

(No Model.)

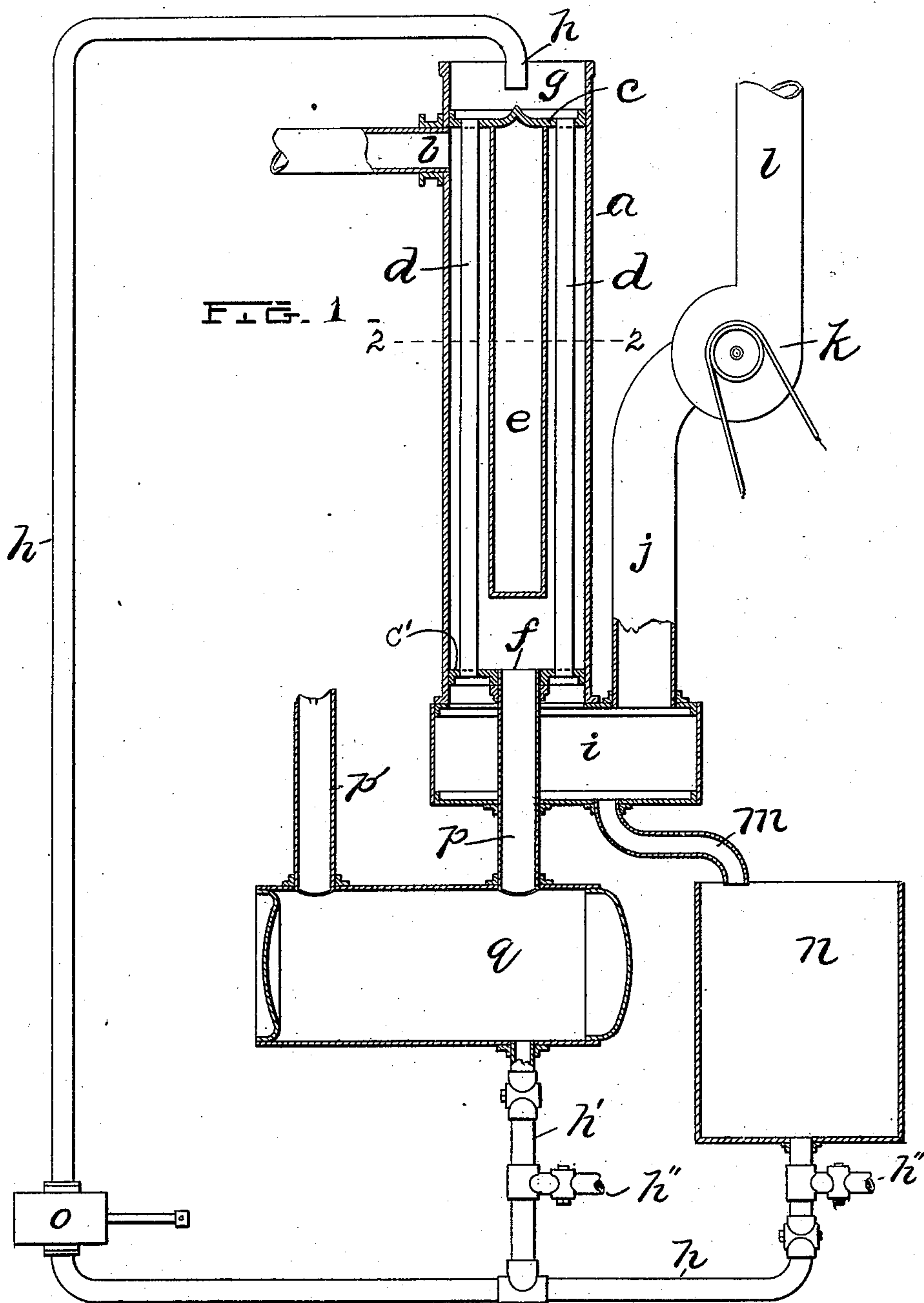
2 Sheets—Sheet 1.

E. D. MELLE.

ART OF AND APPARATUS FOR CONDENSING AND EVAPORATING.

No. 549,001.

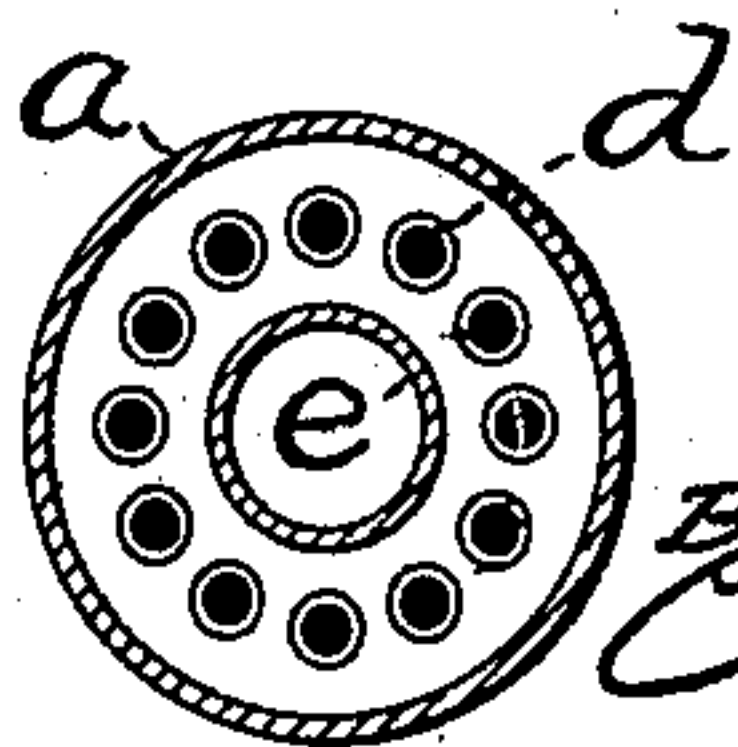
Patented Oct. 29, 1895.



Witnesses.

Arthur F. Randall,
C. C. Sticher

FIG. 2.



Inventor.

E. D. Mellen.

By *Arthur W. Fossey*
Att'y.

(No Model.)

2 Sheets—Sheet 2.

E. D. Mellen.

ART OF AND APPARATUS FOR CONDENSING AND EVAPORATING.

No. 549,001.

Patented Oct. 29, 1895.

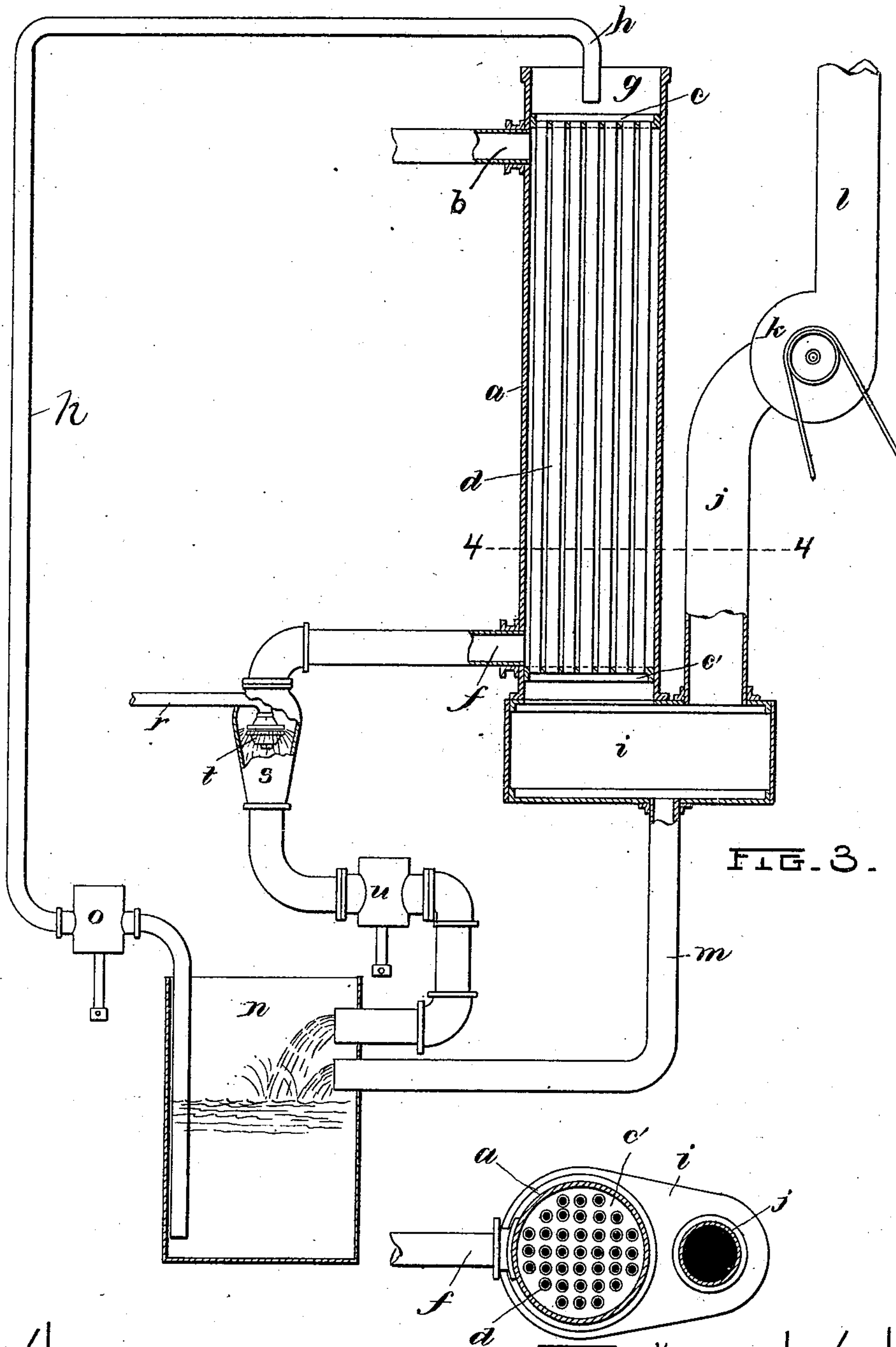


FIG. 3.

FIG. 4.

Inventor.

Witnesses_

Arthur F. Randall,
C. C. Pecker

By E. D. Miller

By Andrew W. Crossley Atty

UNITED STATES PATENT OFFICE.

EDWIN D. MELLEN, OF CAMBRIDGE, MASSACHUSETTS.

ART OF AND APPARATUS FOR CONDENSING AND EVAPORATING.

SPECIFICATION forming part of Letters Patent No. 549,001, dated October 29, 1895.

Application filed November 15, 1894. Serial No. 528,956. (No model.)

To all whom it may concern:

Be it known that I, EDWIN D. MELLEN, of Cambridge, in the county of Middlesex and State of Massachusetts, have invented certain new and useful Improvements in the Art of and Apparatus for Condensing and Evaporating, of which the following is a specification.

This invention relates to condensers and evaporators for and to the art of reducing to a liquid form aqueous vapors arising or produced under various circumstances.

It is the object of the invention to provide such improvements in the method or process of condensing aqueous vapors as will secure the most effective action of the condensing agent or agents employed, thereby enabling the work to be done at a material saving in cost and in the amount of substance employed as the condensing agent.

It is also the object of the invention to provide such improvements in the mode or process of condensing as will enable the liquid product of condensation to be subsequently employed as the condensing agent, or as a portion of the condensing agent, and in its latter office to undergo concentration, so that certain of its constituent elements may result in and be employed as a valuable by-product of the operation.

It is also the object of the invention to provide efficient and simple means for carrying out the aforesaid methods and for use in whole or in part in other modes of procedure in the practice of the art of evaporation and condensation.

To these ends my invention consists in exhausting the air at the discharge ends of the conduits or condensing-tubes through which the condensing agent is passed, in contradistinction to forcing or blowing a current of air therethrough from the receiving ends of the conduits, whereby a current of attenuated air is induced through the said tubes and the condensing liquid is formed in a thin film on the inner walls of the tubes from the receiving to the discharging ends thereof, so as to be rendered as effective as possible in the performance of its office, with the result of securing a more rapid condensation of vapors and evaporation of the condensing liquid

with the use of a less quantity of liquid as the condensing agent than by any other process now known to me.

The invention also consists of improvements in the means employed for carrying the before-mentioned method or process into operation, all as I will now proceed to describe and claim.

Reference is to be had to the annexed drawings, and to the letters marked thereon, forming a part of this specification, the same letters designating the same parts or features, as the case may be, wherever they occur.

The accompanying drawings, which illustrate one efficient form of apparatus by which my invention may be practiced and in which it may be embodied, represent, in—

Figure 1, a side elevation, partially in section, of the improved means particularly adapted for use in condensing the vapors from an evaporator or vacuum-pan and in some processes of distillation in condensing the vapors of a distillate. Fig. 2 is a horizontal sectional view taken on the line 2 2 of Fig. 1. Fig. 3 is a side elevation of the improved apparatus, somewhat similar to Fig. 1, but showing it as particularly adapted for use in condensing steam exhausted from steam engines and pumps. Fig. 4 is a horizontal sectional view taken on the line 4 4 of Fig. 3.

In the drawings, *a* designates the outer shell, which may be formed as is a steam-boiler and be arranged in vertical position, as shown. The said outer shell is provided at its upper part with a port *b* for the inlet (through a pipe or other suitable conduit) of the vapor or gas to be condensed.

c c' designate heads having a liquid-tight fit within the outer shell near or at its ends, and *d* designates tubes fitted in holes in the heads and extending between the same. It is preferred, though not essential, in securing the ends of the tubes *d* in place in the heads to expand the same in the pores or openings, as is done in the construction of tubular boilers, so as to, among other things, avoid packed joints. In the smaller sizes, where the use of but a comparatively limited number of tubes may be necessary and where the location of the outlet-port in the lower head *c'* may be convenient or desirable, the said tubes may

be arranged on a circle, as shown in Figs. 1 and 2, and within this circle of tubes and depending from the head *b* there may be arranged a tubular deflector *e* for keeping the vapors or gases in contact, as far as possible, with the surfaces of the tubes and preventing them from taking a short cut to the outlet-port *f* at the lower part of the shell *a*. This deflecting tube or cylinder *e* may, however, be dispensed with and its place supplied with tubes *d*, as is shown in Figs. 3 and 4, which construction presents a greater condensing-surface within the same size shell *a* to the vapors. The upper head *c* being arranged in the shell *a* a short distance from its upper end, a basin *g* is formed above the said upper head, into which the water or other condensing liquid is discharged from a pipe *h* and directed to the tubes.

i designates a separating-chamber into which the condensing fluid is first collected or discharged after passing through the tubes *d*, and *j* is a large pipe communicating between the separator *i* and an exhaust-fan within a casing *k*, and from the said fan there is led a pipe *l* to the external atmosphere.

m designates a pipe which communicates between the separator *i* and the receiving-tank *n*, from whence the liquid may be returned for reuse through the pipe *h* by means of a circulating-pump *o*.

A pipe *p* leads from the lower part of the shell *a*, Fig. 1, to a suitable receiver *q* to convey the product of condensation thereto. The pipe *p'* connects with an air-pump (not shown) to exhaust the air and residual vapors, if any. If steam or like vapor should be the substance condensed, it may, after condensation, pass through the air-pump *u*, together with the air, and be discharged into the receiver *n*, as shown in Fig. 3; but in case it is desired for any reason to obtain the product of condensation separate from the condensing agent it may be received through the pipe *p* into the receiver *q*, and thence led, if need be, after a time, through the branch pipe *h'* to be discharged by the circulating-pump *o* through the pipe *h* and used as a portion of the condensing agent, as is fully represented in Fig. 1.

It is not necessary that the condensing agent or the product of condensation should be returned to the basin *g* to be reused, since they can be drawn off through the pipes *h'' h''* for other purposes or uses, as shown in the last-mentioned figure.

An injector or other type of condenser *s* may be used between the outlet-port *f* and the air-pump *u* when for any reason it is desired to further cool the product of condensation or to obtain a higher degree of vacuum by further cooling and condensing the residual vapors which may pass the outlet-port *f*. The condensing agent used in this auxiliary condenser *s* may be and preferably is used as the condensing agent delivered to the tubes *d* through the pipe *h*.

In use of the apparatus the pipe *b* for the inlet of the vapor or gas is suitably connected with a steam-exhaust, evaporating-pans, stills, or similar devices or apparatus and a quantity of water is discharged into the basin *g* and drawn off therefrom down through the pipes *d* by means of the suction obtained or created by the fan operating in the casing *k*, the said water being formed as a film on the walls of the said pipes in its passage there-through. This last-mentioned operation is a highly-important feature of the invention and is accomplished by the action of the draft produced by the exhaust-fan. By maintaining the condensing agent as a film on the walls of the conduits *d*, as described, it causes said condensing agent to perform its office to the fullest extent, thus lessening the amount of water necessary for the purpose, reducing the cost of the operation, assisting in maintaining a vacuum in the condenser, effecting a concentration of the condensing agent, and helping to fit the latter for subsequent uses, besides incidentally resulting in other advantages of greater or less importance. The exhaust-fan draws off and discharges to the external atmosphere all vapors from the condensing agent which may be collected in the receiver *i*. This is an important feature of my invention and is to be considered in contradistinction to a construction whereby a current of air might be blown or forced through the tubes from their receiving ends, since my improvements effect an improved mode of operation in that by exhausting the air from the discharge ends of the tubes and discharging the exhaust to the external atmosphere the condensing liquid is formed as a thin film on the inner walls of the tubes from their receiving to their discharge ends. Under these conditions the condensing agent is made effective in the highest degree in condensing the vapors in the shell, and, besides, the condensing agent is itself rapidly concentrated, so that I am enabled in many cases, as has been already stated, to employ the liquid product of condensation as the condensing agent and concentrate the latter to a degree of securing a valuable by-product. If a blast of air were forced through the tubes from their receiving to their discharge ends, the result would be to carry much of the condensing agent through the tubes without touching their walls, and such portions as did come in contact with the walls would for the most part not reach the same until well on their way to the discharging ends of the tubes, so as not to have opportunity of operating to the utmost of their efficiency, as is the case with my improvements, where the body of the condensing agent forms upon the inner walls of the tubes at its start therethrough and moves in contact therewith throughout their length. The arrangement is such that the product of condensation may, if desired, be carried back to the condenser and employed as the con-

densing agent. In thus employing the apparatus in connection with a still in which a substance is distilled with a medium which has subsequently to be removed by evaporation, as is done in the distillation of glycerine in a current of steam, a great economy is effected in the operation. The dilute distillate may be used as the condensing liquid, being thereby concentrated. A saving is effected in the quantity of condensing liquid required and in the heat necessary to concentrate the dilute distillate.

If the apparatus be used in connection with an evaporator discharging a simple vapor, the condensed vapor can be used as the condensing liquid and, under certain conditions, will be more than sufficient in quantity to continue the condensation. If the condensed vapors are valuable for other uses, water is used for the condensing liquid and can be used much hotter than in other types of condensers, and but a small percentage need be used compared with that required by condensers commonly used.

If the apparatus be employed in connection with a still the distillate from which has not to be concentrated or for other reasons cannot be used as the condensing liquid, water may be used for condensing with marked economy over other types of condensers.

It will be observed that the construction is simple and convenient, there being an absence of packed joints and the tubes being so arranged that they can be readily cleaned.

Having thus explained the nature of the invention and described a way of constructing and using the same, though without attempting to set forth all of the forms in which it may be made or all of the modes of its use, it is declared that what is claimed is—

1. The improvement in the art of condensing consisting in introducing the liquid condensing agent alone at the receiving ends of the conduits or tubes, into the interior thereof, and exhausting the air from the interior of the tubes at the discharge ends thereof, as set forth.

2. The improvement in the art of condensing consisting in the employment of a dilute distillate as a condensing medium, exhausting the resultant vapors thereof and discharging the same to the external atmosphere, whereby at one operation vapors are condensed and the dilute distillate is concentrated, as set forth.

3. The improvement in the art of condensing consisting in exhausting the air at the discharge ends of the conduits or tubes through which the condensing agent is passed, whereby a current of air is drawn through the said conduits or tubes, discharging the vapors with the current of air, and collecting the product of condensation.

4. The improvement in the art of condensing consisting in exhausting the air at the discharge ends of the conduits or tubes through which the condensing agent is passed, where-

by a current of air is drawn through the said conduits or tubes, discharging the vapors with the current of air, collecting the product of condensation, and collecting, returning and reusing the concentrated condensing agent as before.

5. The improvement in the art of condensing consisting in introducing the condensing agent to the conduits or condensing tubes at the receiving ends thereof, in continuous volumes, and exhausting air at the discharge end of the conduits or tubes, in contradistinction to forcing a current of air through the tubes from the receiving ends thereof, thereby drawing off and discharging the vapors of the condensing agent and inducing a current of air through the conduit and maintaining a film of condensing liquid over the walls of the said conduits or tubes.

6. A condensing apparatus comprising in its construction a receptacle for the vapor to be condensed, conduits therein for a condensing agent, means for delivering the condensing agent at the receiving ends of said conduits, and air-exhausting means, as an exhaust fan, at the opposite or discharging ends of said conduits for drawing a current of air there-through, whereby a film of condensing liquid is maintained on the inner walls of the conduits throughout their lengths and the vapor of the condensing agent is drawn off and discharged, as set forth.

7. A condensing apparatus comprising in its construction a vertically disposed shell, heads therein, a basin at the upper end to receive the condensing agent, tubes extending through the shell and supported by said heads and establishing communication between the basin and the lower end, means for delivering the condensing agent in the basin on the upper head, and means as a fan at the lower end for exhausting the vapors of the condensing agent and drawing a current of air through the tubes.

8. A condensing apparatus comprising in its construction a vertically disposed shell into which the vapors to be condensed are to be introduced, and which is provided with inlet and outlet ports, upper and lower heads fitted in said shell, tubes extending through between the heads, a separator for receiving the condensing liquid after its passage through the tubes, and an exhaust fan communicating with the separator and with the tubes, for exhausting the vapors of the condensing agent and drawing a current of air through the tubes.

9. A condensing apparatus comprising in its construction a vertically disposed shell into which the vapors to be condensed are introduced, and which is provided with inlet and outlet ports, a receiver communicating with the outlet port, upper and lower heads fitted in said shell, tubes extending between the heads, means of communication between the said receiver and the upper ends of the tubes, a separator for receiving the condens-

ing liquid after its passage through the tubes, and an exhaust fan communicating with the separator.

10. A condensing apparatus comprising in
5 its construction a vertically disposed shell into which the vapors to be condensed are introduced, and which is provided with upper and lower heads fitted therein, a receptacle at the upper end and a separator at the lower
10 end, tubes extending through and between the heads, a receiver for the product of condensation communicating with the shell, an exhaust fan communicating with the said separator, means for communication from the
15 receiver and the separator to the inlet ends of the condensing tubes, and a circulating pump operatively connected with the last-mentioned means.

11. A condensing apparatus comprising in
20 its construction a vertically disposed shell into which the vapors to be condensed are introduced and which is provided with upper and lower heads fitted therein, a receptacle at the upper end and a separator at the lower
25 end, and tubes extending between the heads and supported thereby, said tubes being open at their ends, a receiver for the product of condensation communicating with the shell, an exhaust fan communicating with said separator,
30 and means for communication between the receiver and the inlet ends of the condensing tubes whereby a circulation is maintained as described.

12. A condensing apparatus comprising in its construction a vertically disposed shell, 35 into which the vapors to be condensed are introduced, and which is provided with upper and lower heads fitted therein, a receptacle at the upper end and a separator at the lower end, and tubes extending through and be- 40 tween the heads and supported thereby, said tubes being open at their ends, a receiver for the product of condensation communicating with the shell, an auxiliary condenser communicating with the said receiver and with 45 an air pump, an exhaust fan communicating with said separator.

13. A condensing apparatus comprising in its construction a vertically disposed shell, 50 into which the vapors to be condensed are introduced, and which is provided with inlet and outlet ports, upper and lower heads fitted in said shell, tubes extending through and between the heads, an auxiliary condenser communicating with the said outlet port, a 55 separator for receiving the condensing liquid after its passage through the tubes, and an exhaust fan communicating with the separator.

In testimony whereof I have signed my name to this specification, in the presence of 60 two subscribing witnesses, this 3d day of October, A. D. 1894.

EDWIN D. MELLEN.

Witnesses:

ARTHUR W. CROSSLEY,
GEORGE C. BECKWITH.