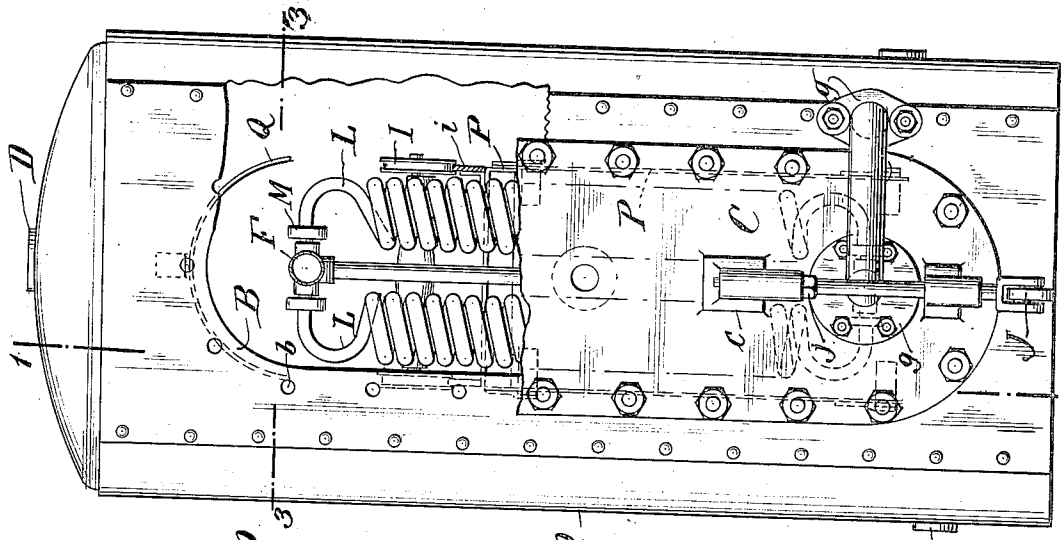


Fig. 2

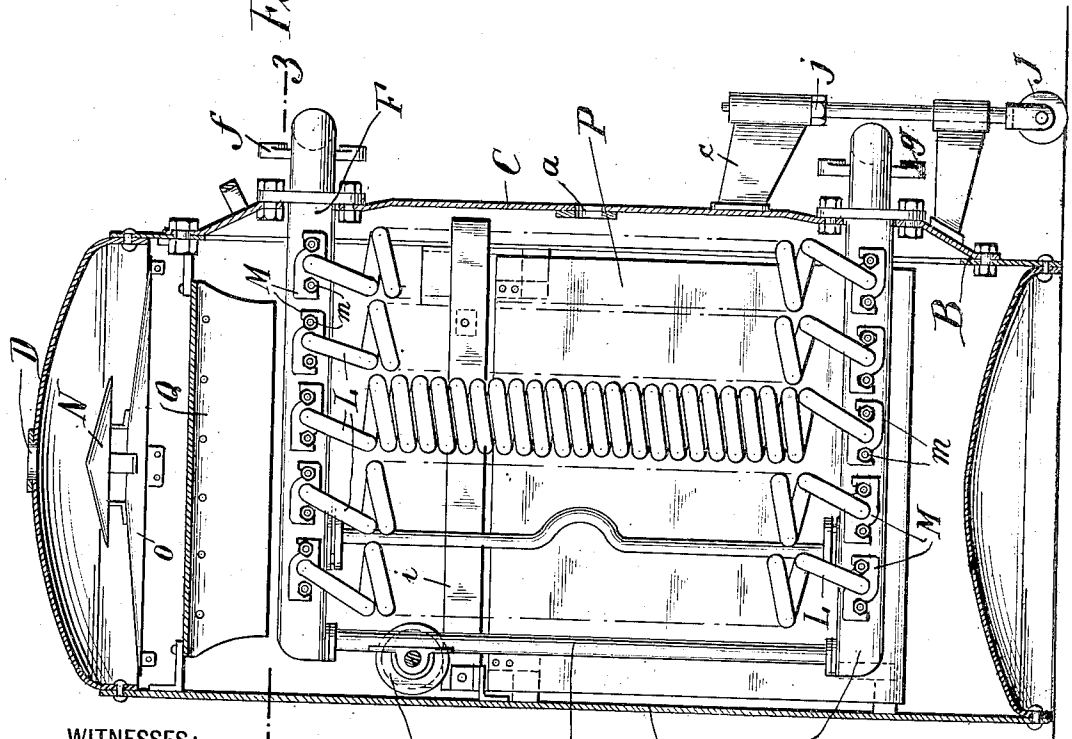


Fig. 1.

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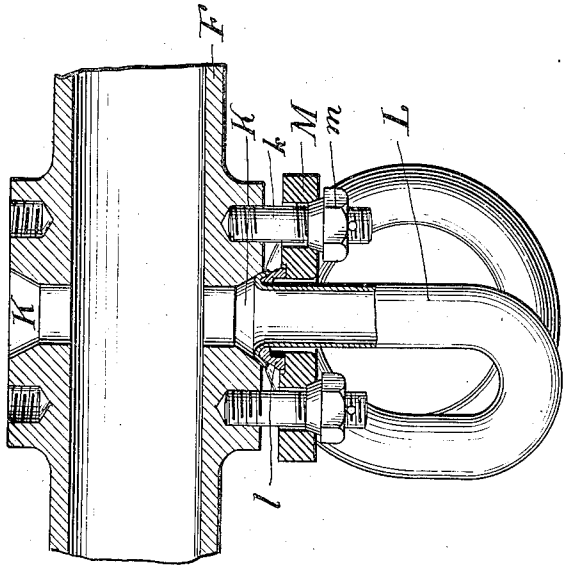


Fig. 4

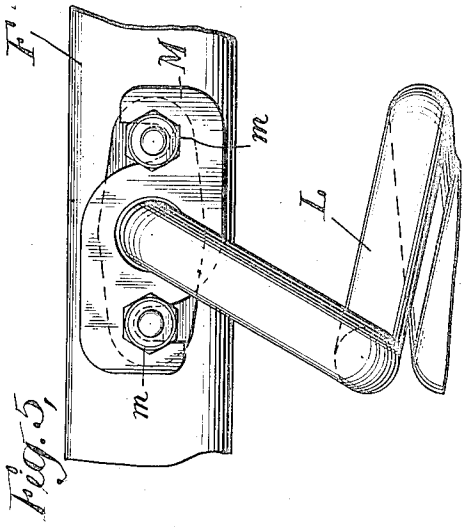


Fig. 5.

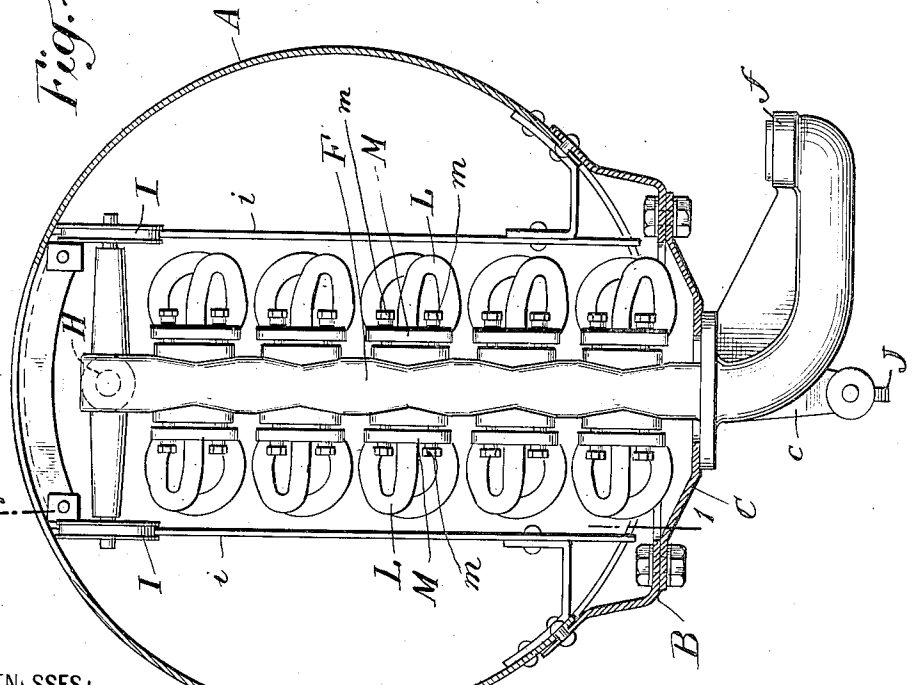


Fig. 3.

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3 SHEETS—SHEET 3.

Fig. 7

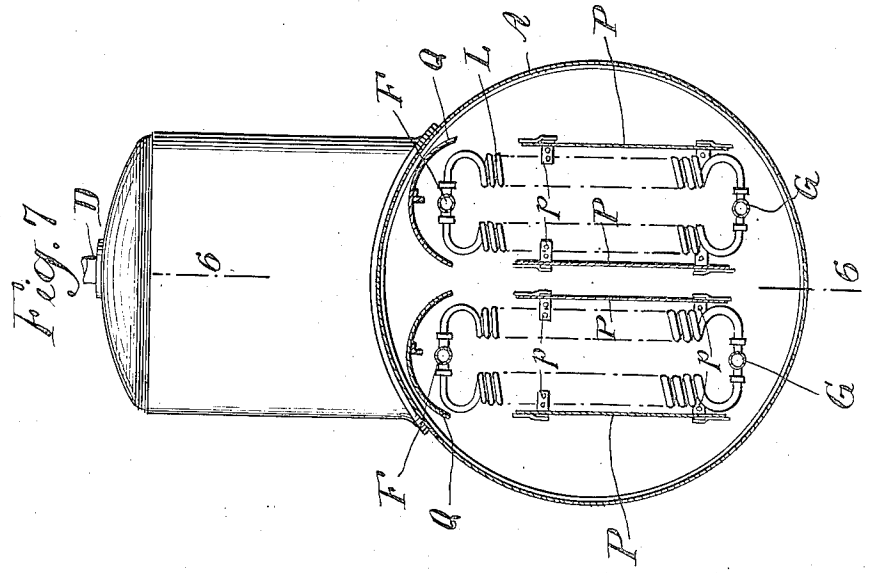
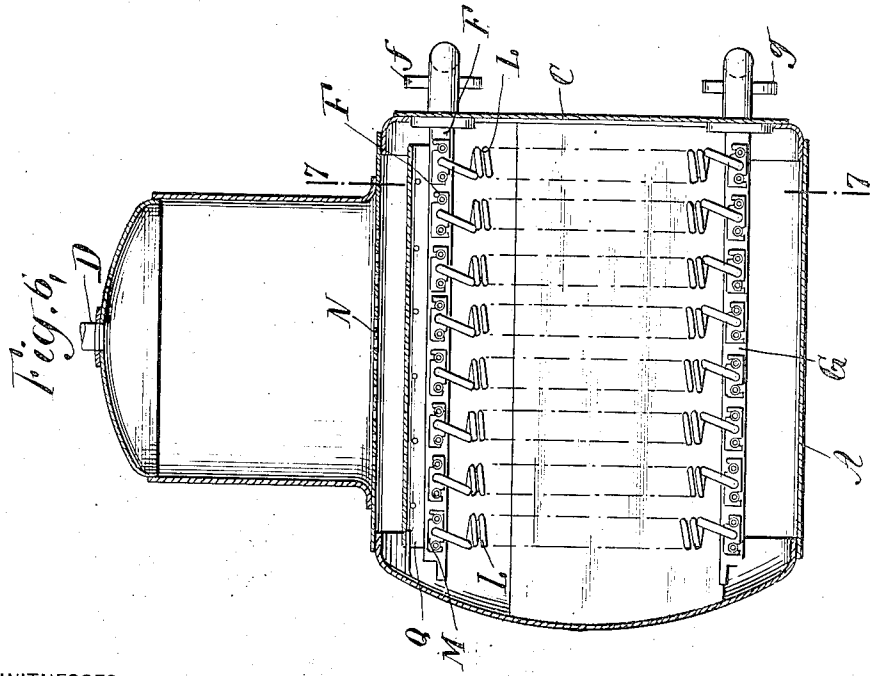


Fig. 6.



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UNITED STATES PATENT OFFICE.

REUBEN R. ROW, OF JERSEY CITY, NEW JERSEY.

EVAPORATOR.

1,131,738. Specification of Letters Patent. Patented Mar. 16, 1915.

Application filed June 7, 1912. Serial No. 702,277.

To all whom it may concern:

Be it known that I, REUBEN R. ROW, a citizen of the United States, residing at Jersey City, county of Hudson, State of New Jersey, have invented certain new and useful Improvements in Evaporators; and I do hereby 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.

The invention contemplates the provision of evaporating apparatus which is at once efficient, compact and convenient, and in which the violent ebullition incident to the most efficient working of the apparatus takes place, while the detrimental effects of priming are avoided.

I attain high efficiency by confining ebullition to the vicinity of the heating surfaces, providing in this way an ebullition compartment and one or more separating compartments into which the priming contents of the ebullition compartments are discharged and in which separating compartments the condition of quiet necessary for the separation of the entrapped vapor from the liquid exists, and from which the vapor rises to an outlet and the liquid flows back to the bottom of the ebullition compartment. The mixed liquid and vapor primes from the upper end of the ebullition compartment into the separating compartment at what may be termed the inlet to the separating compartment, and separate outlets are provided from the separating compartment for the vapor and liquid. Where it is attempted to return the separated liquid to the ebullition compartment by way of the inlet to the separating compartment through which the priming contents of the ebullition compartment enter, efficient operation is prevented owing to the impedance of the circulation and the partial condensation of vapor by contact with the separated and partially cooled liquid. As the vapor outlet from the separating compartments should be at or near the top of the apparatus, and the priming from the ebullition compartment is upward, it is of great advantage to deflect the priming vapor and liquid into the separating compartment in a direction away from said outlet, and particularly downwardly, as the separation is thereby facilitated and the drip from the directing baffle is more easily prevented from reëntering the ebullition compartment.

The adaptation of my invention to apparatus intended for marine installations has resulted in a structural arrangement which offers convenient accessibility to all interior parts for cleaning and repair, which arrangement I have illustrated in the accompanying drawings pointing out the novel features in connection with the description of the drawings and in the appended claims.

In the drawings Figure 1 is a vertical section at about lines 1—1 on Figs. 2 and 3; Fig. 2 is a front view of my improved evaporator showing parts of the door and casing broken away; Fig. 3 is a horizontal section on lines 3—3 of Figs. 1 and 2; Fig. 4 is an enlarged sectional detail of one manifold at the juncture therewith of a coil, and Fig. 5 is an enlarged view of a portion of a manifold and the end of a coil joined thereto; Fig. 6 is a vertical sectional view taken on line 6—6 of Fig. 7 illustrating a modified duplex form especially suitable for evaporators of large capacity; and Fig. 7 is a vertical section taken on line 7—7 of Fig. 6.

Referring to the form shown in Figs. 1 to 3, an outer shell A, which may be in the form of an upright cylinder with crowns as shown, has an upright opening in its front side, the jamb flange B of which opening is provided with bolt holes *b* or other suitable means for the steam-tight attachment thereto of a door C which completes the inclosing shell.

The inlet pipe for the admission of salt water or other solution to be evaporated is fitted into the flanged opening *a*, and a steam or vapor out-take pipe is fitted into the flanged opening D at the center of the upper crown.

A flanged opening U is provided near the bottom for the reception of a blow-off valve.

Horizontal steam manifolds F and G are flanged to the upper and lower portions respectively of the door C extending across the shell A from front to rear when the door is in place. The front ends of the manifolds F and G which extend outwardly through the door C are bent to one side and extended beyond the edge of the door and there bent backward and provided upon their ends with junction flanges *f* and *g* which lie in planes which are substantially parallel to the jamb of the door, and may be

unseated from the steam supply and exhaust pipes simultaneously with the unseating of the door C from the shell A. The inner ends of the manifolds F and G are preferably connected by a spacing bar H.

Rollers I mounted upon studs projecting laterally from the upper portion of this bar H rest upon stationary rails *i* fixed within the shell A and support and guide the inner end of the carriage consisting of the door C and the manifolds F and G carrying the heating coils.

A caster J which rolls upon the floor or deck supports the door C through a bracket *c*, an adjusting nut *j* being provided to regulate the height of the door from the floor that it may be accurately brought into position for attachment to the shell A.

Each of the manifolds is provided upon its opposite sides with cupped holes K for the reception of the conically flanged end of coiled pipes L and these cupped holes may be considered as an element of the quick attachable joint for the coil ends shown in detail in Fig. 4.

Adjacent the holes K in the sides of the steam manifolds F and G, threaded holes are provided for the fixture of threaded studs *k* and nuts *m* threaded upon these studs *k* are adapted to force a dog-flange M against a conical annulus *l* lying behind the conically flanged end of the pipe L and effect a tight joint. This quick attachable and detachable joint forms the subject-matter of a patent No. 1020929 granted to me on March 19, 1912, and its employment in this structure is of peculiar advantage. The coils L are arranged in rows upon both sides of the manifolds F and G and their inherent elasticity not only renders them easily adjustable in their position but takes care of any unequal expansion effects that might occur. Upon the removal of the door the manifolds and the coils attached thereto are moved with it and can pass out through the door opening to give free access to both the coils and the interior of the shell for scaling.

Circular baffles N and O located under the vapor outlet D are designed to intercept liquid particles suspended in the vapor passing to the outlet D and drain these liquid particles toward the periphery of the shell.

Removable partitions P extend from the front to the rear wall of the shell A and from a point above the lower crown of the shell A and below the manifold G nearly to the upper ends of the coils L. These partitions P form a central compartment within which the heating coils L are located, and two outer compartments which communicate with the central compartment at the bottom of the shell and at a point about opposite the upper ends of the heating coils. The partitions P rest in clips *p* on the wall of the shell A and need not be disturbed by the insertion or withdrawal of the heating coils and manifolds with the door, but after the removal of the coils the partitions may be removed from their clips for cleaning and to gain access to the side walls of the shell A to remove the salt and scale.

A curved baffle plate Q is mounted within the shell A directly above the coils L to deflect the mixture of liquid and vapor in the central compartment above the coils, outwardly and downwardly into the outer compartments.

The operation of this form is as follows:— Salt water or other solution to be evaporated is fed to the shell A and its level maintained therein at a height at which the lower ends only of the coils L will be submerged. Steam is run through the coils L producing a violent ebullition of the liquid surrounding their lower ends and creating a rising current of liquid and entrapped vapor within the central compartment about the heating coils. The heating coils L offer such a large heating surface to the water confined about them that the violent ebullition necessary for high efficiency ensues within the central compartment and the contents of this compartment are projected upwardly against the curved baffle Q and are deflected by this baffle outwardly and downwardly into the outer compartments which contain no heating surfaces and in which comparatively quiet conditions exist. Here the violently priming liquid and vapor have an opportunity to separate, the liquid being projected and falling to the bottom and the vapor rising toward the top.

In apparatus wherein the unvaporized liquid particles fall back against the priming stream their retarding effect upon the rising froth materially interferes with the efficient operation of the apparatus.

In Figs. 6 and 7, the duplex type of my apparatus used for large sizes is shown and the operation is substantially the same as that already described.

The best efficiency is attained by effecting violent ebullition and separating the primage from the vapor in the same container and in the presence of the solution heated to a temperature approximating the boiling point. High efficiency for a given capacity requires ebullition so violent that it is seldom attained owing to priming into the delivery pipe while a separation of the primage at a point distant from the body of solution acted upon is accompanied by condensation which generally neutralizes the gain. Effecting the priming from a part only of the surface of the solution acted upon and utilizing the space above the quiet surface of the remaining part reduces condensation to a minimum and presents an opportunity for attaining perfect separation and circulation of the liquid in compact apparatus.

What I claim is:

1. An evaporating apparatus comprising the combination of an upright casing having an outlet at its upper end and an opening in its side wall, a door detachably secured over said opening, partitions detachably mounted within the casing and forming a central ebullition compartment and separating compartments at the sides of the ebullition compartment and communicating with the latter at their upper and lower ends, heating elements mounted on the door and projecting within the ebullition compartment and removable from the ebullition compartment when the door is removed from the casing, a deflector mounted within the casing and above the heating elements for deflecting vapor rising within the ebullition compartment outwardly to the separating compartments and a baffle mounted within the casing between the deflector and said outlet; substantially as described.

2. An evaporating apparatus comprising the combination of an upright casing having an opening in its side wall, a door detachably secured over said opening, partitions mounted within the casing and forming a central ebullition compartment and separating compartments at the sides of the ebullition compartment and communicating with the ebullition compartment at the upper and lower ends thereof, manifolds mounted on the door and projecting therefrom within the ebullition compartment, a plurality of heating coils extending between the manifolds, said door with the manifolds and heating coils thereon being removable from the casing, and a deflector mounted within the casing over the ebullition compartment for deflecting vapor rising within the ebullition compartment outwardly to the separating compartments; substantially as described.

3. An evaporating apparatus comprising the combination of an upright casing having an outlet at its upper end and an opening in its side wall, a door detachably secured over said opening, partitions detachably mounted within the casing and forming a central ebullition compartment and separating compartments at the sides of the ebullition compartment and communicating therewith at its upper and lower ends, two manifolds mounted upon the door one above the other and projecting inwardly from the door into the ebullition compartment, a plurality of coils of heating pipes disposed vertically within the ebullition compartment and connected at their ends to said manifolds, the door with the manifolds and heating pipes mounted thereon being removable from the casing, a deflector mounted within the casing and above the manifolds for deflecting vapor rising within the ebullition compartment outwardly to the separating compartments and a baffle mounted within the casing between the deflector and said outlet; substantially as described.

4. The improvement in evaporating apparatus for obtaining purified liquid, which comprises a containing shell, having an ebullition compartment and a separating compartment communicating with the upper and lowermost portions of said ebullition compartment, a door closing an aperture in said shell leading to said ebullition compartment, manifolds mounted on said door and projecting within said ebullition compartment, heating coils attached to opposite sides of said manifolds by quick-detachable joints, and a laterally deflecting baffle located within said shell above said ebullition compartment; substantially as described.

5. The improvement in evaporating apparatus for obtaining purified liquid, which comprises a containing shell having an ebullition compartment and a separating compartment communicating with the upper and lowermost portions of said ebullition compartment, a door closing an aperture in said shell leading to said ebullition compartment, manifolds and heating coils mounted on said door and projecting within said ebullition compartment, rails mounted within said ebullition compartment. rollers mounted upon the inner and upper end of the structure comprising the manifolds, heating coils and door and adapted to rest upon said rails, a roller mounted upon the lower end of said door and adapted to rest upon the floor, and a laterally deflecting baffle located within said shell above said ebullition compartment; substantially as described.

6. The improvement in evaporating apparatus for obtaining purified liquid, which comprises a containing shell, a door closing an aperture in said shell, a heating coil structure secured to said door and projecting within said shell, rails within said shell, rollers mounted upon the inner and upper portion of said heating coil structure and adapted to rest upon said rails to support the inner end of said structure, and a caster mounted upon the outer side of said door and adapted to roll upon the floor upon which said shell rests and support the outer end of said structure; substantially as described.

7. The improved evaporating apparatus for obtaining purified liquid, which comprises a containing shell, a door closing an aperture in said shell, manifolds secured to and carried by said door, the outwardly projecting ends of said manifolds being extended beyond the edge of said door and backwardly and terminating in flanges lying in planes substantially parallel to the general plane of said door, and a series of

heating coils connected between said manifolds; substantially as described.

8. The improvement in evaporating apparatus for obtaining purified liquid, which comprises a containing shell, a door closing an aperture in said shell, a heating pipe structure secured to said door and projecting within said shell, a supporting roller for said structure within said shell and a second supporting roll for said structure outside said shell; substantially as described.

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

REUBEN R. ROW.

Witnesses:
M. R. COLBY,
G. L. THOMTORS.