No. 792,426. PATENTED JUNE 13, 1905.

G. KNODLER.

APPARATUS FOR PRODUCING PURIFIED WATER.

APPLICATION FILED JUNE 9, 1903.

2 SHEETS—SHEET 1.

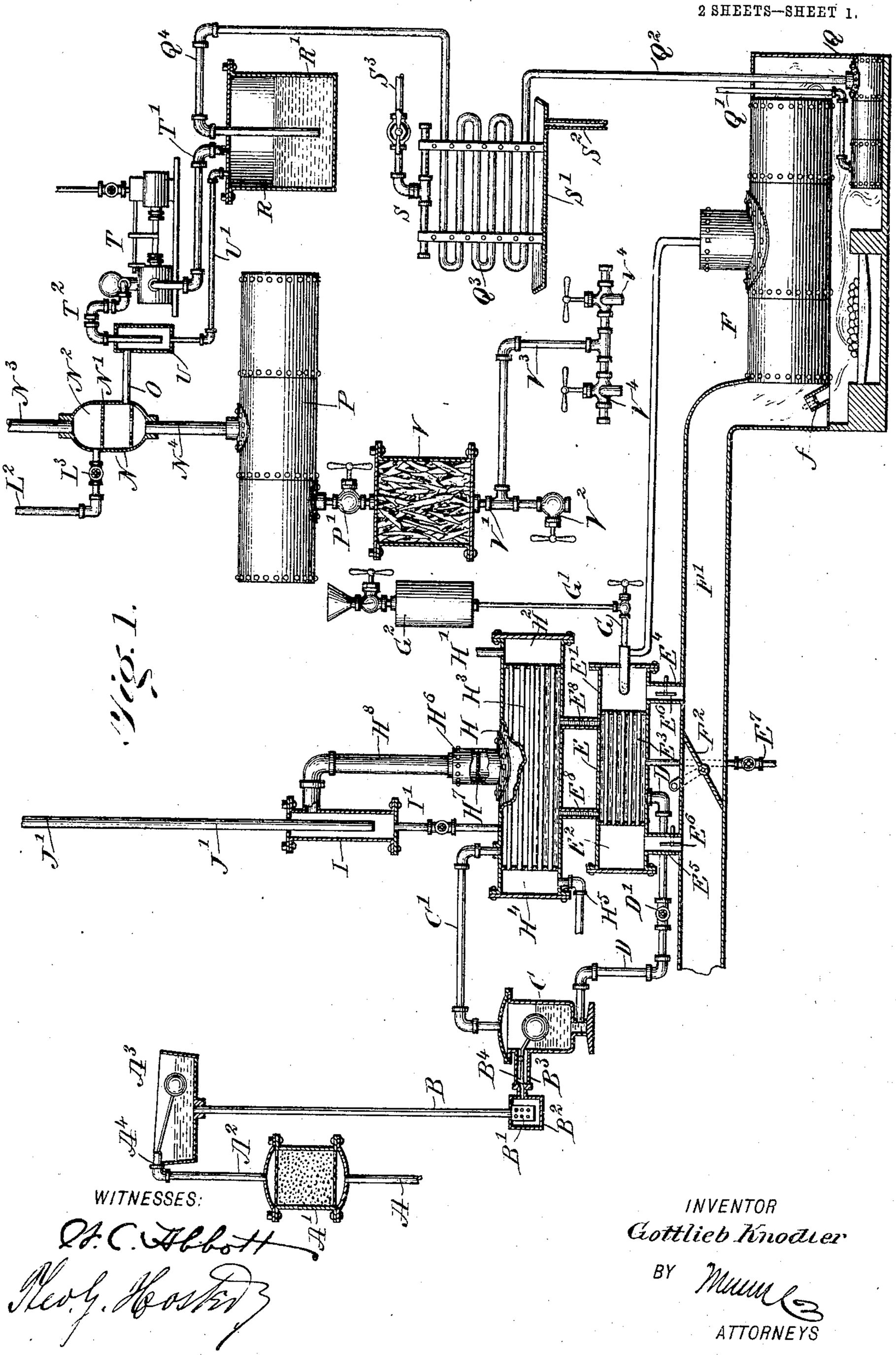

Fig. 1.

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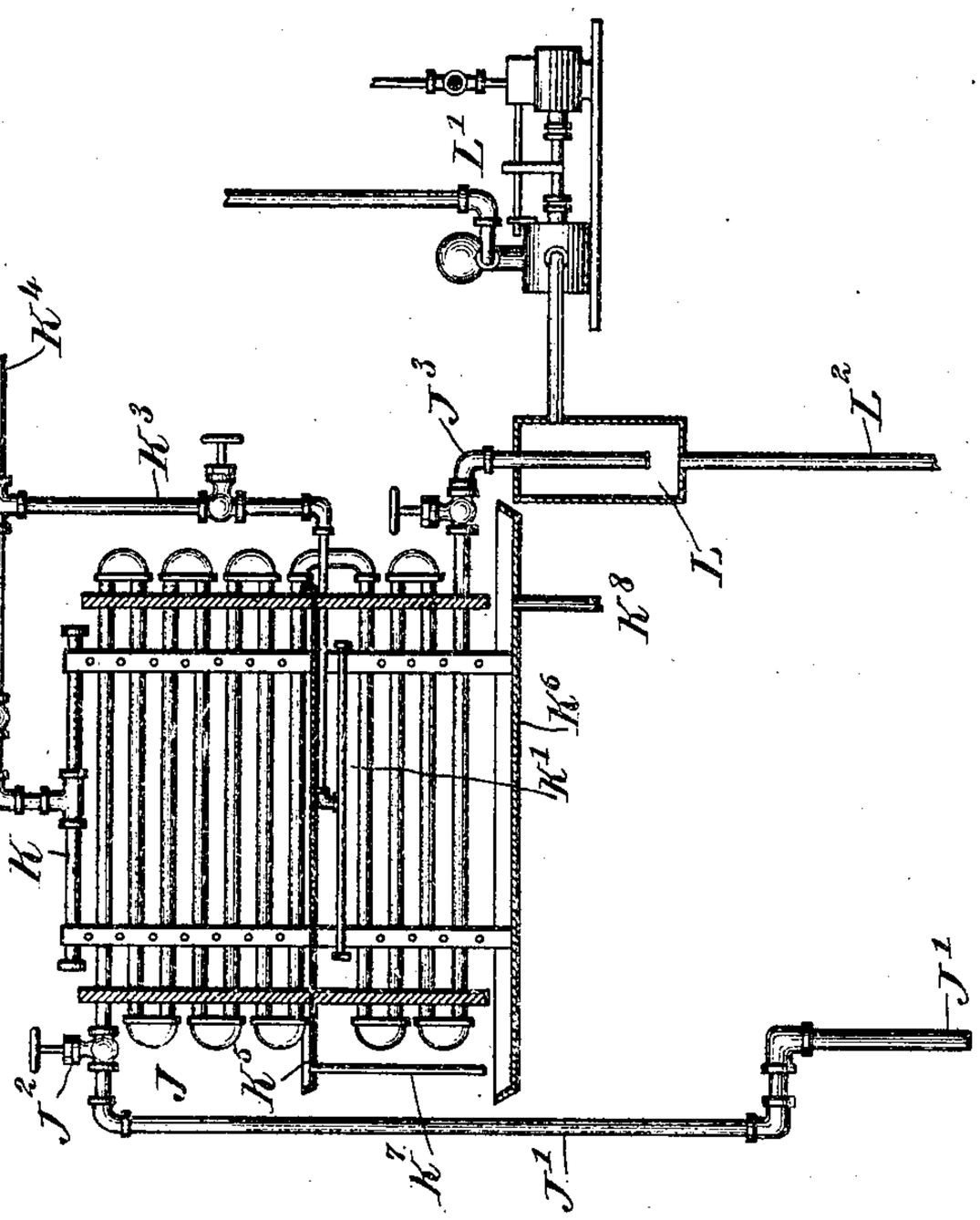
Fig. 1a.



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UNITED STATES PATENT OFFICE.

GOTTLIEB KNODLER, OF NEW YORK, N. Y., ASSIGNOR TO KATHARINE CONOVER, OF NEW YORK, N. Y.

APPARATUS FOR PRODUCING PURIFIED WATER.

SPECIFICATION forming part of Letters Patent No. 792,426, dated June 13, 1905.

Application filed June 9, 1903. Serial No. 160,745.

To all whom it may concern:

Be it known that I, GOTTLIEB KNODLER, a citizen of the United States, and a resident of the city of New York, borough of Manhattan, in the county and State of New York, have invented a new and Improved Apparatus for Producing Purified Water, of which the following is a full, clear, and exact description.

The object of the invention is to provide a new and improved apparatus for producing purified water for drinking and other purposes and arranged to sterilize, evaporate, and condense the water and to sterilize and wash the air used for aerating the sterilized condensed water to insure a product of an exceedingly wholesome nature.

The invention consists of novel features and parts and combinations of the same, as will be more fully described hereinafter and then pointed out in the claims.

A practical embodiment of the invention is represented in the accompanying drawings, forming a part of this specification, in which similar characters of reference indicate corresponding parts in both views.

Figure 1 is a sectional side elevation of the apparatus, and Fig. 1ª is a similar view of a continuation of the apparatus.

The water to be purified, evaporated, condensed, and then aerated with sterilized washed air is taken from a suitable supply—such as a water-main, overhead tank, or the like—and passed under pressure through a pipe A, a sand filter A′, and a pipe A^2 into an overhead tank A^3, in which the water is maintained at a desired level by a suitable float-valve A^4, arranged in the discharge end of the pipe A^2. From the bottom of the overhead water-supply tank A^3 extends downwardly a pipe B, carrying at its lower end a strainer B′, extending in a chamber B^2, connected by a pipe B^3 with a supply and equalizing vessel C, in which the water is maintained at a desired level by a suitable float-valve B^4, as indicated in Fig. 1.

From the bottom of the vessel C leads a pipe D, provided with a valve D′ and discharging into a heater E, in which the water is heated to a high degree by a suitable heating medium—such, for instance, as the waste gases passing from the furnace of a boiler F through a smoke-flue F′—to circulate through the heater, or the latter is heated by a burner G, of any approved construction, preferably of the hydrocarbon type, connected by a pipe G′ with an overhead tank G^2, containing gasolene or the like. If desired, both sources of heating medium may be used at the same time, and in order to accomplish the desired result the heater is provided at its ends with heads E′ and E^2, connected with each other by pipes E^3, extending through the heater proper, containing the water to be purified. The heads E′ and E^2 are connected by branch pipes E^4 E^5 with the smoke-flue F′ on opposite sides of a damper F^2 under the control of the operator, so that when the damper F^2 is closed, as shown in Fig. 1, then the products of combustion from the furnace of the boiler F pass from the smoke-flue F′ through the branch pipe E^4 into the head E′ and from the latter through the pipes E^3 into the head E^2 and then through the branch pipe E^5 into the outlet end of the smoke-flue F′. In the flue F′, where it connects with the furnace of the heater, is arranged a damper *f*.

In the branch pipes E^4 and E^5 are arranged manually-controlled dampers E^6 for controlling the flow of the products of combustion through the heater. The unconsumed gases in the head E′ may be burned by the flame from the burner G; but, if desired, the burner G alone may be used, and in this case the dampers E^6 are closed and the damper F^2 is opened, so that the products of combustion in the smoke-flue F′ pass directly to the chimney without passing through the heater.

The water-compartment of the heater E is connected by branch pipes E^8 with an evaporator H of the usual construction and through which circulates steam, passing from an inlet-pipe H′ into a head H^2 and from the latter by pipes H^3, extending through the evaporator proper to a head H^4, from which the steam passes by a pipe H^5 to a suitable place of discharge. By passing the water through the heater E previous to evaporating it the water is freed of organic matter, the same being precipitated, so that comparatively pure water

is not only evaporated, but the evaporator is prevented from becoming foul by the accumulation of scale therein.

From the bottom of the heater E leads a valved blow-off pipe E^7 for discharging periodically the organic matter precipitated in the heater during the purification process, and the purified water from the heater E now readily rises through the branch pipes E^8 into the evaporator H, in which the water is vaporized by the steam circulating through the evaporator, as described, it being understood, however, that the level of the water in the evaporator H corresponds to the level of the water in the vessel C, as the latter is correspondingly located, and the evaporator is connected by a pressure-equalizing pipe C′ with the top of the vessel C, as shown in Fig. 1. Thus the vessel C maintains a uniform level in the evaporator H, and consequently proper evaporation of the water in the evaporator H takes place, and in order to prevent priming or boiling over of the water in the evaporator the dome H^6 thereof is provided with a horizontal perforated partition H^7. The vapors pass from the top of the evaporator by a pipe H^8 into a drip-chamber I, having a valved return-pipe I′ leading from its bottom into the evaporator H, so that any drip water or water of condensation readily flows from the drip-chamber I back into the evaporator.

Into the drip-chamber I extends the lower end of the inlet-pipe J′ of a condenser J of any approved construction, preferably, however, arranged in the form of an upright coil, as plainly indicated in Fig. 1^a, and the amount of steam passing through the said coil can be controlled by a valve J^2, located in the inlet-pipe J′ at the beginning of the coil. By having the drip-chamber I interposed between the condenser and evaporator it is evident that any water carried along by the steam, owing to the action of the vacuum-pump, readily comes in contact with the walls of the upright pipe J and falls down the same into the drip-chamber I to return to the evaporator. Now the coil is cooled by water flowing down over the coil, and for this purpose two perforated water-distributing pipes K and K′ are preferably employed, connected by valved branch pipes K^2 K^3 with a supply-pipe K^4, leading from a suitable source of water-supply. The perforated distributing-pipe K is located directly above the uppermost convolution of the coil, while the perforated distributing-pipe K′ is located above one of the convolutions between the top and bottom convolutions of the coil, and above this distributing-pipe K′ and below the next adjacent convolution above is arranged a drip-pan K^5, and a similar drip-pan K^6 is located below the lowermost convolution of the coil of the condenser. A drip-pipe K^7 leads from the drip-pan K^5 to the drip-pan K^6, from which leads a discharge-pipe K^8 to a suitable place of discharge. Now when the apparatus is in use and the vapors from the evaporator H rise and pass through the coil of the condenser J, then the said vapors are condensed and the water of condensation flows by the valved outlet-pipe J^3 into a separating-chamber L, connected with a vacuum-pump L′ of any approved construction. A very rapid condensation of the vapors is obtained in the condenser J, as the convolutions of the coil above the pan K^5 are subjected to one stream of water, which becomes warm on reaching the drip-pan K^5, while the lowermost convolutions of the coil are subjected to a second stream of cool water, which passes to the drip-pan K^6, and hence instead of having but one stream of cool water over the coil two such streams are passed over different sections of the coil.

From the bottom of the separating-chamber L leads a pipe L^2, having a valve L^3 and discharging into the upper portion N^2 of an aerating-chamber N, containing a perforated partition N′, and into which leads a pipe O for conducting washed and sterilized air into the said aerating-chamber below the partition N′, so that this air comes in contact with the water flowing through the partition N′ in a divided state for the air to thoroughly aerate the water. The air not taken up by the water escapes from the top of the aerating-chamber through a pipe N^3, leading to the outside of the building in which the apparatus is arranged, while the aerated water flows from the lower end of the aerating-chamber by a pipe N^4 into a storage-tank P.

In order to pass sterilized and washed air by way of the pipe O into the aerating-chamber for the purpose described, the following device is provided: An air-sterilizing vessel Q, provided with an air-inlet Q′, is heated in any suitable manner, preferably by the products of combustion of the boiler F, so as to heat and thereby sterilize the air to a comparatively high degree, the sterilized air passing from the said vessel Q by way of an outlet-pipe Q^2 to a cooling-coil Q^3, in which the air is cooled, to pass finally from the coil Q^3 by way of a pipe Q^4 into an air-washing vessel R, containing a quantity of water R′, in which the discharge end of the pipe Q^4 is immersed. The coil Q^3 is subjected to the action of a cooling medium, such as water, flowing through a perforated distributing-pipe S down over the coil to cool the same and the air passing through the coil. The cooling-water is passed into a drip-pan S′, having a suitable discharge-pipe S^2 for carrying the water to a suitable place of discharge, and the distributing-pipe S is provided with a valved supply-pipe S^3, connected with a suitable source of water-supply. Now the sterilized and cooled air passing through the pipe Q^4 into the water contained in the air-washing vessel R rises through the water and is thus

washed, and the air is then drawn from the top of the vessel R by a pipe T′ to the inlet or suction end of an air-compressor T of any approved construction, having its discharge-pipe T^2 leading into a drip vessel U, from which leads the pipe O, previously referred to, so that the compressed, sterilized, and washed air is forced by the air-compressor through the pipe O into the aerating-chamber N to aerate the water flowing from the chamber L through pipe L^2 into the said chamber N. A drip-pipe U′ leads from the bottom of the drip vessel U to the air-washing vessel R to return any water that may gather in the vessel U.

From the bottom of the tank P leads a valved pipe P′ to the top of a charcoal filter V, having an outlet-pipe V′, provided with a discharge-valve V^2 and with a branch pipe V^3, containing faucets V^4 for drawing the purified water into a glass or other vessel, as required.

When the apparatus is in use, the water is first purified of lumps and other large solid bodies in the sand filter A′, after which the water is strained in the strainer B′, and in the heater E the organic matter is separated from the water, so that the water passes in a purified state into the evaporator, in which the water is evaporated. The water passes out through the separating-chamber L, and hence is not liable to be contaminated by coming in contact with pump-packings, oil, and the like, and the said vacuum-pump is kept running continuously to maintain a uniform vacuum in the system. Now by having the separating-chamber L arranged as described the vapors and foul gases are separated from the water by the action of the vacuum-pump, and the said vapors and foul gases are discharged through the discharge-pipe of the vacuum-pump to the atmosphere. The water, owing to its being of greater specific gravity than the air, drops readily to the bottom of the chamber L to flow to the aerator by way of the pipe L^2, which has a height of about thirty-six feet to overcome atmospheric pressure in aerator. As the rest of system has a vacuum maintained by vacuum-pump, a column of water is maintained in this thirty-six feet of stand-pipe, so it will flow through valve L^3 and enter aerator. The same valve when open permits the water to flow from the chamber L through pipe L^2 into the aerating-chamber N, but when closed not only prevents the flow of water, but also prevents the air from passing into the evaporators to destroy the vacuum, and thereby cause the water to stop evaporating. When the valve L^3 is closed and the pump T is still running, the air passing from the pump into the aerating-chamber escapes through the pipe N^3 into the atmosphere. The water in the aerator is readily sprayed or minutely divided by the perforated plate therein to insure a complete absorption of the rising air by the descending sprayed water.

From the foregoing it will be seen that the water is thoroughly sterilized, then evaporated and condensed, and finally aerated by the use of sterilized and washed air, so that an exceedingly wholesome pure water is obtained. It will also be seen that by the arrangement described the apparatus can be run at a comparatively low cost to produce a large quantity of pure water in a comparatively short time.

Having thus described my invention, I claim as new and desire to secure by Letters Patent—

1. In an apparatus for producing purified water, an evaporator, a condenser connected at its inlet with the evaporator, for the vapors to pass through the condenser, a vacuum and separating-chamber in which discharges the outlet of the said condenser, a vacuum-pump connected with the said vacuum and separating-chamber, and an aerating-chamber having a perforated partition and connected at one side of the partition with a compressed-air supply and the other side of the partition with the said vacuum and separating-chamber, as set forth.

2. An apparatus for producing purified water, comprising an evaporator, a condenser connected at its inlet with the evaporator, for the vapors to pass through the condenser, a vacuum and separating-chamber in which discharges the outlet of the said condenser, a vacuum-pump connected with the said vacuum and separating-chamber, an aerating-chamber having a perforated partition and connected at one side of the partition with a compressed-air supply and at the other side of the partition with the said vacuum and separating-chamber, a storage-tank into which flows the aerated water from the said chamber, and a filter into which flows the water from the storage-tank, the filter having valved outlet-pipes, for drawing off the water as required, as set forth.

3. An apparatus for producing purified water, comprising an evaporator, a drip-chamber connected with the evaporator, a condenser connected with the drip-chamber, a vacuum and separating-chamber into which the condenser discharges, a vacuum-pump connected with said chamber, an aerating-chamber connected with the vacuum and separating-chamber, an air-sterilizing vessel, a cooling-coil connected with said vessel, a washing vessel connected with the cooling-coil, an air-compressor connected with the washing vessel, and a drip vessel connected with the aerating-chamber and with which the air-compressor is connected, as set forth.

4. In an apparatus for producing purified water, the combination with a boiler, of a water-heater, a connection between the heater and the smoke-flue of the boiler, an evaporator connected with the heater, a condenser con-

nected with the evaporator, an aerating-chamber connected with the condenser, an air-sterilizing vessel arranged in the boiler to be heated by the products of combustion, a cooling-coil connected with the said vessel, a washing vessel connected with the cooling-coil, and an air-compressor connected with the washing vessel and the aerating-chamber, as set forth.

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

GOTTLIEB KNODLER.

Witnesses:
VICTOR BONN,
HENRY TRIMBEGER.