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A. M. COYLE.

METHOD OF AND APPARATUS FOR DISTILLING WATER.

No. 364,199. Patented May 31, 1887.

Fig. 1.

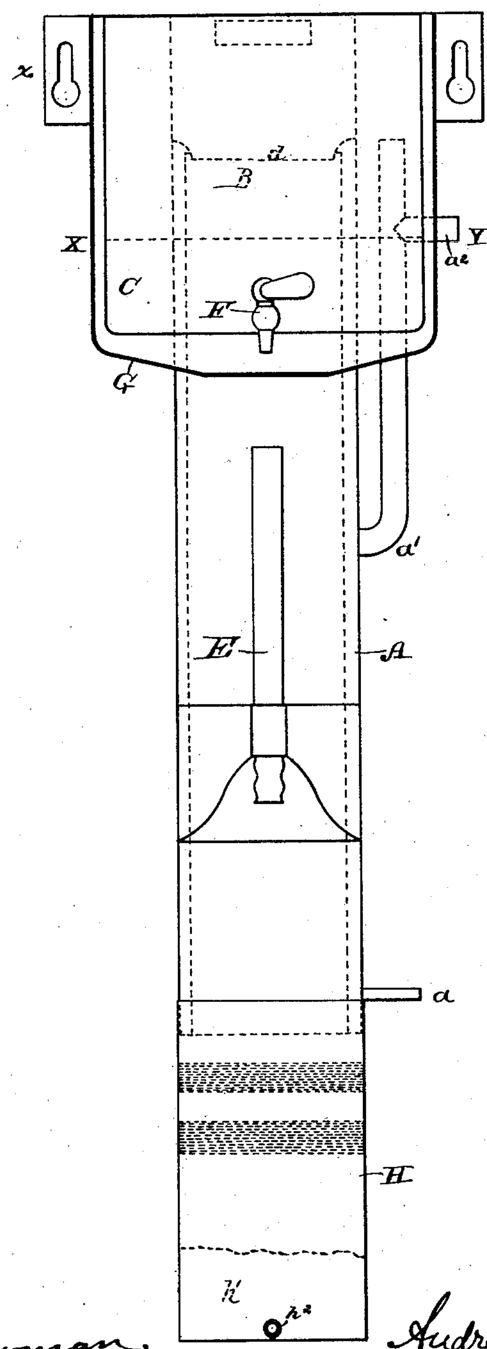

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Fig. 2.

Fig. 3.

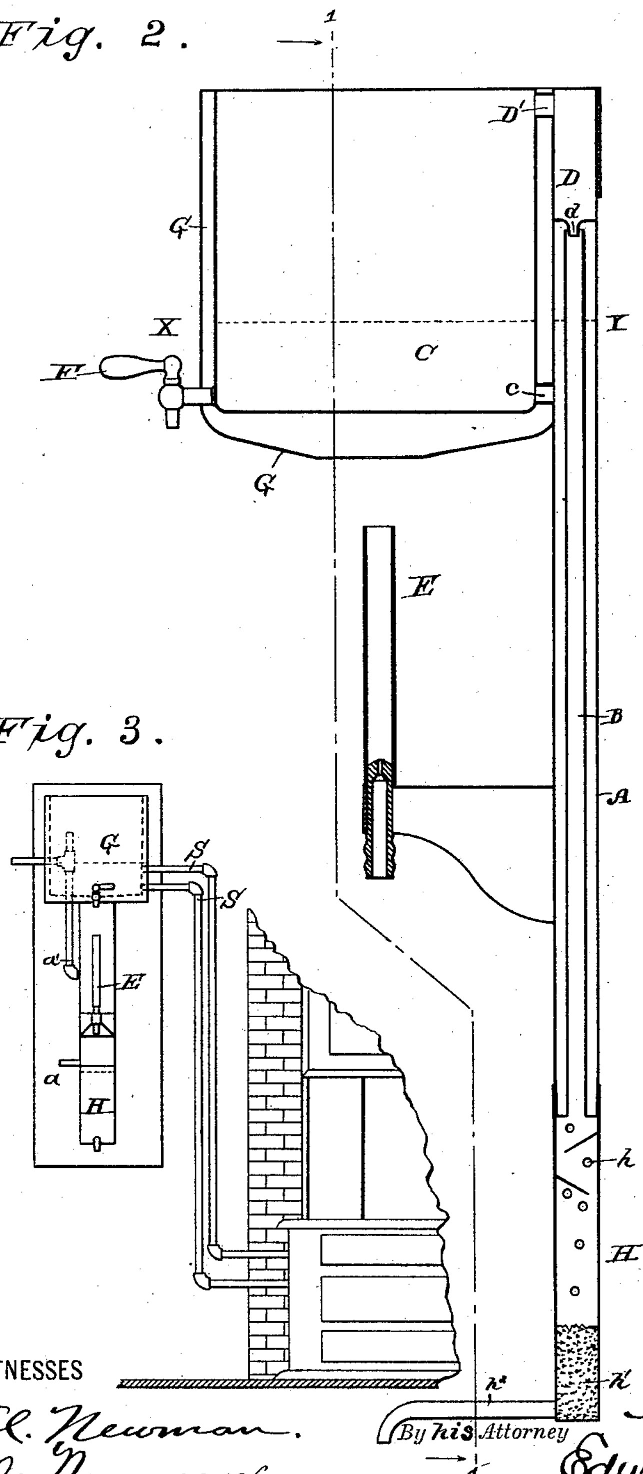

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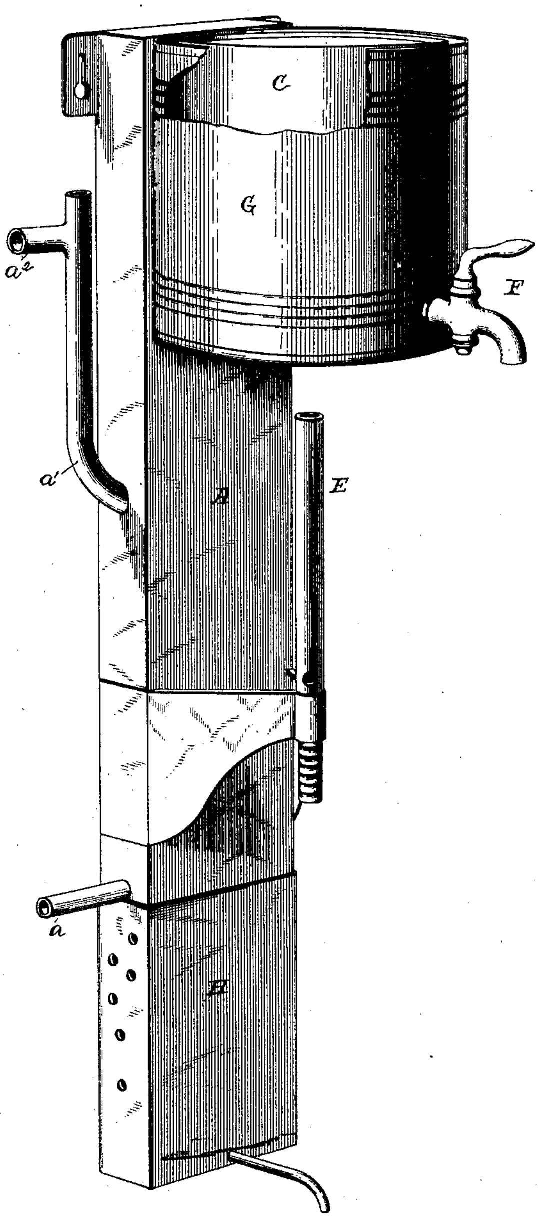
Fig. 4.



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(No Model.)

4 Sheets—Sheet 4.

A. M. COYLE.

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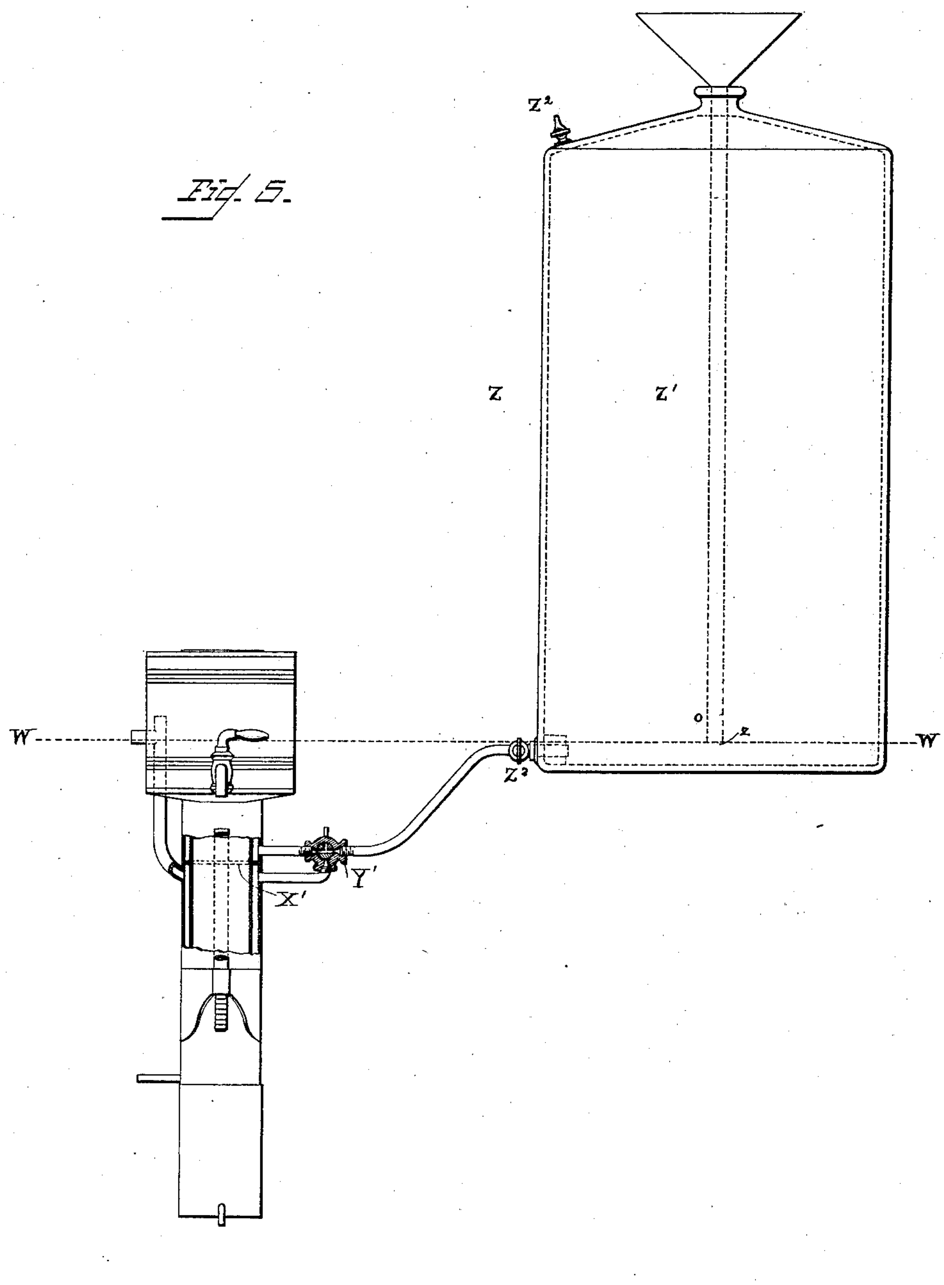

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By his Attorney
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UNITED STATES PATENT OFFICE.

ANDREW M. COYLE, OF WASHINGTON, DISTRICT OF COLUMBIA.

METHOD OF AND APPARATUS FOR DISTILLING WATER.

SPECIFICATION forming part of Letters Patent No. 364,199, dated May 31, 1887.

Application filed December 7, 1886. Serial No. 220,941. (No model.)

To all whom it may concern:

Be it known that I, ANDREW M. COYLE, of Washington, in the District of Columbia, have invented certain new and useful Improvements in the Method of and Apparatus for Distilling Water and other Fluids, of which the following is a specification.

The object of my invention is to provide a still which will be perfectly self-regulating and effect distillation by an improved economical method of operation.

While the apparatus is intended especially to distill water for laboratory and domestic use, it may be used for all sorts of distillation.

In many cities the water-supply has of late years been most dangerously contaminated, and the need of some simple apparatus by which each household may, with the utmost facility and minimum of expense, obtain an abundance of practically chemically pure water has been seriously felt. A leading object of this invention is to supply that want.

I will now describe a specific, practical, and desirable form of the invention, without, however, in any manner limiting myself to the special details of construction.

In the accompanying drawings, Figure 1 is a front view, the drip-pipe h^2 and jacket G of the retort being cut away on the line l l of Fig. 2. The interior construction is illustrated by dotted lines. Fig. 2 is a vertical transverse section; Fig. 3, a detail view illustrating the application of the apparatus to an ordinary domestic range; Fig. 4, a perspective view of a still with the jacket of the retort partly broken away, and Fig. 5 a detail view illustrating a modified construction by which the still is adapted either for alcoholic or water distillation.

The condenser A is shown as rectanular in cross-section. It is of the Liebig type, and consists of a jacket or casing within which one or more flat condensing tubes or passages, B, are arranged, one tube only being shown in the drawings. Its upper end is open and extends nearly to the top of the jacket of the condenser, and the lower end is also shown as open for the discharge of the condensed distillate. Water is supplied from any suitable source of constant supply to the condensing-jacket through a pipe, a, connected at the bottom of the condenser. At a' an overflow or discharge pipe is connected with the jacket and carried up outside of the condenser and retort to the proper height to maintain the desired water-level in the jacket, and also in the retort or distilling-drum, as is presently described. A retort, C, preferably circular, is arranged alongside the upper portion of the jacket A and is supplied with water by a pipe, c, connecting the jacket with the retort near its bottom. With the conditions and connections described the water-level will be the same in the retort, jacket, and overflow-pipe, and with a small constant water-supply at a there will be a small constant overflow at a^2. The dotted lines X Y in Figs. 1 and 2 indicate the water-level.

There is communication, by means of the pipe or opening D′, between the upper part or steam-space of the retort C and a compartment, D, in the upper end of the jacket A. This compartment opens into the top of the condensing-tube B through lips d, which enter the tube sufficiently to produce slight aspiration should steam be blown through them.

If heat be applied to the retort C by means of the ordinary Bunsen gas-burner, E, (which is illustrated as supported by arms or brackets projecting from the condenser-jacket,) or otherwise, steam generated therein will pass into the compartment D and blow down the condensing-tube B. The steam in condensing gives up its heat to the ascending water in the condenser, which is thereby highly heated and enters the retort at c at about the boiling-point.

The automatic operation and the organization thus far described are, so far as I am aware, new. If, therefore, there were no communication from the surface of the water in the jacket A to the open top of the condensing-tube, the construction and operation would be within the scope of my invention. In order, however, to improve the economical operation and obtain better results, I make the still by preference according to the principle involved in the construction illustrated for the following reason: The aspirating action of the steam blowing into the top of the condensing-tube reduces the pressure on the column of highly-heated water in the condenser-jacket and the water bursts into vapor, which is carried by the aspiration down the condensing-tube. The vapor from the water in the jacket A in condensing gives up less heat than that from the retort C, and, as the latter is amply sufficient to heat the water to the desired point, proportionally less condensing-surface is necessary.

So far as I am aware I am the first to heat the supply-water by the steam from the retort and utilize the steam to decrease the pressure on the surface of the supply-water thus heated, and thereby convert it into vapor. Of course the operation is not dependent on the special apparatus shown.

If desired, the jacket at the water-level may be enlarged to afford a greater surface for vaporization.

The retort is provided with a sediment-tap, F. By opening the tap and supplying an increased flow of water any sediment in the retort will be drawn off.

To prevent waste of heat by radiation, the sides of the retort may be protected by a jacket, G. Any suitable casing, of asbestus, or any known means for preventing waste by radiation, may, of course, be employed.

The water of condensation may fall into a drip-box, H, provided with one or more inclined shelves, preferably of wire-gauze, and perforated, as shown at *h*, so that the water will be thoroughly aerated. Charcoal, *h*, or other material, may, if desired, be placed in the bottom of the box to improve the taste or quality of the water.

h^2 is the drip-tube or outlet of the box.

Any suitable form of aerator may be attached to the apparatus. That shown is, however, deemed entirely sufficient whenever an aerator is desired.

x x represent perforated ears or straps, by means of which the apparatus may be hung upon a wall or carrying-board.

In use the apparatus may be hung on the wall in convenient proximity to a water-cock and gas-tap, if gas is to be used to heat the retort. The inlet-tube *a* is connected with the water-faucet by means of a piece of rubber tubing, or otherwise, and the Bunsen burner is similarly connected with the gas tap or burner. The faucet being operated to permit the flow of a small stream of water, the condenser-jacket, retort, and overflow-pipe will fill until the water reaches the level X Y, at which it will be maintained by the constant overflow at a^2. The Bunsen burner being lighted, steam will be generated in the retort, and the operation indicated in the above description will continuously take place. So long as the flow of water and gas continues the operation is entirely automatic, and the apparatus requires absolutely no attention. To work most economically the water-supply should be reduced until the overflow at a^2 is warm. The warm overflow need not be wasted, but may be delivered into a vessel for use.

By connecting the overflow-pipe about halfway up the condenser all of the very hot water at the top is retained and the water-level maintained by the overflow of merely warm water. The supply of water at *a* may be so increased that the overflow will be cold.

Any suitable construction for fully utilizing the heat of the burner may be adopted—as, for instance, such expedients as are resorted to in steam-boilers, &c.

The material of which the still is made may be copper, tin, or any other suitable metal, and, if desired, may be porcelain-lined.

An apparatus having a capacity of one-half gallon of distilled water per hour, when burning about six feet of gas, would be of about the following dimensions: The retort, five inches in height and diameter. The outside measurements of the condenser would be sixteen inches long, three inches wide, and about three-fourths inch thick; the interior condensing-tube, two and one-half inches wide by one-fourth inch by fourteen and seven-eighths inches. The aspirating lips or tube *d* may be about one-eighth inch by two and three-eighths inches. The overflow-pipe should be connected with the condenser-jacket about seven and one-half inches from the bottom, and the pipe should be about one-half inch in diameter. Should the drip-box be dispensed with and the drip-pipe for the distillate connected directly with the bottom of the condensing-tube, that pipe should also be about one-half inch in diameter, so as to permit access of air to the interior of the condensing-tube.

The above dimensions were those adopted in several specimen stills which had the capacity above mentioned. I do not, however, limit myself to any particular dimensions.

An apparatus constructed as described may be connected with the water-back or fire-pot of a range or heater of any kind by pipes S S′, (shown in Fig. 3,) which communicate with the retort and the water-back of the heater. With this arrangement water which rises into the retort will flow down the pipe S to the water-back and fill the water-back and pipes S S′, and, when heated, will rise through the pipe S′ into the retort, where it will give off its steam, the operation being precisely the same as above described. With this arrangement I should prefer to retain the burner E for use when the range is not burning. Instead of connecting with the ordinary water-back, a continuous pipe S S′ may be passed through the fire-pot of the range.

In Fig. 5 is illustrated one way of construction by means of which the still may be used for alcoholic distillation or the manufacture of fluid extracts. At X′, just above the overflow-connection with the jacket, a partition is placed across the jacket, so as to divide it into two compartments. On each side of the partition there is a pipe-connection with the jacket, leading to a common two-way cock, which, when in one position, places the two compartments of the jacket in communication, so that water may be distilled, as above described. In the other position this communication is cut off and the tap Y′ placed in communication with the upper compartment of the jacket, which may now be fed from a tank or supply-bottle, Z, preferably working automatically to supply the still at a constant level, as is well understood, with fluid of any kind to be distilled. Obviously all the advantages incident to the manner of distilling water above described are here obtained.

The operation of the apparatus shown in Fig. 5 is as follows: The bottle Z is located in such relation to the still that the end z of pipe Z', which passes through the top of the bottle and extends nearly to its bottom, is on a level with the desired fluid-level in the retort, the level being indicated by the horizontal dotted lines W W. The vessel or bottle Z is provided with an air-valve, Z^2, and with a suitable outlet-pipe, Z^3, provided with a stop-cock at its bottom. The air-cock Z^2 being open and the outlet cock at Z^3 closed, a quantity of liquid is supplied to the vessel through the tube Z', the displaced air escaping through the air-cock. The air-cock is then closed and the cock at Z^3 opened, the pipe Z^3 being connected with the tap Y' of the three-way cock by a suitable piece of tubing, the three-way cock of course being in the position illustrated in the drawings. The liquid in the vessel Z then commences to flow out into the still and a partial vacuum is formed above the liquid in the vessel. The full pressure of the atmosphere on the surface of the liquid in the tube Z' will cause the water therein to be depressed to some point—say o—and finally to the bottom of the tube Z', after which air will pass through the tube and ascend through the liquid into the space above.

It is evident that the force required to carry air through the tube Z' is a pressure caused by a hydrostatic column equal to the distance from the bottom of the tube Z' to the surface of the liquid in Z. Air will continue to pass through the tube until the level in the still has reached the lower end of the tube, after which the conditions above described do not exist, because the distance from the surface of the liquid in the still and the surface of the liquid in the vessel Z is less than the hydrostatic column required to force air through the tube Z'. As soon, however, as the level in the still falls below the lower end of the tube Z', air will again pass into the vessel Z, and the liquid flow out to supply the deficiency in the retort of the still.

Of course the still might be fed from a suitable tank of ordinary construction and the level regulated by an overflow-pipe. The overflow would by preference be taken from the pipe outside of the jacket, and preferably between the cock and tank.

I claim as my invention—

1. The herein-described improvement in the art of distillation, which consists in continuously supplying the fluid to the retort, heating said supply-fluid by the vapor of distillation from the retort, decreasing the pressure upon the surface of the heated supply-fluid by the action of the vapor from the retort, thereby causing it to vaporize at a relatively low temperature, and then condensing the combined vapors derived from the fluid.

2. The herein-described improvement in the art of distillation, which consists in causing the vaporous distillate on its escape from the retort to produce a second distillation at a lower temperature than that in the retort by heating the supply-fluid and reducing the pressure on the surface of the same prior to its entrance into the retort, substantially as set forth.

3. The combination, substantially as set forth, of the retort, the condenser, normally-open fluid and vapor connections between the condenser and retort, a fluid-supply pipe connected with the condenser, and an overflow pipe or connection whereby, with a constant fluid-feed, a uniform level is maintained in the condenser and retort.

4. The combination, substantially as set forth, of the retort, the condenser, normally-open fluid and vapor connections between the retort and condenser, a fluid-supply pipe connected with the condenser, and an overflow-pipe connected with the condenser below the retort and carried up to the proper point to maintain the desired level in the retort and condenser.

5. The combination, substantially as set forth, of the fluid-distilling retort, a supply-conduit for conveying the fluid to the retort, and an overflow pipe or connection communicating with the supply-conduit for the overflow of the fluid, whereby, with a constant fluid-feed, a uniform level is automatically maintained in the retort, substantially as set forth.

6. The combination, substantially as set forth, of the retort, the condensing-jacket, the fluid communication or connection between the retort and jacket, the condensing-tube within the jacket, open at its upper end, a vapor chamber or compartment, and means whereby the vapor from the retort may blow into the open end of the condensing-tube, and a fluid-supply connection with the condenser.

7. The combination, substantially as set forth, of the retort, the condenser-jacket, the interior condenser tube or tubes, the steam or vapor compartment arranged opposite the open end of the condenser-tube and opening into it, a fluid-connection between the condenser and retort, and a steam-connection between the retort and said vapor-compartment, and the fluid-supply and overflow connections.

8. The combination, substantially as set forth, of a Liebig condenser, the fluid-supply connection a at one end, the retort arranged opposite the other end of the condenser and communicating therewith by normally-open vapor and fluid connections, and an overflow-pipe, for the purpose described.

9. The combination, substantially as set forth, of a Liebig condenser, the fluid-supply connection a at one end, the retort arranged opposite the other end of the condenser and communicating therewith by normally-open

vapor and fluid connections, an overflow-pipe, and a heater or Bunsen burner support arranged below the retort.

10. The combination, substantially as set forth, of the condenser, the retort having vapor and fluid connections with the condenser, the overflow-pipe, the fluid-supply connection with the condenser, and the retort-tap or blow-off pipe, for the purpose described.

11. The combination, substantially as set forth, of the condenser, the retort, the vapor and fluid connections between the condenser and retort, the fluid-supply and overflow pipes or connections of the condenser, the blow-off tap of the retort, and the protecting-jacket G.

12. The combination, substantially as set forth, of a distilling-retort, a fluid-chamber within which the supply-fluid is heated by the steam or vapor leaving the retort, a condensing-tube which passes through said fluid, and an aspirating-tube through which the vapor from the retort is blown into the condensing-tube, for the purpose set forth.

13. The combination, substantially as set forth, of the retort, the condenser-jacket, a fluid-connection between the jacket and retort, the condensing-tube therein, a vapor-connection between the retort and condensing-tube, a partition, X′, in the jacket, by which it is divided into two compartments, pipe-connections by which the upper and lower compartments of the condensing-jacket may be placed in communication with or cut off from each other, and fluid supply and discharge pipes or connections for the lower compartment of the condenser.

In testimony whereof I have hereunto subscribed my name.

ANDREW M. COYLE.

Witnesses:

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JOHN T. ARMS.