

(No Model.)

8 Sheets—Sheet 1.

D. B. MORISON.
STEAM GENERATOR OR EVAPORATOR.

No. 460,150.

Patented Sept. 29, 1891.

Fig. 1.

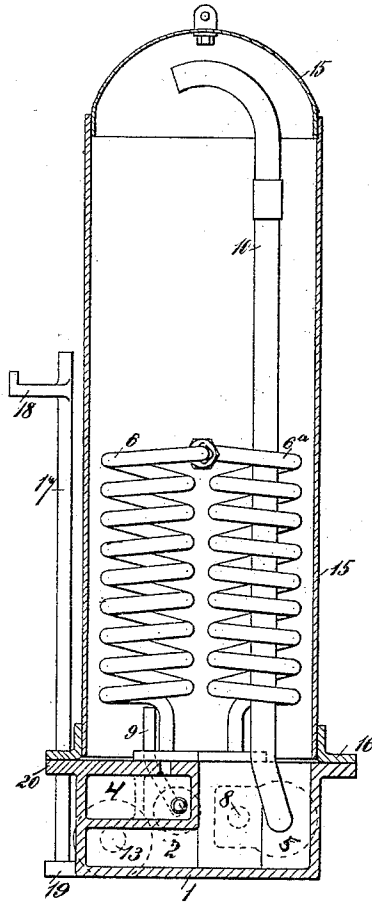
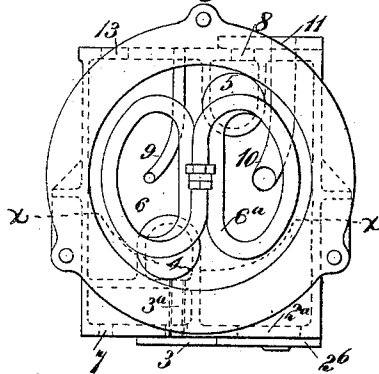


Fig. 2.



Witnesses.

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Longgate.

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Jonas Game Mottin

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Fig. 13.

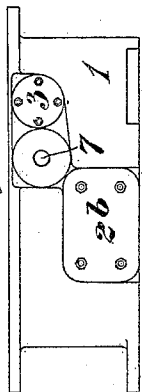


Fig. 14.

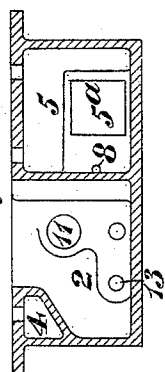


Fig. 15.

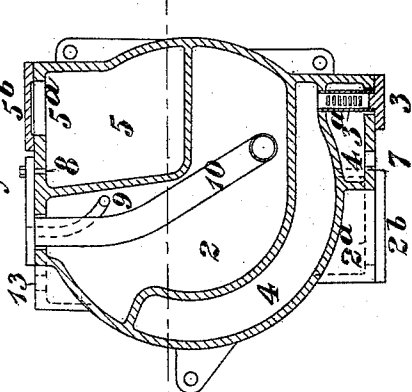


Fig. 10.

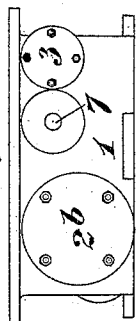


Fig. 11.

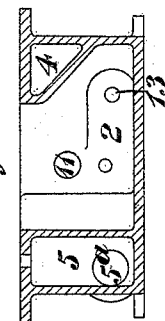


Fig. 12.

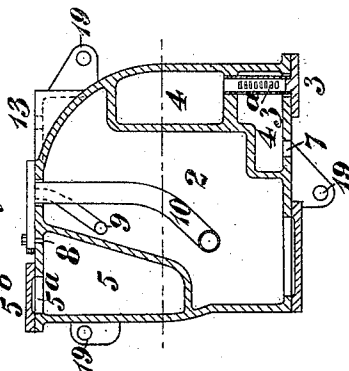


Fig. 3.

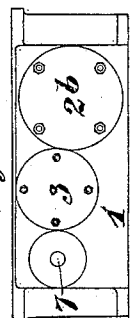


Fig. 4.

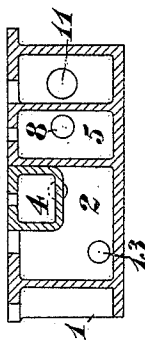
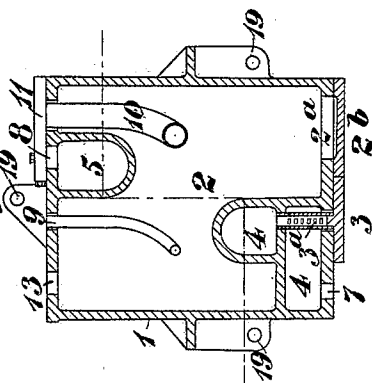


Fig. 5.



Witnesses

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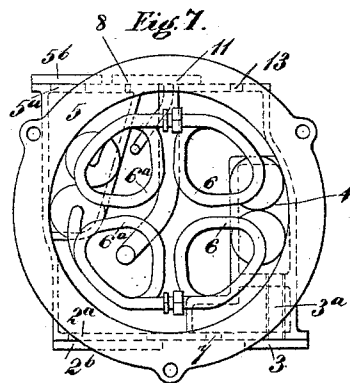
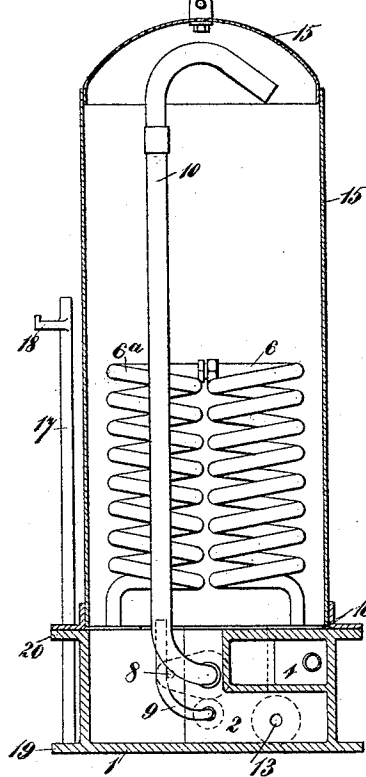
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Fig. 6. Patented Sept. 29, 1891.



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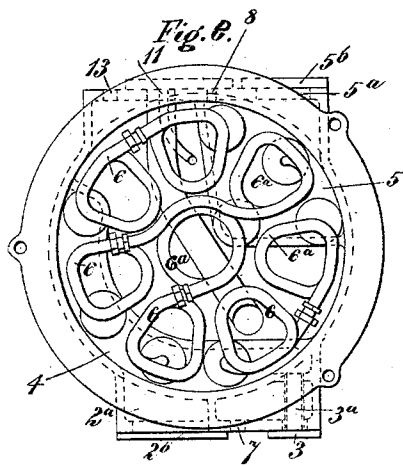
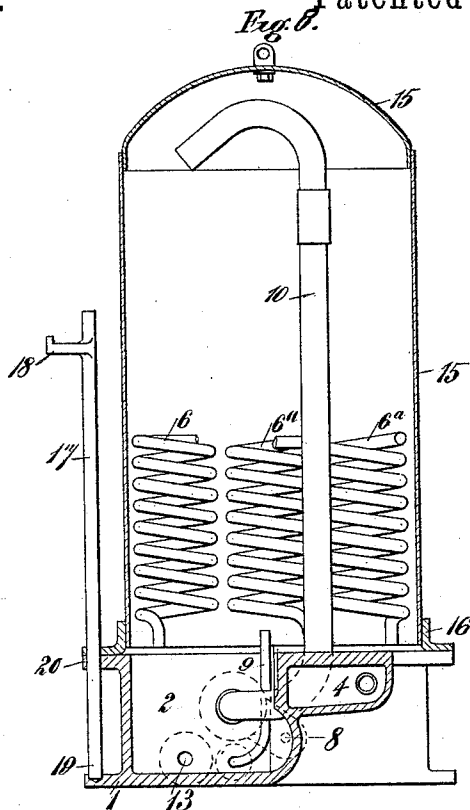
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Witnesses.

E. Hall-Mrown.
L. D. Wajate.

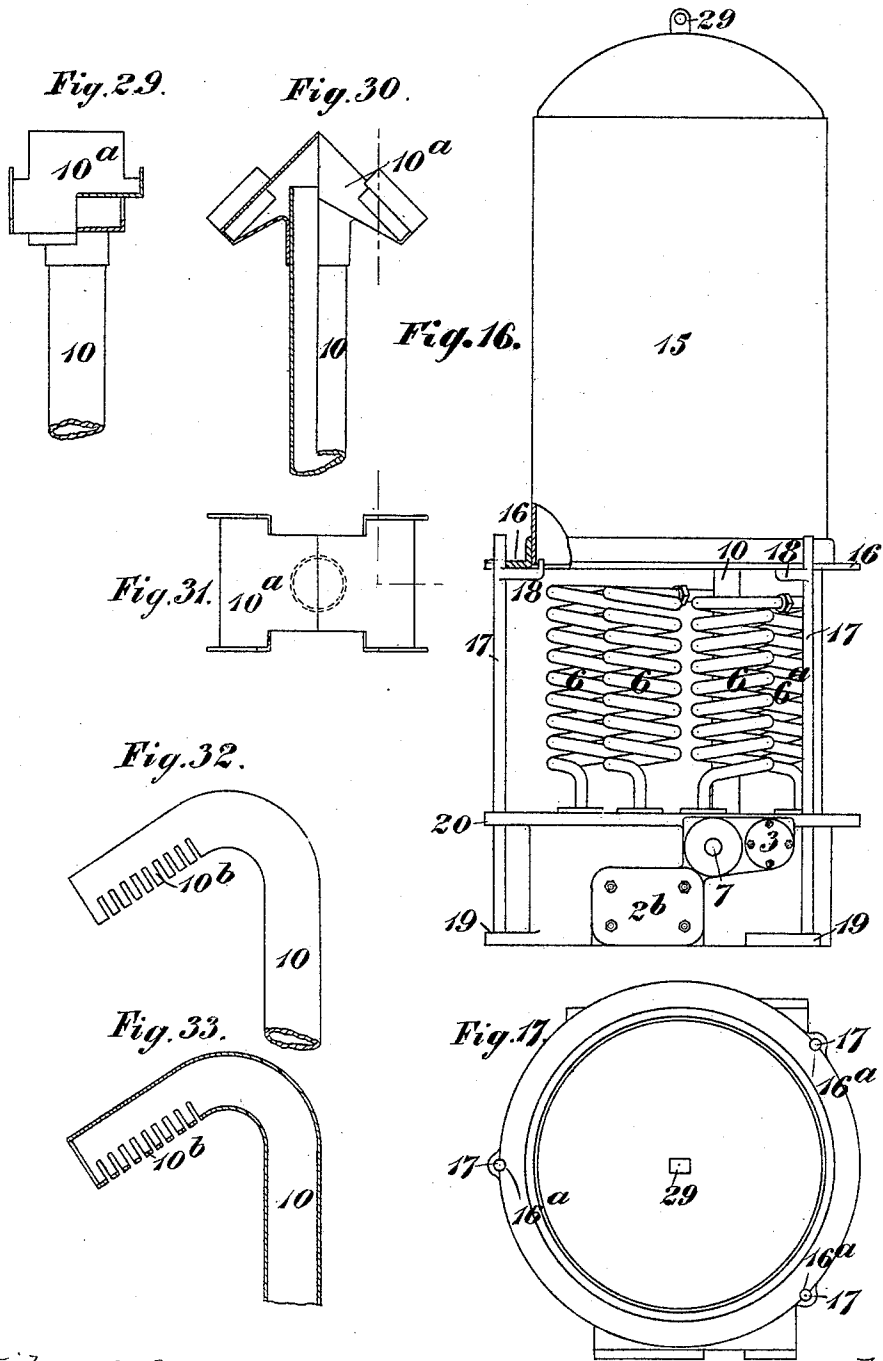
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Witnesses

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Fig. 18.

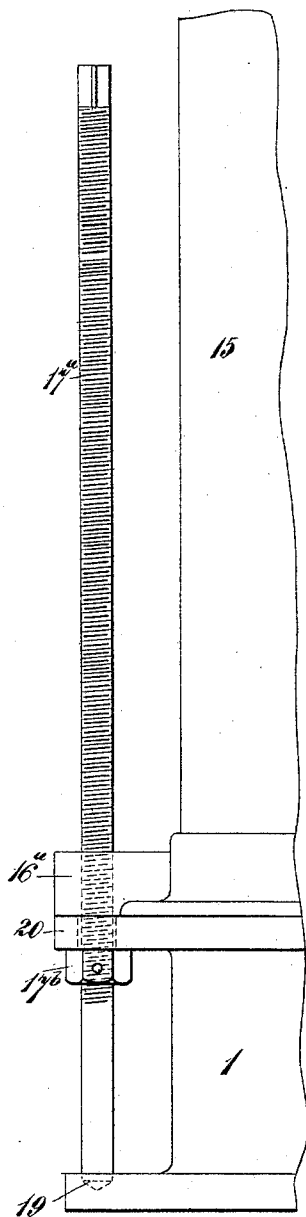
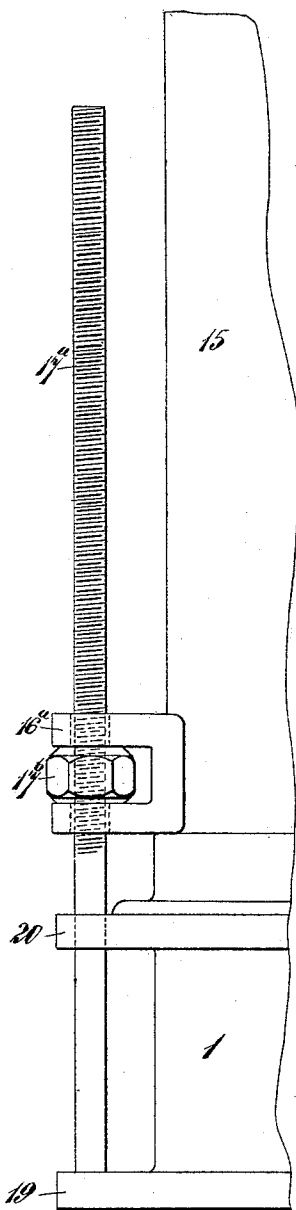


Fig. 19.



Witnesses.

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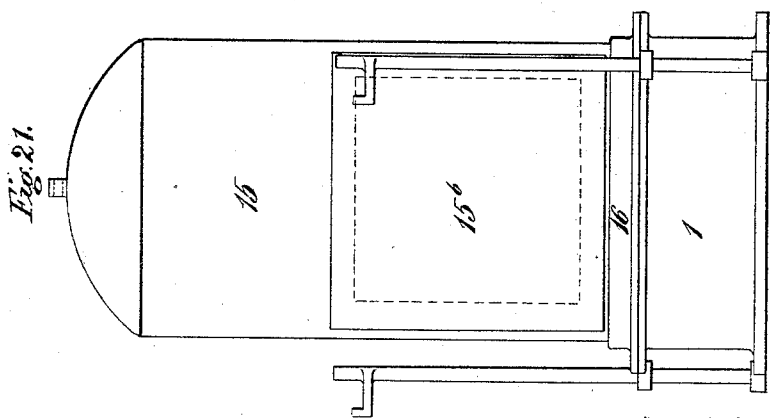
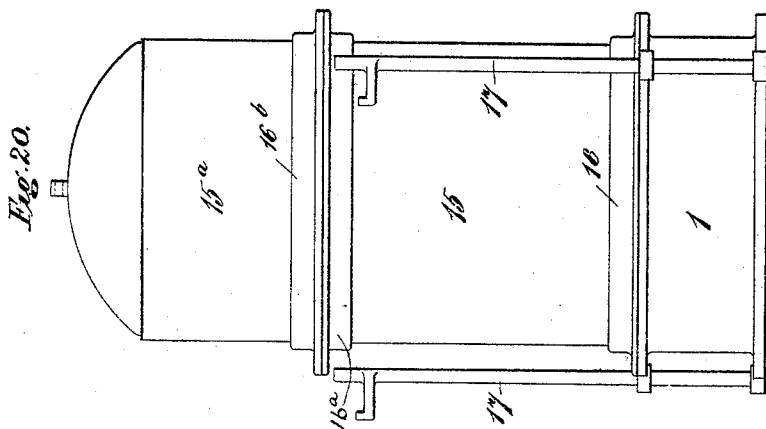
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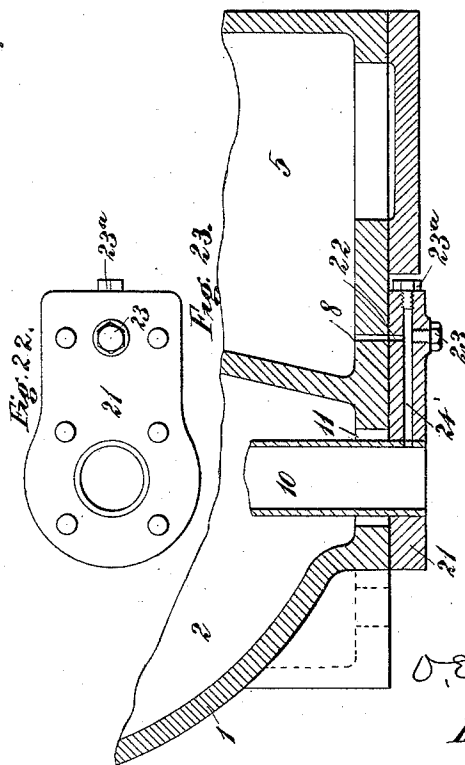
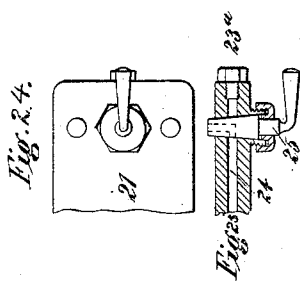
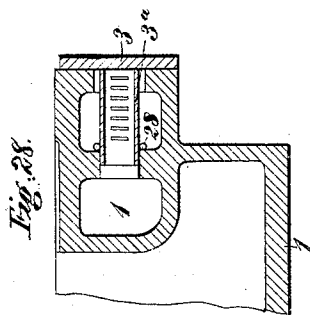
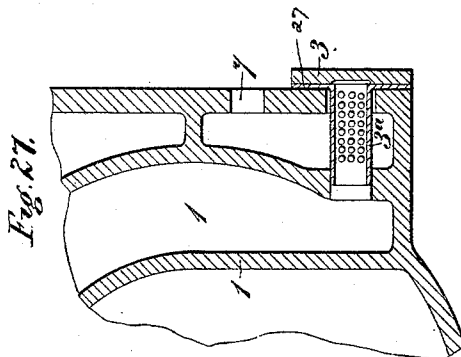
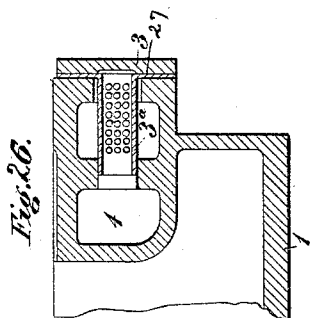
Witnesses.
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UNITED STATES PATENT OFFICE.

DONALD BARNES MORISON, OF HARTLEPOOL, ENGLAND.

STEAM GENERATOR OR EVAPORATOR.

SPECIFICATION forming part of Letters Patent No. 460,150, dated September 29, 1891.

Application filed April 25, 1890. Serial No. 349,521. (No model.) Patented in England May 31, 1889, No. 9,041; in Germany November 16, 1889, No. 53,450; in France November 22, 1889, No. 202,636; in Belgium November 23, 1889, No. 88,587; in Norway December 4, 1889, No. 1,606; in Italy December 31, 1889, LII, 381; in Spain March 8, 1890, No. 10,274; in Austria-Hungary June 22, 1890, No. 11,220; in Victoria July 16, 1890, No. 7,886, and in New South Wales July 18, 1890, No. 2,345.

To all whom it may concern:

Be it known that I, DONALD BARNES MORISON, a subject of the Queen of Great Britain and Ireland, residing at Hartlepool, in the county of Durham, Kingdom of Great Britain and Ireland, have invented Improvements in Steam Generators or Evaporators, (for which I have obtained patents in Great Britain, dated May 31, 1889, No. 9,041; in Germany, dated November 16, 1889, No. 53,450; in Austria-Hungary, dated June 22, 1890, No. 11,220; in Norway, dated December 4, 1889, No. 1,606; in France, dated November 22, 1889, No. 202,636; in Belgium, dated November 23, 1889, No. 88,587; in Spain, dated March 8, 1890, No. 10,274; in Italy, dated December 31, 1889, LII, No. 381; in Victoria, dated July 16, 1890, No. 7,886; in New South Wales, dated July 18, 1890, No. 2,345,) of which the following is a specification.

My invention relates to the construction and arrangement, as hereinafter described, of apparatus for evaporating liquids, and particularly for evaporating water in a closed vessel by means of steam passing through pipes or coils of pipes.

The apparatus is designed more particularly for distilling salt or impure water in order to obtain therefrom fresh or pure water, which may serve as auxiliary feed-water for steam-boilers or for other purposes.

Referring to the accompanying drawings, Figure 1 is a vertical section taken on line *x x*, Fig. 2; and Fig. 2 is a plan of my apparatus with dome removed as constructed with two coils of pipes for evaporating liquids. Figs. 3, 4, and 5 are respectively a side elevation, a vertical section, and a horizontal section of the lower portion of the apparatus. Figs. 6 and 7 and also Figs. 8 and 9 are similar views to Figs. 1 and 2, respectively, illustrating modified constructions of evaporators. Figs. 10, 11, and 12 are similar views to Figs. 3, 4, and 5, respectively, of the lower part of the apparatus shown in Figs. 6 and 7. Figs. 13, 14, and 15 are similar views of the lower part of the apparatus, shown in Figs. 8 and 9. Fig. 16 is an elevation of the apparatus of the kind shown in Figs. 6 and 7, but with

the dome or upper part held in its raised position. Fig. 17 is a plan thereof. Figs. 18 and 19 are outside elevations illustrating modified arrangements for raising and lowering the upper part of the apparatus. Fig. 20 is an outside elevation of an evaporator designed for spaces where the head-room is insufficient to allow of the dome being lifted in the usual manner. Fig. 21 is a similar view to Fig. 20, illustrating an evaporator having a further modified construction of the upper part or dome. Figs. 22 to 23, inclusive, show various details, hereinafter referred to. Figs. 24 and 25 show a modification. Fig. 26 is a sectional elevation thereof. Fig. 27 is a sectional plan of a portion of the bottom vessel. Fig. 28 is a sectional elevation showing a modified form of strainer. Figs. 29, 30, 31, 32, and 33 are detail views of varied constructions.

1 is a lower vessel or casting, hereinafter called the "bottom vessel," upon which all steam and water pipe connections are placed. It is formed with a chamber 2 to receive deposit from the water, a steam-inlet 7, a steam-chest 4, and a water vessel or trap 5 to receive water of condensation from the steam within the coils.

2^a is a man-hole with removable cover 2^b to facilitate the removal of deposit from the chamber 2. In the larger sizes of the apparatus (see Figs. 6 to 15) the chamber 5 is formed with a hand-hole 5^a, with a removable cover 5^b to afford access to its interior.

6^a are heating-coils arranged in pairs, the coils of each pair being preferably connected together at the top by any suitable means, such as a screw connection, as shown. The lower end of each of the coils 6 is connected to the top of the steam-chest 4, and the lower end of each of the coils 6^a is connected to the top of the chamber 5. The inlet branch 7 for steam to heat the water is provided with a door 3 and strainer 3^a to prevent the entrance of dirt and to permit of the strainer being removed for cleaning, as described hereinafter, and shown in Figs. 5, 12, 15, 26, 27, and 28.

8 is the outlet for water of condensation

from the chamber 5. It is preferably of such area as will just pass the water condensed in the coils, or it may be controlled by a suitable cock or valve, one form of which is shown in Figs. 24 and 25.

9 is an inlet-pipe provided with a non-return valve (not shown) for supplying salt-water to be evaporated.

10 is an outlet-pipe for the steam generated from the salt-water by heat from the coils 6 and 6^a. This pipe is connected at its lower end to the bottom vessel 1 at an outlet passage 11, formed in that vessel. The upper end of the pipe 10 may be fitted with a hood or baffle-plate 10^a, as shown in Figs. 29, 30, and 31, or it may be provided with slots 10^b, as shown in Figs. 32 and 33, as well understood, or it may be simply turned over and left open-ended, as shown in Figs. 1, 6, and 7.

13 is an opening in the vessel 1, in which a blow-off cock can be secured.

15 is the dome or upper part, hereinafter called the "dome of the evaporator." It is arranged to inclose the coils 6 6^a and upper parts of the water-inlet pipe 9 and steam-outlet pipe 10, and is provided with a flange 16, by which it can be readily connected to or disconnected from a flange on the bottom vessel 1 by any suitable means, such as bolts and nuts. The flange of the bottom vessel 1, to which the flange 16 of the dome is fitted, is preferably arranged in the same plane as the flanges to which the coils of pipes 6 6^a are jointed, so that when the dome is raised the coils 6 6^a and their flanges may be completely exposed.

To the dome are connected only such fittings as do not require removal when the dome is lifted—as, for example, a water-gage, a pressure-gage, an air-cock, and a safety-valve.

17 are vertical guides and supports, of which there are three in the example shown. They are each provided with a projecting arm 18, forming a rest, and are mounted to rotate in a foot-step bearing 19 and lug 20, carried by the bottom vessel or casting 1 in such a manner that after the dome 15 has been raised sufficiently to expose the whole of the coils 6 6^a by any suitable gear or tackle the projecting rests 18 can be brought by a partial rotation of the supports into position under the lower edge or flange of the dome, which can then be lowered onto and will be supported by the rests 18, as shown in Fig. 16. The flange 16 of the dome is recessed at 16^a, Fig. 17, to enable it to slide up the vertical guides 17 to a point above the rests 18.

Although I have so far described my apparatus as constructed with only two coils, it may be constructed with two or more pairs of coils. Thus Figs. 6, 7, 10, 11, and 12 illustrate my apparatus as made with two pairs of coils, and Figs. 8 and 9 show it constructed with four pairs of coils.

Although the heating-surface is shown in

the form of coils in all the drawings, it is evident that the copper pipes may be bent into any other form.

In the drawings of each of these modifications the same reference-numerals are employed to denote like parts, as in Figs. 1 and 2, and the arrangement and operation will be readily understood from the drawings aided by the description hereinbefore given.

In lieu of the supports 17, already described, I may in either of the arrangements of my apparatus employ one or other of the devices illustrated in Figs. 18 and 19.

In Fig. 18, 17^a is a guide and support in the form of a spindle, resting at its lower end in a foot-step 19 and passing freely (with clearance) through a plain hole in a projection 20 of the part 1, below which a nut or collar 17^b is secured to the support. The support is formed with a screw-thread, and passes through a correspondingly-threaded hole formed in a bracket or projection 16^a, projecting from the dome or upper part 15. The support can be rotated by means of a spanner or a ratchet applied to its upper squared end. Although only one guide and support is shown, it will be understood that more than one are to be employed.

In the modification illustrated in Fig. 19 the screwed part 17^a of the guide or support is fixed in the projecting parts 19 and 20 on the bottom vessel, but passes freely through holes formed in the projecting bracket 16^a on the dome. Upward and downward motion of the dome is obtained by rotating the nut 17^b on the screw part 17^a. Endwise movement of this nut is prevented by the arms of the bracket 16^a.

In Fig. 20, which illustrates an evaporator designed for spaces where the head-room is insufficient to allow of the dome being lifted in the usual manner, the dome is divided into two parts 15 and 15^a, united by the flanges 16^a and 16^b. The steam-outlet pipe 10, hereinbefore referred to, is also divided into two parts, connected together by means of a socket-joint. This arrangement permits of the upper part 15^a being removed horizontally when the bolts connecting it to the lower part 15 are withdrawn. Access is afforded to the socket-joint of the pipe 10 for the purpose of disconnecting and removing or lowering the upper portion of the pipe 10 by raising the dome a short distance before removing the top part horizontally from the lower part. The lower part 15 can then be lifted in the usual manner and supported by the supports 17 or 17^a, as hereinbefore described.

In the arrangement shown in Fig. 21 the evaporator-dome 15 is provided with a door 15^b for the purpose of examining or removing the coils from the interior.

Fig. 22 is an elevation, and Fig. 23 is a sectional plan, of a flange 21, adapted to be applied to the bottom vessel 1 (part of which is shown in section) over the steam-outlet 11

and the condensed-water outlet 8 from the chamber 5. This arrangement is more particularly suitable when the steam generated from the salt-water and the water of condensation from the chamber 5 are utilized to heat the feed-water for the boilers of the main engines. 22 is the opening registering with the water-outlet 8, which is generally of small area. Removable screw-plugs 23 23^a are provided to enable the passages 22 and 24 to be easily cleaned. Figs. 24 and 25 show a modification of this flange having an open-ended plug 25 inserted, so that the drain from the coils can be regulated thereby.

Fig. 27 illustrates a portion of the bottom vessel 1, showing the steam-inlet 7 and part of the steam-chest 4. 3 is the door for access to the strainer 3^a.

Fig. 28 shows a modified form of strainer 3^a. The strainer may be made with a flange 27, as shown in Figs. 26 and 27, or with a collar 28, as in Fig. 28, to maintain it in its proper position.

The manner in which the evaporator is worked is as follows: Salt-water is first pumped through the inlet-pipe 9 and into the evaporator to a proper height, as indicated by the gage. The supply of water is then shut off, and steam is turned onto the inlet-branch 7. The steam passes through the strainer 3^a into the steam-chest 4, and thence passes upward through the coil or coils 6 and downward through the coil or coils 6^a, thus heating the water surrounding the coils and becoming itself condensed and falling as water of condensation into the chamber 5, whence it escapes through the outlet 8. After the water in the evaporator has commenced to boil the feed-water is again turned on and suitably regulated, so as to compensate for the water being evaporated. The steam produced by the evaporation of the salt-water passes off through the pipe 10 and outlet 11 and thence into a condenser.

To obtain the greatest efficiency from the evaporator and to prevent salt being deposited on the coils, the density of the water in the evaporator should never be allowed to exceed two and one-half—thirty-two as measured by a salinometer. In order to maintain the density of the water at this point, more than one-fourth of the water pumped into the evaporator must be discharged through a brining-cock, (not shown,) but secured in the blow-off opening 13. This cock should be allowed to run continuously, suitable provision being made for adjusting the flow in a manner that will be readily understood.

What I claim is—

1. In apparatus for evaporating liquids, the combination of a bottom vessel having a chamber to receive deposit from the water, a steam-inlet, a steam-chest, a water vessel or trap, and a water-inlet pipe, heating-pipes arranged in pairs, the lower end of one of said pipes being connected to the top of said steam-chest and the lower end of the other to the top of said

water-chamber, a removable dome connected to the bottom vessel in about the same plane as the flanges to which the lower ends of the heating-pipes are jointed, and a steam-outlet pipe carried by said bottom vessel and having its upper open end within the steam-space at the upper part of said dome, substantially as herein described, for the purpose set forth.

2. In apparatus for evaporating liquids, the combination of a bottom vessel, to which the various pipe connections are made, a removable upper part or dome adapted to be connected to said bottom part, and guides and supports adapted to guide said upper part or dome while the same is being raised and to support it when raised, substantially as herein described, for the purpose set forth.

3. In apparatus for evaporating liquids, the combination of a bottom vessel to which the various pipe connections are made, a removable upper part or dome adapted to be connected to said bottom part and made in two sections, the upper of which can be disconnected from the lower one and removed in a horizontal direction, and guides or supports adapted to guide the lower section of said upper part or dome when the same is being raised and to support it when raised, substantially as herein described, for the purpose set forth.

4. In apparatus for evaporating liquids, the combination of a bottom vessel to which the various pipe connections are made, a steam-outlet pipe carried by said bottom vessel and having its upper open end located within the steam-space of the apparatus, and a removable part or dome normally carried by said bottom vessel and constructed with a door, such as 15^b, substantially as herein described, for the purpose set forth.

5. In apparatus for evaporating liquids, the combination, with the bottom vessel 1, having a water-vessel 5, with outlet 8 for water of condensation from steam-heating pipes, and a steam-outlet pipe 10, of a flange 21, adapted to be applied to the said vessel over the outlet end of said pipe 10, and formed with an opening 22 and passage 24, arranged to communicate with said outlet 8 and with said pipe 10, substantially as herein described, for the purpose set forth.

6. In apparatus for evaporating liquids, the combination, with the bottom vessel 1, having a water-vessel 5, with outlet 8 for water of condensation from steam-heating pipes, and a steam-outlet pipe 10, of a flange 21, adapted to be applied to the said vessel over the outlet end of said pipe 10 and formed with a passage 24 in communication with said outlet 8 and with said pipe 10, and a plug 25, arranged to control the communication between said water vessel and passage, substantially as herein described, for the purpose set forth.

7. In apparatus for evaporating liquids, the combination, with the bottom vessel having a steam-chest 4, to which a heating-pipe is con-

nected, of a circular removable strainer or arrester arranged in the steam-passage leading to said steam-chest, substantially as herein described.

- 5 8. Apparatus for evaporating liquids, comprising a bottom vessel 1, with chamber 2, steam-chest 4, and water-chamber 5, heating-coils 6 6^a, secured together at their upper ends and connected at their lower ends to flanges
10 fixed to the tops of said steam-chest and water-chamber, respectively, a water-inlet pipe and steam-outlet pipe 10, carried by said bottom vessel 1, and a removable dome 15, inclosing said coils and the upper part of said
15 outlet-pipe and connected to said bottom vessel in about the same plane as the flanges carrying said coils, substantially as herein described, for the purpose specified.

9. In apparatus for evaporating liquids, the combination of a bottom vessel 1, carrying the 20 various pipe connections, a removable dome 15, normally carried by said bottom vessel, and vertical guides and supports 17, each arranged external to said vessel and dome, capable of partial rotation and provided with a 25 projecting arm 18, substantially as herein described, for the purpose specified.

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

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Witnesses:

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