A. DUODO.

EVAPORATING AND DISTILLING APPARATUS.

APPLICATION FILED NOV. 16, 1917.

1,353,521. Patented Sept. 21, 1920.

Fig. 1.

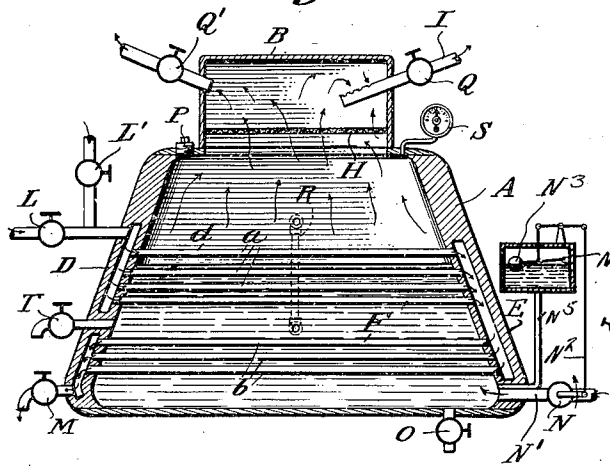


Fig. 2.

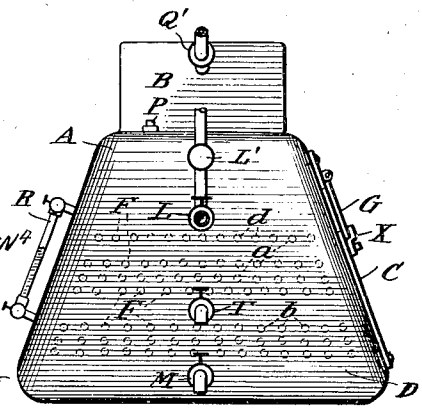
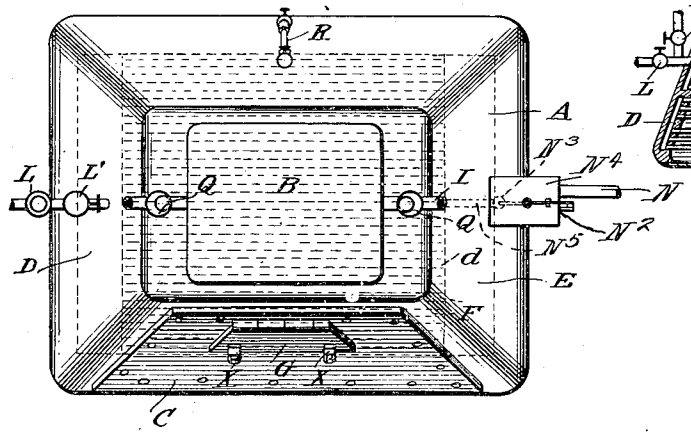


Fig. 7.

Fig. 3.



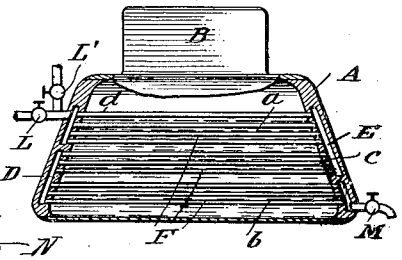


Fig. 5.

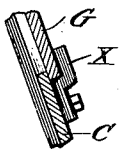
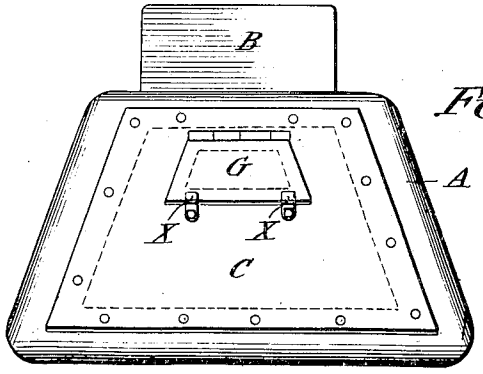


Fig. 6.



Fig. 4.



Inventor:
Arturo Duodo
By Louis Bainbridge
Attorney.

UNITED STATES PATENT OFFICE.

ARTURO DUODO, OF GENOA, ITALY.

EVAPORATING AND DISTILLING APPARATUS.

1,353,521. Specification of Letters Patent. Patented Sept. 21, 1920.

Application filed November 16, 1917. Serial No. 202,406.

To all whom it may concern:

Be it known that I, ARTURO DUODO, subject of the King of Italy, resident of Genoa, in the Kingdom of Italy, N. 20 Corso Firenze, have invented new and useful Evaporating and Distilling Apparatus, of which the following is a specification.

The present invention relates to an evaporating and distilling apparatus of the class in which feed water for steam boilers and fresh water for drinking or other purposes are obtained from sea water or from impure fresh water by distillation by means of live steam, reduced pressure steam, or exhaust steam.

The present invention is applicable to apparatus for installation on board ships as well as to apparatus for installation on land, whether of vertical or horizontal type. Its main feature consists in the provision of an evaporating box and tube nest of special form, which are so constructed as to realize the maximum evaporating capacity with the minimum consumption of steam.

The way in which the heating coils are grouped together and the multiple passage of the steam therein are further characteristic features enabling a constant and uniform evaporation. This improves the efficiency of the apparatus and prevents salt water being entrained along with the steam due the priming.

The form with trapezoidal section and rounded off corners adapted for the evaporating box and nest of heating coils is advantageous also in that the dead spaces are thereby reduced to a minimum, the whole of the space occupied by the water in the evaporator according to this invention being traversed by the heating coils.

A further advantage consists in the small weight of the apparatus, both when empty and when filled with water, the amount of water used also being smaller.

The apparatus may be built up of cast material or rolled material, with a single or with a double set of heating coils, and is consequently well adapted for the highest outputs; it requires no pre-heating of the feed water, the same object being achieved by the multiple passage of the steam through the heating coils.

The evaporating and distilling apparatus according to the present invention is illustrated in the annexed drawings which represent one of its simplest forms.

Figure 1 is a sectional elevation and Fig. 2 a front view. From these two figures the above said trapezoidal form with corners rounded off may be seen; in Fig. 1 the multiple steam passage through the heating coils is indicated by the arrows.

Fig. 3 is a plan view and shows the form of the heating coils and of the headers to which the coils are connected.

Fig. 4 shows the evaporator door as seen from without; it also shows the closing system with hammer bolts, of which Figs. 5 and 6 are details.

Fig. 7 is a detail of the arrangement of the triple passage coils.

The apparatus essentially consists of the following parts: evaporating box A of trapezoidal section with rounded off corners; dome B on top of box A; side door C of the box; headers D, D′ and E, E′ to which the heating coils F are connected. The door C is fitted with an inspection door G which can be readily opened by means of hammer bolts X.

Inside the dome B a steam separating filter H and a steam outlet pipe I are arranged, the upper portion of this pipe being perforated as shown.

The apparatus comprises the following fixtures:

Stop valve L for the live steam coming direct from the boilers; stop valve L′ for the reduced pressure steam or exhaust steam for the heating coils; drain valve M for the heating coils; automatic feed valve N; double cock O for blow-off or sludging purposes; safety valve set P; stop valve Q in pipe I for the secondary steam going to the condenser; stop valve Q′ in pipe I′ for the secondary steam going to the still; water gages R with cocks; pressure gages S; testing and salimeter cock T. The feed valve N is arranged in the inlet pipe N′ for the sea or impure water, and is operated, through a lever system N^2, from a float N^3. The latter is mounted in an elevated tank or chamber N^4 which communicates with the lower portion of the box A by way of a depending pipe N^5, the several parts just mentioned thus constituting a constant-level device, as will be understood.

The working of the apparatus is as follows:

The live steam coming direct from the boilers, or steam under reduced pressure, or exhaust steam, is let through valves L or L′

into the header D; thence it passes through the upper set —*a*— of the heating coil nest F into the header E and back through the bottom set —*b*— to the header D′, whence it is drained as condensate through the drain valve M and conveyed to the condenser or feed tank of the plant.

In the bottom around the set —*b*— of the heating coil nest the temperature of the sea-water contained in the box is raised close to the boiling point; the evaporation proper is effected in the upper set —*a*—. The first coil —*d*— of the set —*a*— is arranged above the sea water level in the box, and has for its object to superheat the steam evolved and render it sufficiently dry.

In this way the steam traveling through the heating coils makes two passages; however three passages might be arranged, as shown in Fig. 7. In the latter case the coil nest is divided into three sets —*a*—, —*b*—, —*c*—, each of them consisting of a number of coils proportionate to the amount of water that must be evaporated.

The sea water can be fed into the evaporator by any pump of the plant in connection with which the evaporator is installed.

The sea or impure water inlet is through the pipe N′ containing the feed valve N, as previously stated. Coming into contact with the various parts of the coil nest F, the water is gradually heated till it is converted into steam.

The steam collects in dome B where, after being separated from the entrained water by filter H, it escapes either through the perforated pipe I and its valve Q to the condenser, or through pipe I′ and valve Q′ to the still.

In order to maintain a uniform degree of concentration of the water to be evaporated or distilled, water is blown off from time to time through cock O; instead of a portion only, the whole of the water can be discharged through cock O when it is desired to clean the apparatus without interfering with the process of distillation.

Having now described my invention and how the same is to be carried out, what I claim as my invention is:

1. An evaporating apparatus, comprising in combination a closed receptacle of trapezoidal section having rounded corners; a plurality of superposed groups of heating tubes within said receptacle; headers to which the ends of all the tubes are connected, at least one header having the adjacent ends of two groups of tubes opening into it, so as to provide communication betwen said groups and thereby enable a forward and backward flow of steam through the groups; a source of steam supply connected to one header for passage therefrom directly into the uppermost group of tubes, another of the headers being provided with a steam outlet; supply means for the liquid to be evaporated communicating with the interior of the receptacle and acting to maintain the level of the liquid at a point where all of the tubes excepting those of the topmost layer are submerged, whereby the said topmost layer of tubes will be surrounded by the steam arising from the evaporating liquid and so as to cause superheating of the steam passing through that layer; a steam dome mounted on the top of the box and provided with a steam outlet; and a filter in said dome to separate out the entrained liquid from the steam.

2. An evaporating apparatus, comprising in combination a closed receptacle of trapezoidal section having rounded corners; a plurality of superposed groups of heating tubes within said receptacle; headers to which the ends of all the tubes are connected, at least one header having the adjacent ends of two groups of tubes opening into it, so as to provide communication between said groups and thereby enable a forward and backward flow of steam through the groups; a source of steam supply connected to one header for passage therefrom directly into the uppermost group of tubes, another of the headers being provided with a steam outlet; and supply means for the liquid to be evaporated communicating with the interior of the receptacle and acting to maintain the level of the liquid at a point where all of the tubes excepting those of the topmost layer are submerged, whereby the said topmost layer of tubes will be surrounded by the steam arising from the evaporating liquid and so as to cause superheating of the steam passing through that layer.

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

ING. ARTURO DUODO.

Witnesses:

JAMES J. MURPHY, JR.,

EDWIN M. ATHERTON.