

March 12, 1940.

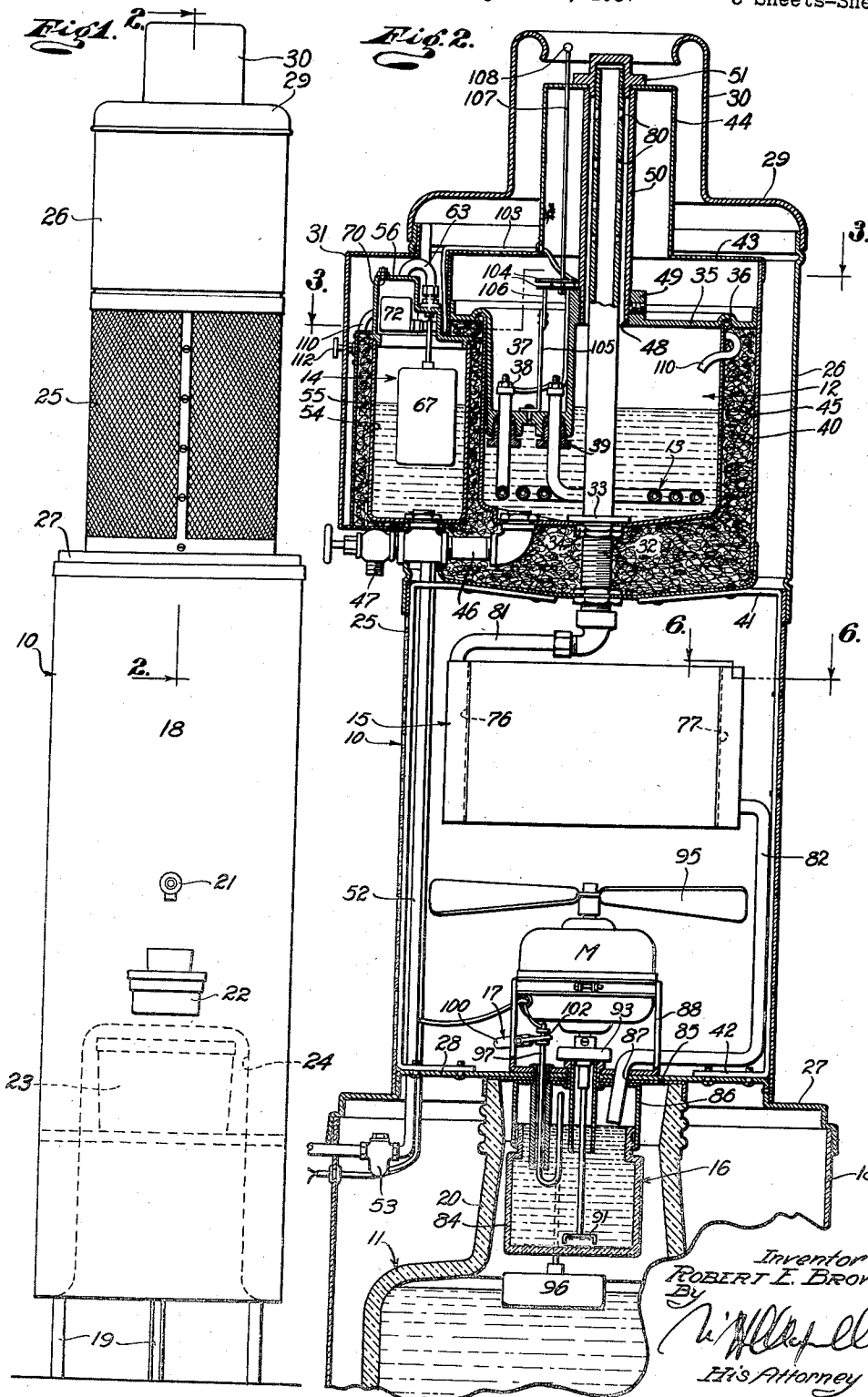
R. E. BROWN

2,192,879

DISTILLING APPARATUS

Filed April 12, 1937

3 Sheets-Sheet 1



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Fig. 3.

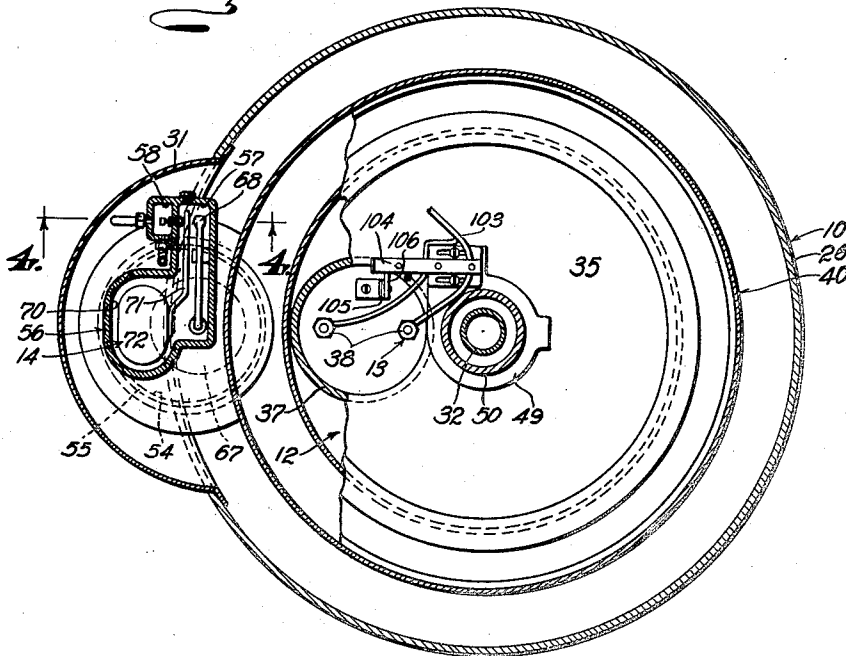


Fig. 4.

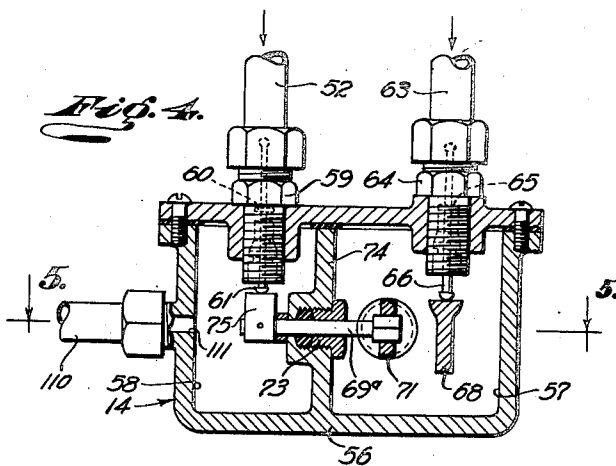


Fig. 5.

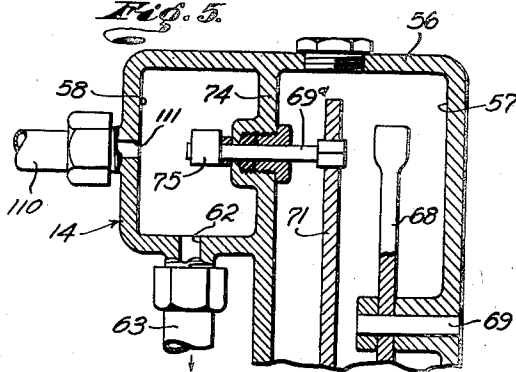
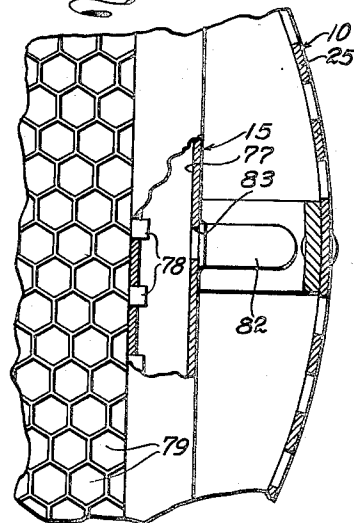


Fig. 6.



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3 Sheets-Sheet 3

Fig. 7.

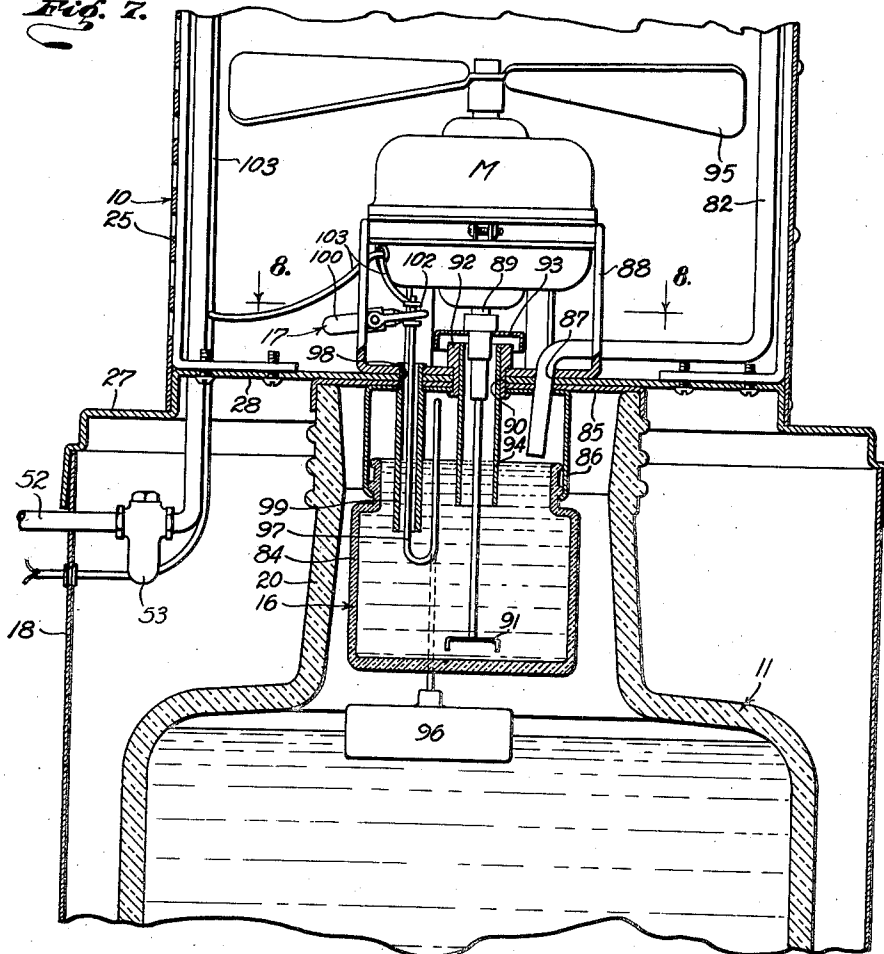
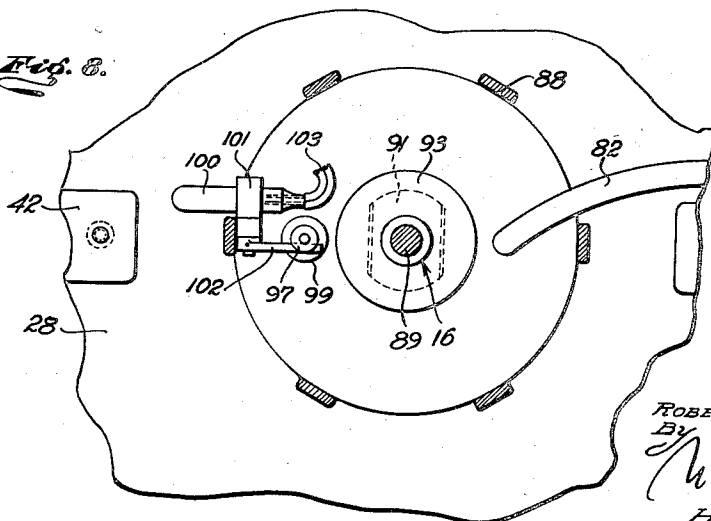


Fig. 8.



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UNITED STATES PATENT OFFICE

2,192,879

DISTILLING APPARATUS

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Application April 12, 1937, Serial No. 136,233

5 Claims. (Cl. 202—203)

This invention relates to distilling apparatus and relates more particularly to apparatus for distilling and aerating water. A general object of this invention is to provide a practical, simplified and particularly effective water distilling device that is entirely automatic in its operation.

Another object of this invention is to provide an improved water distilling apparatus of the general character fully described and claimed in my co-pending application entitled Apparatus for distilling water, Serial No. 748,058, filed October 12, 1934.

Another object of this invention is to provide an automatic water distilling device that is operable to provide and maintain a supply of cool aerated distilled water, being operable to automatically supply substantially unlimited quantities of water as may be required.

Another object of this invention is to provide an automatic water distilling apparatus that may be embodied in an attractive, compact unit suitable for installation in dwellings, hotels, public buildings and the like.

Another object of the invention is to provide a water distilling apparatus that is adapted to receive water from a city water line or other similar source and distill and aerate it as it is used, to maintain a suitable constant supply of fresh cool distilled water that has had its oxygen content restored by aeration.

Another object of the invention is to provide an automatic water distilling apparatus of the character mentioned that embodies a novel condenser that employs air as a cooling medium, thereby eliminating the necessity of a second water connection, and a waste or drain for carrying off cooling water.

Another object of this invention is to provide an automatic apparatus for distilling water that is entirely safe as it does not handle or contain steam at any appreciable pressure and embodies an automatic safety control for the heating element of the boiler and a safety control for the boiler feed.

Another object of the invention is to provide an automatic water distilling apparatus of the character mentioned that embodies means for aerating the distilled water and means for maintaining a circulation of cooling air through the condenser and the interior of the housing, both of said means being operated by a single electric motor.

Another object of the invention is to provide an apparatus of the character mentioned that includes a simple and very dependable control

responsive to the level of the water in the distilled water container that automatically controls both the heating element of the boiler and the motor driving the aerator and the air circulating fan.

Another object of the invention is to provide a water distilling apparatus of the character mentioned that embodies a simple, effective means for aerating the distilled water before it reaches the container holding the supply of distilled aerated water.

Another object of this invention is to provide an automatic water distilling device of the character mentioned that is economical to operate as it employs water and electrical energy only when the level of the supply of aerated distilled water is lowered.

A further object of the invention is to provide an automatic water distilling and aerating apparatus that is dependable in operation, requiring very little attention or servicing.

The various objects and features of my invention will be fully understood from the following detailed description of a typical preferred form and application of the invention, throughout which description reference is made to the accompanying drawings, in which:

Fig. 1 is a side elevation of the apparatus provided by this invention. Fig. 2 is a central vertical detailed view taken substantially as indicated by line 2—2 on Fig. 1 illustrating the principal operative parts of the apparatus and showing the condenser in side elevation. Fig. 3 is an enlarged horizontal detailed sectional view taken substantially as indicated by line 3—3 on Fig. 2. Fig. 4 is an enlarged fragmentary vertical detailed sectional view taken substantially as indicated by line 4—4 on Fig. 3. Fig. 5 is a horizontal detailed sectional view taken as indicated by line 5—5 on Fig. 4. Fig. 6 is an enlarged fragmentary detailed sectional view taken as indicated by line 6—6 on Fig. 2. Fig. 7 is an enlarged vertical detailed sectional view illustrating the aerating means and the adjacent parts of the apparatus. Fig. 8 is an enlarged, fragmentary horizontal detailed sectional view taken substantially as indicated by line 8—8 on Fig. 7.

The apparatus provided by the present invention includes, generally, a body or housing 10 carrying a vessel or container 11 for receiving the aerated distilled water, a boiler 12 in the housing 10 embodying a heating element 13, a boiler feed 14, a condenser 15 in the housing 10 for receiving the steam or water vapor from the

boiler 12, means 16 for aerating the distilled water received from the condenser 15 and for circulating cooling air through the condenser 15, and an automatic control 17 for governing the heating element 13 of the boiler 12 and the means 16.

The body or housing 10 carries and encloses the various parts and mechanisms of the apparatus. The housing 10 may be varied somewhat in construction and design without departing from the present invention. In the particular construction illustrated in the drawings the housing 10 includes a lower section 18 for housing the container 11. The lower housing section 18 is an upright or vertical structure that may be cylindrical in its general configuration. The housing section 18 is supported on suitable legs 19 and is hollow or tubular to receive the container 11. The container 11 is preferably formed of glass or a suitably porous material and has a reduced neck 20 projecting slightly above the upper end of the lower housing section 18. A suitable valve or faucet 21 communicates with the interior of the container 11 and projects from the housing section 18 to facilitate the drawing of water from the container. A cup or glass holder 22 is spaced below the faucet 21. The holder 22 is adapted to discharge overflow water into a removable container 23 supported within the lower housing section 18. The housing section 18 has an opening 24 in its rear wall to permit the ready insertion and removal of the container 23.

The housing 10 includes an intermediate section 25 and an upper section 26. The intermediate housing section 25 houses the condenser 15 and is foraminous or perforate to admit cooling air for circulation through and about the condenser 15. In practice the housing sections 25 and 26 may be smaller in diameter than the lower section 18 and may be co-axial with the section 18. The intermediate housing section 25 may be supported on the upper end of the lower section 18 by an adapter member 27. The member 27 is cap-like having a horizontal top forming a partition 28 separating the interior of the section 25 from the interior of the lower housing section 18. The upper housing section 26 contains the boiler 12 and the boiler feed 14 and is a hollow cylindrical structure. The housing section 26 is supported on the upper end of the section 25 and is provided with a removable cap or head 29. The head 29 has a reduced tubular portion 30 projecting upwardly and having an open upper end. The upper edge of the portion 30 may be rolled or curved inwardly as clearly illustrated in Fig. 2 of the drawings. The upper housing section 26 may have an extension or projecting portion 31 on its rear side.

The boiler 12 is located within the upper housing section 26 and is a simple vessel substantially centrally disposed within the section 26. The boiler 12 may be supported by a central vertical pipe 32 which extends vertically through it and projects from its lower end. A collar 33 on the pipe 32 bears against the upper surface of the bottom wall of the boiler 12 while a clamp nut 34 on the pipe 32 engages the lower surface of said wall to secure the boiler to the pipe. The boiler 12 has a removable cover 35 on its upper end. A groove 36 may be provided in the cover 35 to receive the upper edge portion of the boiler 12. The cover 35 of the boiler 12 is provided with a downwardly extending socket or well 37. The well 37 is comparatively deep and projects downwardly within the water carrying zone of the

boiler 12. The heating element 13 of the boiler 12 is an electrically energized heating means located or disposed within the lower portion of the boiler. The heating element 13 is, of course, suitably insulated and may be in the form of a spiral or coil. The terminals or posts 38 of the heating element 13 extend through packing glands 39 in the lower wall of the well 37 to project upwardly into the well.

In accordance with the invention the boiler 12 is provided with an insulating jacket 40. The jacket 40 surrounds or encloses the boiler 12 in spaced relation thereto. In the typical construction illustrated in the drawings the insulating jacket 40 is supported on brackets 41 which also serve to support the pipe 32. The brackets 41 may be attached to the inner side of the intermediate housing section 25 and may have feet 42 bolted or otherwise secured to the partition 28. A removable cap 43 is provided for the upper end of the jacket 40. The cap 43 has a reduced part 44 extending upwardly into the portion 30 of the head 29. The part 44 of the cap 43 is spaced a considerable distance from the interior of the portion 30. The jacket 40 is filled or provided with suitable thermal insulating material 45. A drain 46 communicates with the lower end of the boiler 12 and extends to the exterior of the housing 10 where it is provided with a drain valve 47. The pipe 32 extends upwardly through an opening 48 in the cover 35 to project from the boiler 12. A boss 49 surrounds the opening 48 and a pipe 50 is threaded into the boss to project upwardly from the boiler cap 35. The pipe 50 surrounds the pipe 32 with substantial clearance and its upper end may engage the under side of the upper wall of the jacket part 44. A plug or head 51 may be threaded on the upper end of the pipe 32 to close the same and to clamp against the the upper wall of the jacket part 44.

The boiler feed 14 is provided to automatically maintain the proper water level in the boiler 12. The boiler feed 14 is float controlled and is entirely automatic in its operation. A water feed line or pipe 52 enters the housing 10 at a suitable point and extends to a point adjacent the rear side of the jacket 40. In the particular case illustrated the feed pipe 52 enters the lower housing section 18 and extends upwardly through the sections 25 and 26 to a point adjacent the upper end of the boiler jacket 40. It is to be understood that the water feed pipe 52 may be connected with any suitable source of water supply (not shown). A strainer and trap 53 may be provided in the feed pipe 52 at any suitable point. The boiler feed 14 includes a float chamber 54 provided by a vessel 55 in the rear portion of the housing section 26 and its projecting part 31. The lower end of the float chamber 54 has constant communication with the drain pipe 46 and, therefore, is in constant communication with the lower end of the boiler 12.

A casting or fitting 56 closes the upper end of the vessel 55. The fitting 56 is partitioned or chambered having a chamber 57 whose lower end is in communication with the float chamber 54 and an outer or second chamber 58. A tubular valve fitting 59 is threaded in an opening in the wall of the second chamber 58 and carries a spring pressed valve 60 having a stem 61 projecting into the chamber 58. The feed pipe 52 is connected with the fitting 59 to supply water to the chamber 58 when the valve 60 is open. A port 62 is provided in the wall of the second chamber 58 and a pipe 63 extends from the

port 62 to a tubular valve fitting 64 extending through an opening in a wall of the inner chamber 57. A spring pressed valve 65 is provided in the fitting 64 and is operable to close off the passage of water from the pipe 63 to the chamber 57. The valve 65 has a stem 66 projecting from the fitting 64 to extend into the chamber 57.

The boiler feed 14 includes a float 67 in the float chamber 54. The float 67 is carried by or connected with a lever 68 pivoted on a pin 69 carried by the fitting 56. The upper arm of the lever 68 is adapted to cooperate with the stem 66 of the valve 65. When the level of the water in the boiler 12 and the float chamber 54 lowers beyond a definite point the float 67 moves downwardly causing the lever 68 to pivot and move the valve stem 66 to open the valve 65 and thus admit water from the pipe 63 into the float chamber 54. It is believed that it will be apparent how the float 67 operating the lever 68 is adapted to control the valve 65 to maintain the proper level of water in the boiler 12.

The boiler feed 14 includes a safety control to prevent the flooding of the boiler in the event that the valve 65 refuses to close or the float 67 becomes caught. The fitting 56 has an upper chamber 70 whose lower end is in communication with the float chamber 54. A lever 71 is rigidly supported on a turnable pin 69^a and carries a float 72 which is disposed within the chamber 70. The lever 71 projects into the chamber 57. A packing gland 73 is provided in the wall 74 which separates the chambers 57 and 58 and seals about the pin 69^a. A cam 75 is provided on the pin 69^a. A cam 75 is provided on the pin 69^a to engage the valve stem 61 to normally hold the valve 60 open. In the event that the valve 65 fails to close or the float 67 becomes caught in a lower position and the boiler 12 receives an excessive amount of water the water rises and enters the chamber 70. When this occurs the float 72 is raised and the cam 75 is turned so that the spring of the valve 60 closes the valve to cut off the passage of water to the chamber 58, the float chamber 54 and the boiler 12.

Flushing means may be provided for flushing out the boiler 12. A conduit 110 is connected with a port 111 in the wall of the chamber 58 and extends to the interior of the boiler 12 and may be employed to flush the boiler. A suitable manual control valve 112 is provided in the conduit 110 to control the passage of water through the conduit 110. To flush the boiler 12 the drain valve 47 is first opened to allow the boiler to drain; the valve 112 is then opened to discharge the flushing water into the boiler.

The condenser 15 receives steam or vapor from the boiler 12 and discharges condensate or distilled water which is received by the aerating means 16. The condenser 15 is arranged within the housing section 25 and is spaced below the boiler 12. It is a feature of the invention that the condenser 15 employs air as the cooling medium. In the form of the invention illustrated in the drawings, the condenser 15 is a substantially rectangular structure having vertically disposed chambers 76 and 77 at its opposite ends. A multiplicity of spaced tubes 78 extend between and connect the two chambers 76 and 77. The tubes 78 are associated with or provided with the usual heat radiating plates arranged in the well known honey comb pattern to provide vertical air passages 79. The pipe 32 described above receives steam from the boiler 12 being provided with openings 80 in its upper portion

which communicate with the interior of the pipe 50 which in turn communicates with the upper end of the boiler 12. The openings 80 are located above the float 72 so that the level of water in the boiler 12 cannot reach the openings 80 without having first caused closing of the valve 60.

A tube or pipe 81 connects the lower end of the pipe 32 with the upper end portion of the condenser chamber 76. A discharge pipe 82 communicates with the lower end of the chamber 77 and extends downwardly to carry the condensate or distilled water to the aerating means 16. The steam or vapor passing through the tubes 78 gives up its heat and is converted into water which flows out through the pipe 82. In accordance with the invention a relief port 83 is provided in the wall of the condenser chamber 77 to place the interior of the condenser in communication with the atmosphere. The relief port 83 preferably communicates with the upper end portion of the condenser chamber 77. The port 83 in connecting the interior of the condenser with the atmosphere prevents a superatmospheric pressure or a reduced pressure from developing in the condenser and boiler system. The relief port 83 is comparatively small and does not permit the loss of an appreciable amount of water vapor from the condenser.

The means 16 for aerating the distilled water from the condenser 15 and for circulating air through the condenser 15 is a motor driven means governed by the automatic control 17. The means 16 includes an open topped vessel or cup 84 arranged within the neck 20 of the container 11. The cup 84 is preferably formed of glass or the like and is spaced from the wall of the neck 20. A cap or plate 85 may extend across the upper end of the neck 20 and the cup 84 may be supported by a hanger 86 projecting downwardly from the plate 85. The discharge pipe 82 of the condenser 15 passes through an opening 87 in the partition 28, the plate 85 and the hanger 86 to discharge into the cup 84. As the cup 84 has an open upper end the water is free to overflow from it into the container 11.

The aerating and air circulating means 16 includes a vertically disposed electric motor M located above the partition 28. A suitable bracket 88 on the partition 28 supports the motor M. The shaft 89 of the motor M projects downwardly through an opening 90 in the bracket 88, the partition 28, the plate 85 and hanger 86 and carries an agitator 91 which is adapted to rotate in the cup 84 to agitate and aerate the water in the cup. A sleeve 92 lines the opening 90 and may be flanged to secure or aid in securing the hanger 86, the plate 85, and the bracket 88 to the partition 28. An inverted cup-shaped shield 93 may be provided on the motor shaft 89 above the sleeve 92 to prevent the passage of foreign matter downwardly through the sleeve. The sleeve 92 carries a tube 94 which projects downwardly into the water in the cup 84 to provide a water seal about the shaft of the agitator 91. When the motor M is in operation the agitator 91 effectively aerates the water in the cup 84 to recharge the distilled water with air.

In addition to aerating the distilled water as it is delivered to the cup 84 the means 16 operates to circulate air through the condenser 15 and the housing sections 25 and 26 to insure the proper condensation of the water vapor in the condenser and to cool the water or condensate. The motor shaft 89 has a portion projecting

above the motor which carries a bladed fan 95. The blades of the fan 95 are pitched to force or circulate air upwardly through the housing sections 25 and 26 and through the foraminous condenser 15. The perforations of the intermediate housing section 25 admit air to the interior of the housing at the fan 95 while the opening in the upper end of the head portion 39 allows the air to pass upwardly out of the housing so that a free circulation of air is maintained while the motor M is in operation. It is believed that it will be apparent how the air circulated upwardly by the fan 95 passes through the honey comb structure 79 of the condenser 15 to effect the condensation of the water vapor in the condenser and to cool the resultant condensate.

The automatic control 17 is responsive to the water level in the container 11 and is operable to simultaneously energize the heating element 13 and the motor M when the water level in the container 11 falls below a certain point and operates to simultaneously de-energize the heating element 13 and the motor M when the level of the water in the container is raised to a proper point or level. The control 17 is in the nature of a float control including a buoyant body or float 96 in the container 11 arranged to float upon the distilled water in the container. A stem or rod 97 is connected to the float 96 and projects upwardly therefrom. The rod 97 is bent or formed to extend above the cup 84, then curve downwardly into the cup and then extend upwardly through an opening 98 in the hanger 86, the plate 85, the partition 28 and the bracket 88. A tube 99 is arranged in the opening 98 to project downwardly into the water in the cup 84 to provide a water seal about the float rod 97. The tube 99 receives the float rod 97 with suitable clearance to permit the free movement of the float 96.

The energizing electric circuit of the motor M and the heating element 13 is controlled by a mercury switch 100. A suitable bracket 101 pivotally mounts the mercury switch 100 on an arm of the bracket 88. A suitable slack connection 102 is provided between the float rod 97 and the mercury switch 100 whereby the switch is pivoted by vertical movement of the float 96. The necessary electrical conductors 103 extend to the mercury switch 100 and the motor M and the heating element 13. When the container 11 is filled with distilled aerated water at the desired level the float 96 acting through the medium of its rod 97 holds the switch 100 in a position where the energizing circuit to the motor M and the heating element 13 is broken or open. After an amount of water has been withdrawn from the container 11 to lower the water level an appreciable extent the float 96 will have moved downwardly to cause pivoting of the mercury switch 100 to a position where its mercury completes the energizing circuit to the motor M and the heating element 13, so that aerated distilled water is again supplied to the container 11 to raise its water level.

The present invention provides an automatic safety control for the heating element 13 which operates to de-energize the element 13 in the event that the boiler temperature becomes excessively high. A switch is connected in one of the energizing leads 103 of the heating element 13. The switch may comprise two contact arms 104 mounted on the boss 49. The lower contact arm 104 normally tends to flex down-

wardly out of engagement with the upper contact arm 104. A thermostatic element or bi-metal element 105 is supported on the lower wall of the well 37 and projects upwardly toward the contacts 104. A finger 106 of insulation is provided on the upper end of the bi-metal element 105 to engage the under side of the lower contact 104. The bi-metal element 105 is proportioned to normally hold the lower contact 104 in engagement with the upper contact 104. The bi-metal element 105 being in the well 37 is subjected to and is responsive to the heat of the boiler 12. When the boiler temperature becomes excessively high or raises above a predetermined degree the bi-metal element 105 is bent by the heat so that its finger 106 releases from the lower contact 104 allowing the lower contact to flex out of engagement with the upper contact 104. Thus the heating element 13 is automatically de-energized when the boiler temperature becomes excessively high and the apparatus is protected against injury by excessively prolonged energization of the heating element 13.

Means is provided for resetting the lower contact 104 and the bi-metal element 105. A reset rod 107 is connected with the lower contact 104 and extends upwardly through the part 44 of the jacket cover 43. The reset rod 107 extends through an opening in the top of the part 44 and has a suitable handle 108 on its upper end. After the boiler 12 has cooled down following opening of the switch 104—104 the bi-metal element 105 tends to return to a substantially vertical position and the attendant may engage the handle 108 and raise the rod 107 to flex the lower contact 104 upwardly to allow the bi-metal element 105 to return to its normal position where it holds the lower contact 104 in engagement with the upper contact 104.

In the operation of the apparatus the container 11 is normally filled with the distilled aerated water to a level where the float 96 holds the mercury switch 100 in an open condition. The float control or boiler feed 14 maintains a suitable water level in the boiler 12. The container 11 may be formed of partially porous material so that the evaporation of water on its external surface keeps the contained water cool. As the water is drawn off from the container 11 the water level in the container is, of course, lowered. When the level of the water in the container 11 has reached a predetermined point the float 96 will have moved downwardly to a position where it has pivoted the mercury switch 100 to a position where its mercury completes the circuit to the motor M and the heating element 13. Thus the motor M and the heating element 13 are automatically energized.

The heating element 13 raises the temperature of the water in the boiler 12 to vaporize the water and vapor passes upwardly through the pipe 50 and enters the pipe 32 through the openings 80. Thus the vapor is delivered to the condenser 15. The air circulated through the condenser 15 by the fan 95 effectively condenses the water vapor and cools the resultant condensate before it passes out through the discharge pipe 82. The relief port 83 in the wall of the condenser chamber 77 puts the interior of the condenser and boiler system in communication with the atmosphere so that reduced pressure or super-atmospheric pressures cannot develop in the system. The distilled water from the condenser 11 discharges through the pipe 82 into the cup 84 where it is aerated by the action of the agitator 91. The

aerated distilled water overflows from the cup 84 into the container 11. The boiler feed 84 operates to maintain the proper water level in the boiler 12 during the distilling operation. The air circulated upwardly through the housing by the fan 95 passes around the boiler jacket 40 and flows upwardly through the open upper end of the portion 30 to prevent overheating of the apparatus. The distilling operation continues until the level of the water in the container 11 raises to the point where the float 96 has pivoted the mercury switch 100 to a position where the energizing circuit of the motor M and the heating element 13 is open. Thus the control 17 provides for the automatic energizing and de-energizing of the motor M and the heating element 13.

The apparatus operates to maintain a substantial supply of aerated distilled water in the container 11 and is capable of distilling a substantial quantity of water as conditions may require. The boiler feed 14 involving the safety valve 60 and the safety control float 72 operates to maintain the proper level of the water in the boiler 12 and prevents flooding of the boiler. The thermostatic control comprising the contacts 104 and the bi-metal element 105 are adapted to automatically de-energize the heating element 13 in the event that the boiler temperatures become excessively high. The apparatus of the present invention is capable of operating for a long period with little or no servicing or adjustment. The boiler 12, the feed 14 and the adjacent parts may be made accessible for adjustment, repair, etc. by removing the head 24, the cap 43 and the cover 35. The apparatus is compact and as the condenser 15 does not require a supply of cooling water the apparatus does not necessitate the installation of an outlet or drain for cooling water.

Having described only a typical preferred form and application of my invention, I do not wish to be limited or restricted to the specific details herein set forth, but wish to reserve to myself any variations or modifications that may appear to those skilled in the art or fall within the scope of the following claims:

Having described my invention, I claim:

1. Water distilling apparatus including a housing having a foraminous portion, a boiler in the housing above said foraminous portion, an air cooled condenser in said foraminous portion of the housing, a vessel below said foraminous portion receiving the distilled water from the condenser, means in the housing below the condenser for circulating air upwardly through the

housing, and an agitator for aerating the water in the vessel.

2. Water distilling apparatus including a housing having a foraminous portion, a boiler in the housing above said foraminous portion, an air cooled condenser in said foraminous portion of the housing, a vessel below said foraminous portion receiving the distilled water from the condenser, means in the housing below the condenser for circulating air upwardly through the housing, an agitator for aerating the water in the vessel, and a motor in the housing operating the said means and the agitator.

3. Water distilling apparatus comprising a boiler embodying an electric heating element, an air cooled condenser receiving water vapor from the boiler, the condenser having an air conducting cooling grid and a condensate discharge line, a housing enclosing the boiler and condenser, the housing having air inlet means in the lower portion and air outlet means at its upper end, power driven means for circulating air through the condenser grid and the housing to cool the condenser and carry the heat upwardly through the air outlet, a vessel receiving the condensate from the said line of the condenser, and a control for the heating element and said power driven air circulating means responsive to the water level in the vessel.

4. Water distilling apparatus including a housing having a foraminous portion, a boiler in the housing, an air cooled condenser in communication with the boiler to receive the vapor therefrom and operating to condense the vapor, the condenser being below the boiler and located within the foraminous portion of the housing, and means for circulating air upwardly through the condenser and housing to cool the condenser and to carry the heat therefrom upwardly past the boiler, and a vessel receiving the condensate from the boiler.

5. Water distilling apparatus including a housing having a foraminous portion and having an air outlet in its upper end, a boiler in the housing above said foraminous portion, an air cooled condenser in said foraminous portion spaced below the boiler and receiving the vapor from the boiler, air circulating means in the housing for circulating air upwardly through the housing and condenser to cool the condenser and carry the heat therefrom upwardly past the boiler to said outlet, and a vessel receiving the condensate from the condenser.

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