(No Model.) 2 Sheets—Sheet 1.

W. F. PAMPHLETT.

APPARATUS FOR PRODUCING FRESH WATER FROM SEA WATER.

No. 419,215. Patented Jan. 14, 1890.

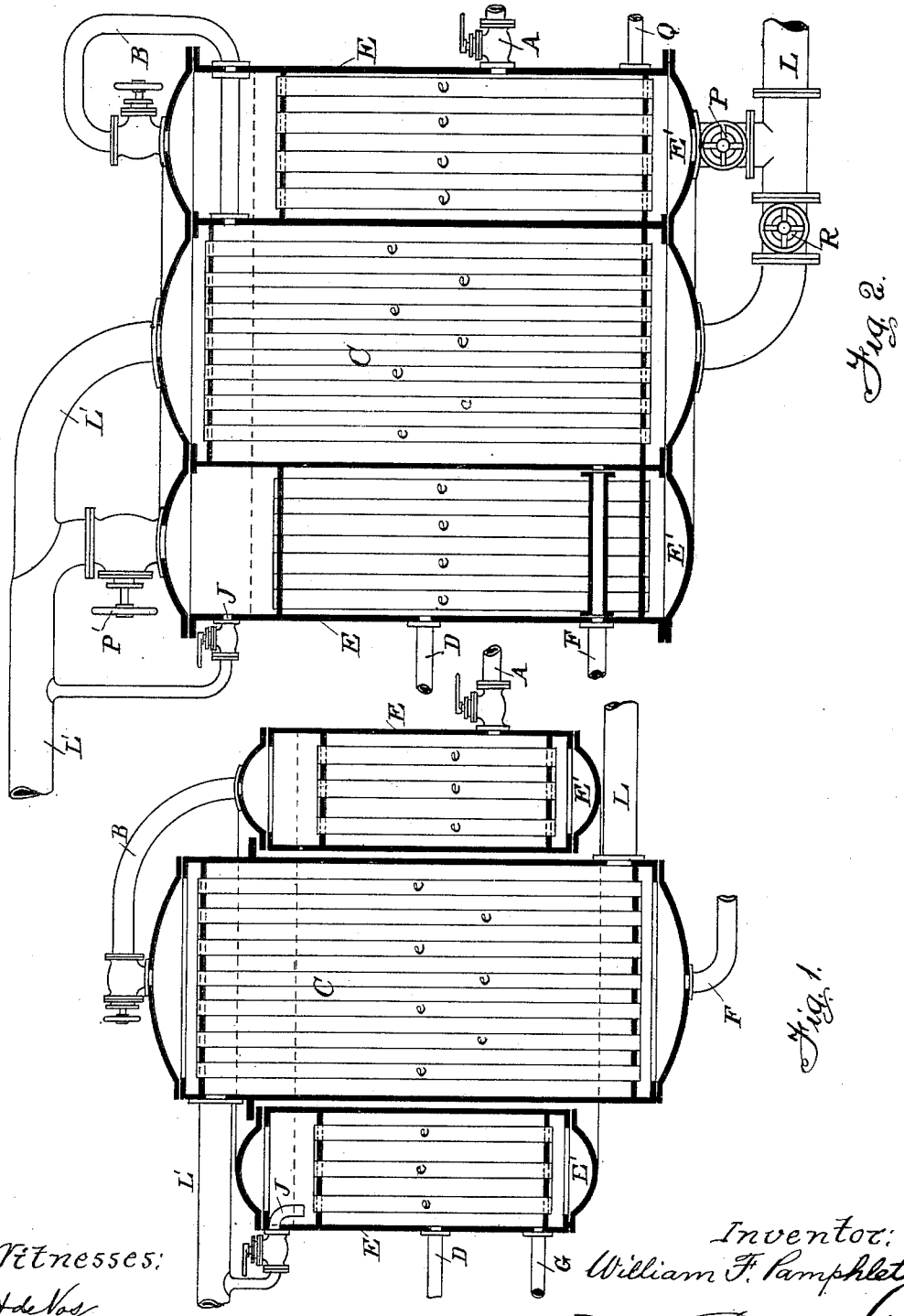

Fig. 2.

Fig. 1.

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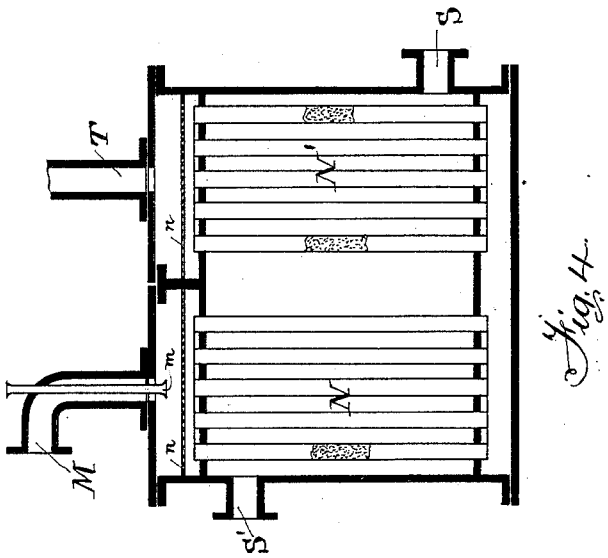

Fig. 4.

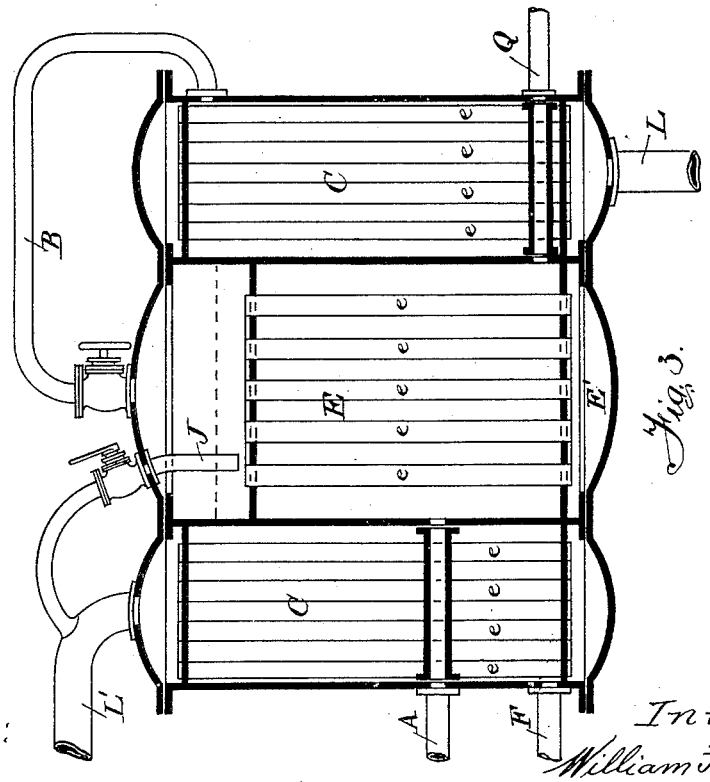

Fig. 3.

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UNITED STATES PATENT OFFICE.

WILLIAM FREDERIC PAMPHLETT, OF PORTSEA, COUNTY OF HANTS, ENGLAND.

APPARATUS FOR PRODUCING FRESH WATER FROM SEA-WATER.

SPECIFICATION forming part of Letters Patent No. 419,215, dated January 14, 1890.

Application filed March 5, 1889. Serial No. 302,000. (No model.) Patented in England October 19, 1887, No. 14,228, and in Italy February 2, 1888, XLV, 48.

To all whom it may concern:

Be it known that I, WILLIAM FREDERIC PAMPHLETT, residing at Portsea, in the county of Hants, England, a subject of the Queen of Great Britain and Ireland, have invented an Improved Evaporating and Condensing Apparatus for Producing Fresh Water from Sea-Water for Drinking Purposes and for Boiler-Feed, (patented partially in England October 19, 1887, under No. 14,228, and in Italy February 2, 1888, under No. 48, Vol. XLV,) of which the following is a specification.

My invention relates to an improved apparatus for the evaporation and condensation of fresh water from sea-water for drinking purposes, to be afterward cooled and aerated, if desirable, or for boiler-feed, and it is designed to effect the same by means of especially simple and convenient apparatus and in an economical manner.

By a well-known law boiling water under a vacuum enables the evaporation to be effected at a comparatively low temperature, and this law I take advantage of in carrying out the evaporation of sea-water under a vacuum by means of steam, utilizing the preheated condensing-water for evaporation.

My apparatus, in addition to being suitable for the production of fresh water for drinking purposes, is also particularly applicable for the supply of the usual loss of fresh water to the boiler.

My apparatus consists in the construction of a combined evaporator and condenser, the one placed concentrically within the other, so as to form an exceedingly compact, cheaply-made, and easily-repaired device used in conjunction with a set of suitable pumps.

I may, equivalently, either form the complete combined condenser and evaporator in one casting or in separate castings, the one introduced into the center of the other and secured in place by bolts. The inner chamber may be used as a condenser and the outer as the evaporator, or vice versa, or both being convertible into condensing-chambers when desired.

I prefer, for simplicity of form, to make my whole device cylindrical in shape, closed at the top and bottom with suitable covers, and divided into an inner and outer chamber (where the casting is in one piece) by an internal cylindrical wall, the covers over the central chamber and outer annular chamber being preferably distinct from one another. Where I use two distinct castings for the inner and outer chamber, the relative position remains the same, the outer chamber being an annulus of considerable depth and the inner chamber being introduced within the outer nest or annular chamber. In the inner and outer chambers, respectively, I provide suitable tube plates or diaphragms and closely pack the intervening space with plain or corrugated tubes, which thus form convenient vessels either for evaporation by steam or for condensation by cold condensing-water.

For evaporation by steam it is obvious I may introduce the steam either within the said tubes, the sea-water to be evaporated occupying the space around them, or vice versa, and, similarly, in the condensing-vessel the steam to be condensed may pass through the nest of tubes while surrounded with cold circulating water; or, vice versa, the water may be within the tubes and the steam to be condensed in the space outside; or, by a suitable series of alternative pipe-connections and cocks, I may use both chambers for condensation of steam from auxiliary engines, &c., when no evaporation is required.

In order that my invention may be the better understood, I now proceed to describe the same in relation to the drawings hereunto annexed, reference being had to the letters marked thereon.

Like letters refer to like parts throughout the figures.

Figure 1 shows in sectional elevation one form of my improved combined evaporator and condenser. Fig. 2 shows in sectional elevation an equivalent but modified form of my improved evaporator and condenser with alternative connections and cocks to enable the whole device to be used as a condenser. Fig. 3 shows in sectional elevation another equivalent but modified form of combined evapo-

rator and condenser. Fig. 4 shows a sectional elevation through a convenient filter and cooler.

E is the evaporator, made of any suitable material, according to the pressure of steam used. The tubes *e'* may be either of brass, iron, or steel, and plain or corrugated in shape, and straight or coiled. By the use of corrugated tubes, in addition to obtaining increased evaporating-surface, greater strength is obtained. The corrugations may be either at right angles to the axis of the tube or slightly spiral, so as to facilitate cleaning and withdrawal. The salt-water to be evaporated is supplied conveniently through the pipe J into the evaporator E, where it fills the lower portion E' of the evaporator E, the interior of the tubes, and is allowed to stand to some slight height above the top tube-plate. Live steam from the boiler is admitted through the pipe and valve A into the chamber containing the evaporating-tubes, so as to surround the latter and impart its heat to the sea-water therein contained.

In Figs. 1 and 2, the condenser-chamber C is within the annular evaporating-chamber, and in Fig. 3 the condenser C is the annulus within which is placed the evaporator E.

In Fig. 1 I introduce steam from a boiler through the pipe A into the annular chamber E, containing the outer nest of tubes, and into the said space introduce the exhaust-steam either from the engine or from any other source of waste by the pipe D. In the tube-space in this annular chamber I supply hot sea-water taken from the circulating water after it has been used for such condensation. This water is here evaporated and carried by suitable pipe-connections B to the condenser C, passing to the nest of tubes therein and drawn therethrough by the vacuum of any suitable air-pump by the pipe F. The space surrounding the nest of tubes in the condenser is in this case occupied by the cold circulating water or any suitable source of supply through the pipe L and passes off through the pipe L'. The evaporation therefore proceeds under a vacuum. The condensed products from the steam taken from the boiler or exhaust of the engine or other waste, which condense in the process of parting with their heat to evaporate the sea-water, are removed by a feed-pump through the pipe G. In this case the inner condenser may conveniently be made of a distinct casting from that of the evaporator E, and can be put together as illustrated herewith.

In the case of Fig. 2 similar parts have similar letters, as in the above description; but in this case the evaporated sea-water is carried by the tube B into the space surrounding the tubes *e* of the condenser C instead of through the said tubes. The condensing-water in this case passes through the pipe L, inside the tubes *e*, and has its exit through the pipe L'. By the addition of the connections P and screw-down valve therein, as also by placing a similar valve R in the main branch of the admission-pipe for the circulating water, and also by reason of the branch P' and screw-down valve therein added to the exit-pipe of the circulating water the evaporator and the condenser may both be converted into condensers by opening all the screw-down valves therein P R P' except that in the tube B. In this case the circulating water is free to pass through the whole of the tubes in both chambers and to issue from the exit-pipe L', the whole of the space surrounding such tubes being thus available for condensing purposes when the evaporator is not required.

In Fig. 3, by a slight modification in the arrangement of the pipes, I may use the inner nest as the evaporator E, the steam from the boiler or other exhaust or waste (being introduced therein by the pipe A) surrounding the nest of tubes and the water to be evaporated being taken from the circulating-water outlet and supplied to the interior of the tubes by the pipe J in the internal chamber. The outer chamber is then used for the condensation of the evaporated products from the inner chamber transmitted by the pipe B into the space surrounding the tubes *e* of the condenser C. The circulating water is introduced by the pipe L through the tubes *e*, issuing by the pipe L', and the condensed products for drinking purposes being collected, as before, from the pipe F, the condensed greasy products being withdrawn by the feed-pump through the pipe Q.

In the first case the arrangement in Fig. 1 is provided with a space between the inner and outer vessels to prevent intercommunication of heat, which may be left an air-space, or may be suitably packed to effect this, as indicated in Fig. 1.

Drinking-water so produced by the evaporation or distillation of sea or other water is warm and flat to the taste, and therefore requires cooling and filtration as well as aeration before being pleasant to the taste. This I effect by combining with my evaporator and condenser a cooling filter-vessel, Fig. 4, into which the water to be filtered is introduced by the pipe M, provided with an internal open-air pipe *m* for the aeration of the water. A perforated plate *n* is placed over the tubes to distribute the flow of water. The upper part of the filter is divided by a diaphragm and a transverse rib into two parts, into one of which fresh water is delivered from the condenser. It then passes through the series of tubes N to the lower part of the filter and ascends again through similar tubes N' to the outlet T. Circulating water enters the pipe S', surrounding the whole of the said tubes, issuing from the outlet S, thus further cooling the fresh water. The tubes N N' are filled with charcoal or other approved filtering medium to filter the

water as it passes through the said tubes. The resulting product is thus cooled, aerated, and filtered and excellent to drink.

Having now particularly described the nature of my invention, what I claim, and desire to secure by Letters Patent, is—

1. In an evaporator and condenser, the combination, with two chambers, one fitting within the other and provided with longitudinal tubes and transverse partitions, and a connection between the said chambers, of means for supplying water to said chambers, and means, substantially as described, for conducting the condensed water off, substantially as set forth.

2. In a combined evaporator and condenser, the combination of two chambers, one within the other, a pipe B, connecting the upper portions of the same, a pipe A, adapted to conduct steam to the inner chamber, transverse partitions and longitudinal tubes in the latter chamber, a circulating-water pipe, a water-pipe leading to said tubes, a second set of transverse partitions and tubes in the outer chamber, and connections between the circulating pipe and the second set of tubes, substantially as set forth.

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

WILLIAM FREDERIC PAMPHLETT.

Witnesses:

REGINALD WILLIAM JAMES,

ALBERT E. NASH.