3 Sheets—Sheet 1.

A. NORMANDY.

Evaporating Pan.

No. 21,693. Patented Oct. 5, 1858.

Fig. 1,

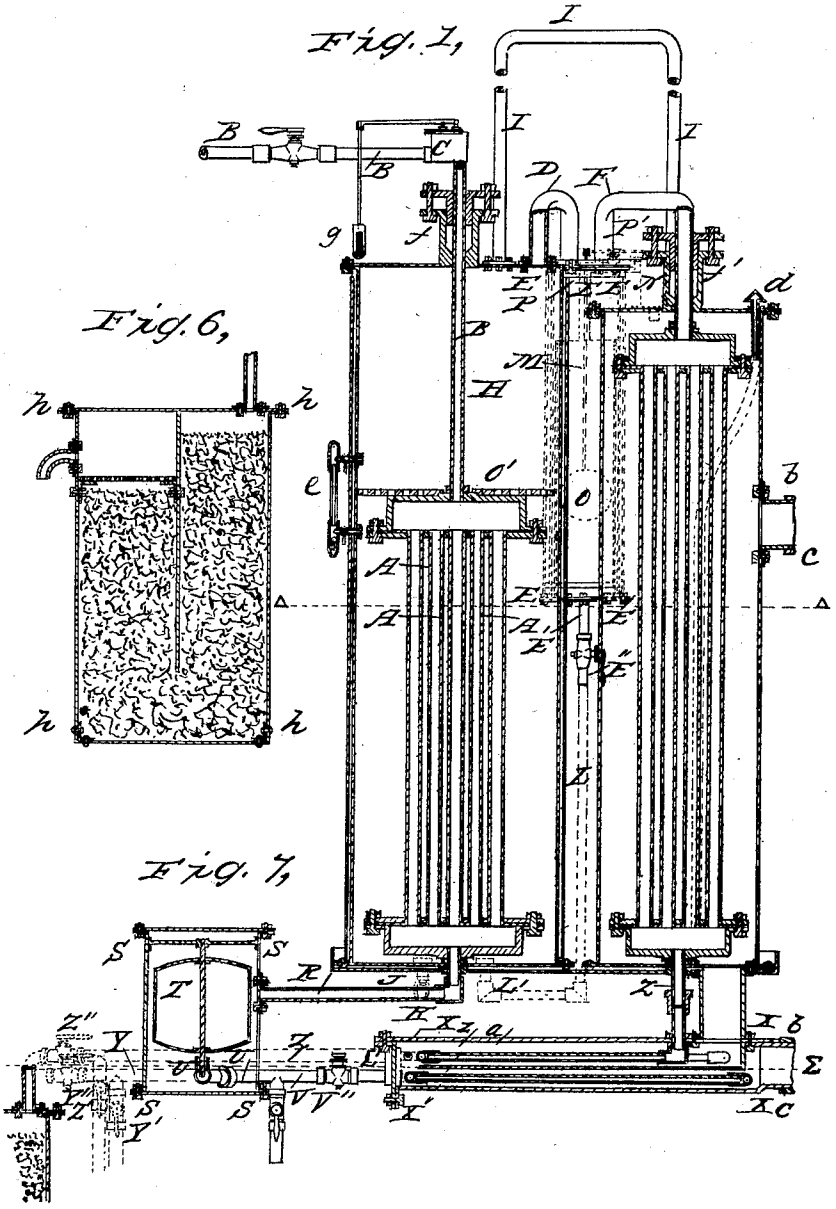


Fig. 6,

Fig. 7,

Witnesses:
Kay Bynum Pugh
J. Barker.

Inventor,
A. Normandy.

PETERS, Photo-Lithographer, Washington, D. C.

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A. NORMANDY.

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Fig. 2,

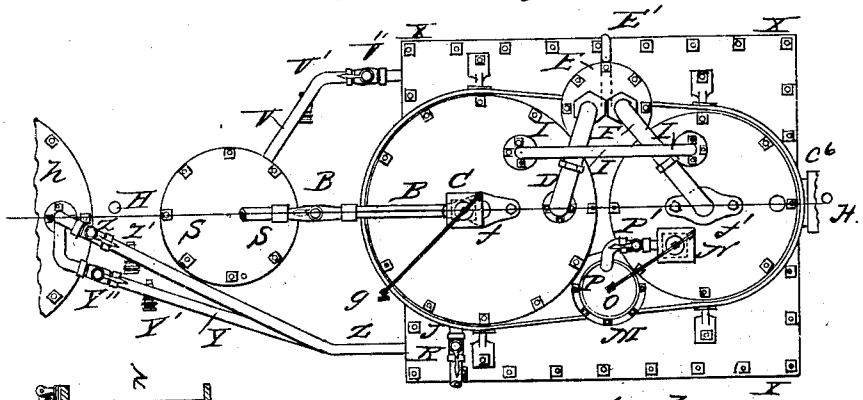


Fig. 5

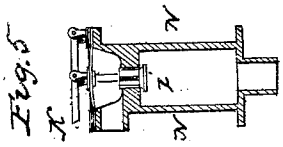


Fig. 3,

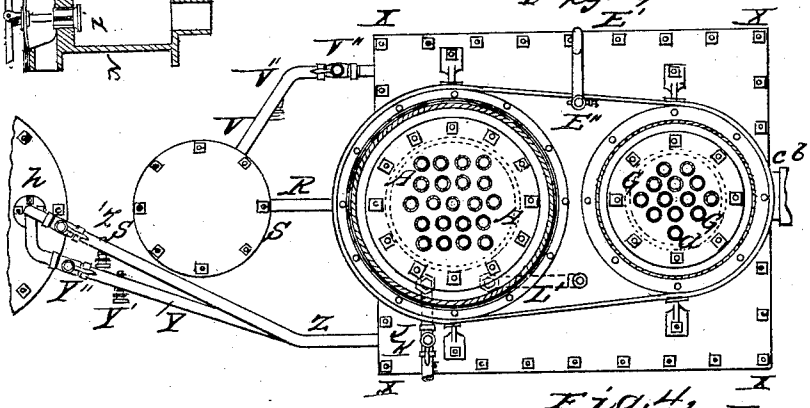
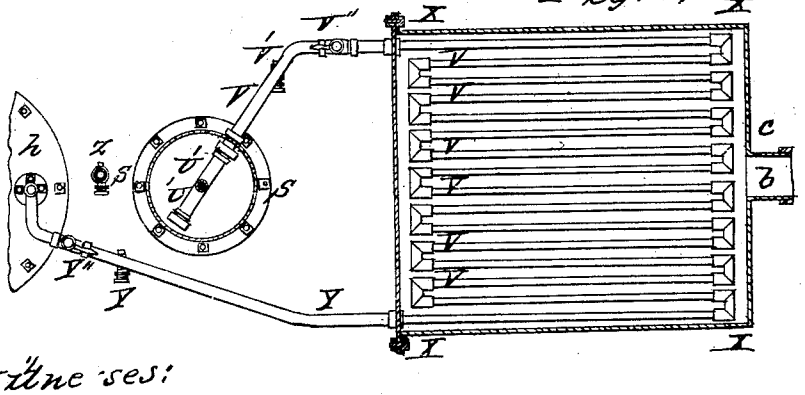


Fig. 4,



Witnesses:

J. Baker.

Inventor:
A. Normandy

N. PETERS, Photo-Lithographer, Washington, D. C.

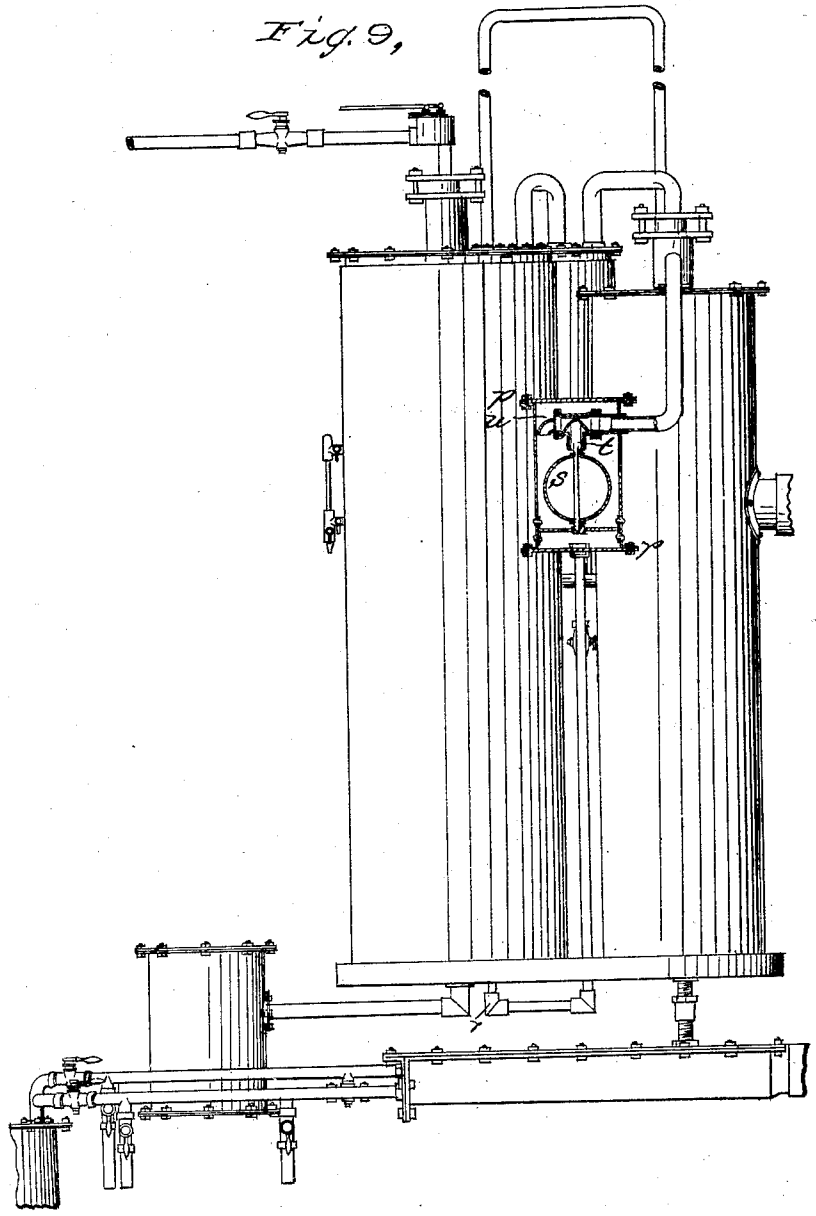
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A. NORMANDY.

Evaporating Pan.

No. 21,693. Patented Oct. 5, 1858.

Fig. 9,



Witnesses:
Henry Abendroth
J. Bailord

Inventor:
A. Normandy.

N. PETERS, Photo-Lithographer, Washington, D. C.

UNITED STATES PATENT OFFICE.

A. NORMANDY, OF FRANCE.

IMPROVEMENT IN DISTILLATION OF FRESH WATER FROM SALT-WATER.

Specification forming part of Letters Patent No. **21,693**, dated October 5, 1858.

To all whom it may concern:

Be it known that I, A. NORMANDY, a citizen of France, have invented a certain new and useful Process for Producing Fresh Water from Sea-Water; and I do hereby set forth and describe said process, together with such apparatus as I have found best adapted to carrying said invention into use.

My apparatus consists, essentially, of four parts: first, the evaporator; secondly, the condenser; thirdly, the priming-box; fourthly, the refrigerator, which four principal parts are securely bolted and fastened together, as will be seen by inspecting the drawings herewith. They are connected with four other accessory parts—namely, fifthly, differential or equilibrium valve for regulating the pressure of steam, a description of which will be found in a former patent, and which therefore need not be repeated here; sixth, a water-regulator; seventh, a steam-trap, and eighth a filter.

In the drawings which accompany the present specification, the same pieces are always represented by the same letters, and the figures are one-sixth of their real size, except Figure V.

Fig. I is a section of an elevation of the apparatus according to the line ⊖ ⊖. Fig. II is a plan of the apparatus. Fig. III is a plan of the apparatus. Fig. III is a plan of a section of the apparatus according to the line △ △. Fig. IV is a plan of a section of the refrigerator according to the line ⋈ ⋈. Fig. V is a section of the water-regulator, (elevation half the real size.) Fig. VI is a vertical section of an elevation of the filter. Fig. VII is a vertical section of the steam-trap; Fig. VIII, plan of a section of the steam-trap. Fig. IX is a section of another form and system of water-regulator.

The evaporator, Fig. I, is a cylinder covered up with felt or other non-conducting substance into which vertical tubes A A A A A A (which may be replaced by a worm) are placed, and which are plunged into a certain quantity of the sea-water to be evaporated. Steam proceeding from a boiler and at a pressure more or less elevated is admitted into those tubes through the steam-pipe B B B passing through the equilibrium-valve C, which valve, however, may be used or not, as occasion may require, as the apparatus works well without it, though not in so regular a manner, when the rate of pressure of the steam is fluctuating. The steam admitted into the tubes A causes the water which surrounds them to boil, and being thus evaporated, partly escapes in the state of steam through the tube D, and thence into the priming-box E E E E E, which is a cylinder of smaller dimensions, provided at the bottom with a bent tube, E′, provided with a cock, E″. This priming-box serves to arrest any salt-water which might be projected or mechanically carried along with the stream, and thus prevent it (the salt-water) from passing into the tubes G of the condenser. In effect, the tube D being directed downward, any water which may have primed naturally falls to the bottom of the priming-box, whence it may be removed by opening the cock E″, or whence it may flow out through the bent tube E′, when it has reached that level, the bent part of the tube being a few inches higher than the bottom of the priming-box, and the pure steam continuing its course, passes through the exit-tube F, which is placed at the top of the priming-box, and thence into the condenser C in the state of fresh water. When there is reason to fear that the boiler will prime, I also put a priming-box between the said boiler and the evaporator; but instead of a bent tube E′, I connect the bottom of the priming-box with a steam-trap like that which is marked S in the drawings, Fig. VII. The condenser consists, also, of a series of tubes, G G G G, (which may likewise be replaced by a worm,) which are immersed in the sea-water contained in another cylinder. The steam from the evaporator of course heats the water which surrounds these tubes; but as the cold sea-water comes into the apparatus through the bottom, while on the contrary the steam from the evaporator comes in at the top of the condenser, the consequence is that the sea-water which surrounds the condensing-tubes G is hotter at the top than at the bottom of the cylinder—that is to say, the sea-water, which is cold at the bottom of the cylinder, becomes gradually hotter toward the top, and at the top the temperature is generally as high as about 200° Fahrenheit, and as the air naturally contained in water begins to separate therefrom at a temperature of about 130° or 140° Fahrenheit, the consequence is that the greatest portion of the air contained in the sea-water which circulates through the apparatus is separated, and is as it were poured into the steam-room H of the evaporator

through the tube I I I, which unites the evaporating and the condensing cylinders. This tube should be higher than the level of the sea, or of the sea-water contained in the tanks which are to feed the apparatus. The steam of the evaporator and the air separated from the sea-water used for condensing it are therefore mixed together in the space or steam-chamber H, so that the steam which passes from the evaporator H through the tube D into the priming-box E, and thence through the tube F into the tubes G G G G of the condenser is not pure steam, but a mixture of steam and air, and hence the condensation of that steam is not ordinary non-aerated distilled fresh water, but is distilled water containing a large quantity of air in solution. When sea-water is subjected to distillation the steam resulting therefrom is free from salt, the latter remaining behind with the as yet unevaporated portion of the salt-water, the saltiness of which is augmented *pro tanto.* If the distilling were continued, a time must eventually come when the proportion of salt thus accumulated would become larger than the water can dissolve, and form a deposit or incrustation which would soon obstruct everything and destroy the apparatus. This accident might be guarded against by providing the apparatus with a brine-cock, and opening it from time to time for the purpose of discharging the brine and replacing it by a fresh quantity of ordinary sea-water, just as is done on board seafaring steamers with marine boilers. I prefer, however, putting a tube, J, at the bottom of the evaporator, which tube is provided with a cock, K, which I leave constantly open in such a way that a quantity of brine equal to about one-third of the aerated fresh water produced is constantly flowing out.

In order to keep the sea-water in the evaporator at a uniform level, and in order also to feed the apparatus with fresh sea-water to replace that which is let out through the brine-cock K, and that which is evaporated, the apparatus is provided with a little cistern, M, carrying a float, O, connected by a lever with a water-regulator, N, of a peculiar construction, and which will be described presently. This cistern is in communication with the evaporating-cylinder by means of the pipe L L′. When, by reason of the evaporation and of the discharge of the brine, the level of the sea-water in the evaporating-cylinder sinks below its due point, the float O, by sinking and in due time rising up again, opens or shuts the valve of the water-regulator N, and admits or shuts off the influx of fresh quantities of sea-water by means of the tube P, which opens into the cistern M, in communication with the bottom of the evaporating-cylinder by means of the tube L L′, as we just said. The cock P′, with which this tube P is provided, is for the purpose of regulating the supply of sea-water by hand, in case any accident should interfere with the proper working of the valve of the water-regulator N. In this way, or by any other contrivance of an analogous nature, the level of the salt-water remains, practically speaking, at a uniform and constant level in the cylinder, so that the space or steam-room H remains about the same. This little cistern M may be provided with an open tube a few inches above the floating-point of the ball O, in order to guard against any chance of filling the evaporating-cylinder more than it should, for it is evident that if from any obstruction the closing of the valve of the water-regulator were to be prevented, the person in charge of the apparatus would immediately receive notice of the fact by the water which would pour from that tube. O′ is a perforated wooden disk, the object of which is to moderate the ebullition and frothing of the water in the space H.

In order that no uncondensed steam should escape from the condensed-water-pipe R, I put the latter in communication with a steam-trap, S S S S, Fig. VII, containing a float, T, provided with a plug, U, pressing and closing a tube of vulcanized india-rubber contained in a cylinder, *l*′, so that as soon as the condensed water has accumulated into the steam-trap in sufficient quantity to float up the float T, the tube of vulcanized india-rubber being released and open, the condensed water runs out through the tube V, which is coiled in the refrigerator X X X X, whence it issues in a cold or cool state in *y*, and thence into the filter *h*. *y*′ and *y*″ are two cocks for the purpose of allowing the escape of the rusty water, which at first flows out of the apparatus when it has been left without working and preventing it from soiling the filter. For this purpose the cock *y*″ is shut and *y*′ open, and it is through the latter that the rusty water flows out. When it comes clear *y*′ is to be closed and *y*″ open, whereupon the clear water is admitted into the filter. V′ V″ are also cocks, the object of which is to obtain the condensed water in a hot state when required, for which purpose V″ should be shut, to prevent it from going into the refrigerator, and on opening V′ the hot condensed water may of course be collected. On the other hand the aerated water condensed in the tubes G G G G of the condenser finds an exit through the tube Z, which is also coiled several times in the refrigerator X X X X, in which it is cooled, and may be finally mixed with the non-aerated condensed water by means of a common tube, in order to produce an average aeration of the water. The cocks *z*′ and *z*″ answer the same purpose as *y*′ *y*″.

X X X X is a refrigerator on box containing the tubes V and Z, separated by a diaphragm, *a*, and in which refrigerator the sea-water enters through the large tubes 6 6, provided with cocks, which do not appear in the figure, which cocks communicate with the sea or with the sea or salt water tanks, the level of which should be higher than the whole apparatus, but less so than the air-tube I.

c c represent the end of a large vulcanized

caoutchouc tube slipped over the large tubes 6 on one side, and the large cocks (not represented in the figures,) and thus making a tight connection between them. These muffs or large tubes of caoutchouc are covered over with a coil of copper wire, in order to protect them against injury.

d is a tube, which may be called the "breathing-tube," and which opens on one end into the lower hood of the tubes G G G G of the condenser, which tube served for the exit of the excess of the air poured in the space H, and it removes at the same time an undue pressure from the apparatus, which is thus put in free communication with the atmosphere.

e is a water-gage.

f f' are stuffing-boxes.

g is a spring-balance for the purpose of regulating the pressure of the steam in the evaporator.

Fig. V is a vertical section of the water-regulator.

i is a valve.

j is a diaphragm of vulcanized india-rubber, to which the shank of the valve is attached. *k* is a lever attached to the float O in the little cistern M, and which, by opening or shutting the valve *i*, of course regulates the flow of water into the apparatus.

The pipe *l* of the water-regulator is made so as to plunge a few inches into the water of the condenser.

Fig. VI is a section of the filter divided by a partition, *m*, into two parts. It is filled with animal charcoal, as represented.

The working of the apparatus is as follows: First open the large cocks of the large tubes 6 6, and when the float O, by rising to its proper height, shows that the apparatus is charged, shut the cocks *z''* and *y''* and open the cocks *y' z'*. Open also the cock of the steam-pipe B, in order to admit steam into the apparatus. The steam thus admitted into the tubes of the evaporator A A A A becomes condensed and the condensed water passes through the tube R into the steam-trap S, and thence through the tube V into the refrigerator X, and through the tube *y* it flows out from the cock *y'*. At first it has a rusty color, and after a few minutes it flows out quite clear. When this is observed, the cock *y'* should be shut and *y''* open, when it will run into the filter *h*. On the other hand the sea-water which surrounds the pipes A of the evaporator eventually is partly converted into steam, which passes through the tube D into the priming-box E, and thence through the tube F into the tubes G of the condenser, and thence into the pipes Z, coiled in the refrigerator X, whence it flows out through the cock *z'*. At first the water which runs out is rusty, but it also, after a few moments, becomes clear, when the cock *z'* should be shut, and on opening the cock *z''* it will run into the filter *h'* in the state of cold aerated fresh water, and in which it mixes with the non-aerated water of pipe *y''*, so that the fresh water which runs out of the filter is a water generally containing at least a mean quantity of air. It is evident, however, that both waters may be collected separately, and one of them only passed through the filter, if required. As soon as the pipe or tube Z begins to produce water, the brine-cock K of tube J should be opened in such a manner or to such a degree that a qantity of sea-water may run out proportionate to the quantity of aerated fresh water produced—that is to say, if, for example, one gallon of fresh water be flowing from the tube Z in a given time, one-third of a gallon of brine should be allowed to run out through the cock K during that same given time. Things being thus arranged and adjusted, the working of the apparatus proceeds of itself with only occasional attendance.

Instead of the water-regulator represented in Fig. V, the supply of water to the evaporating-cylinder may also be regulated by means of the apparatus represented in Fig. IX, in which *p p* is a cistern in communication with the evaporating-cylinder by means of the pipes *q* and *r*. This cistern contains a float, *s*, provided with a plug, *t*, pressing and closing a tube of vulcanized caoutchouc contained in the tube *u*, so that as soon as, by reason of the evaporation and of the flowing of the brine, the float *s* sinks below a certain level, the tube of vulcanized india-rubber not being any longer closed by the pressure of the plug *t*, allows a certain quantity of water to flow through the pipes *v* and *u* into the cistern; but as soon as enough water has thus been admitted, the float *s*, rising again, shuts off the supply, because the plug *t* presses then against the tube of vulcanized caoutchouc within the tube *u*.

Of course the plan which I have now described and represented in the drawings for obtaining fresh water from salt-water may be modified in various ways, the principal novelty in my system of distillation being the process of double distillation, whereby aerated and non-aerated fresh water are produced, as herein described, and in which they may be mixed together for the purpose of deodorizing and sweetening the whole product.

What I claim in the above-described process is—

The process herein set forth, by which aerated and non-aerated fresh water are obtained by distilling sea-water.

A. NORMANDY.

Witnesses:

JAS. BARLOW,
Agent, 6 Hobert Street, Adelphi, London.

HENRY L. VANDERPUMP,
Clerk to Dr. A. Normandy, 9 Lancaster Place, Strand, London.