

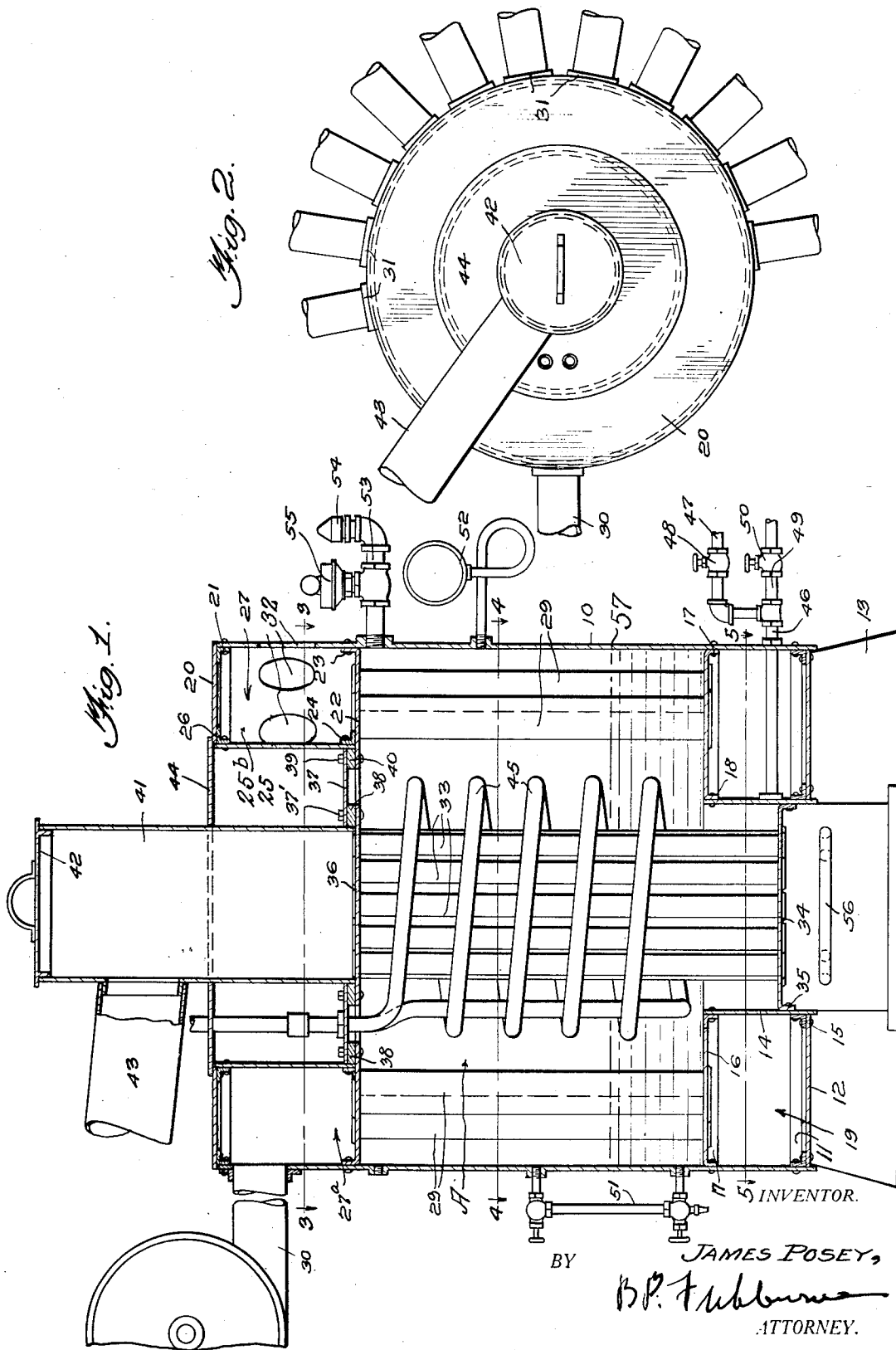
Feb. 11, 1930.

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COMBINED HEATING AND COOLING APPARATUS

Original Filed March 22, 1928 2 Sheets-Sheet 1



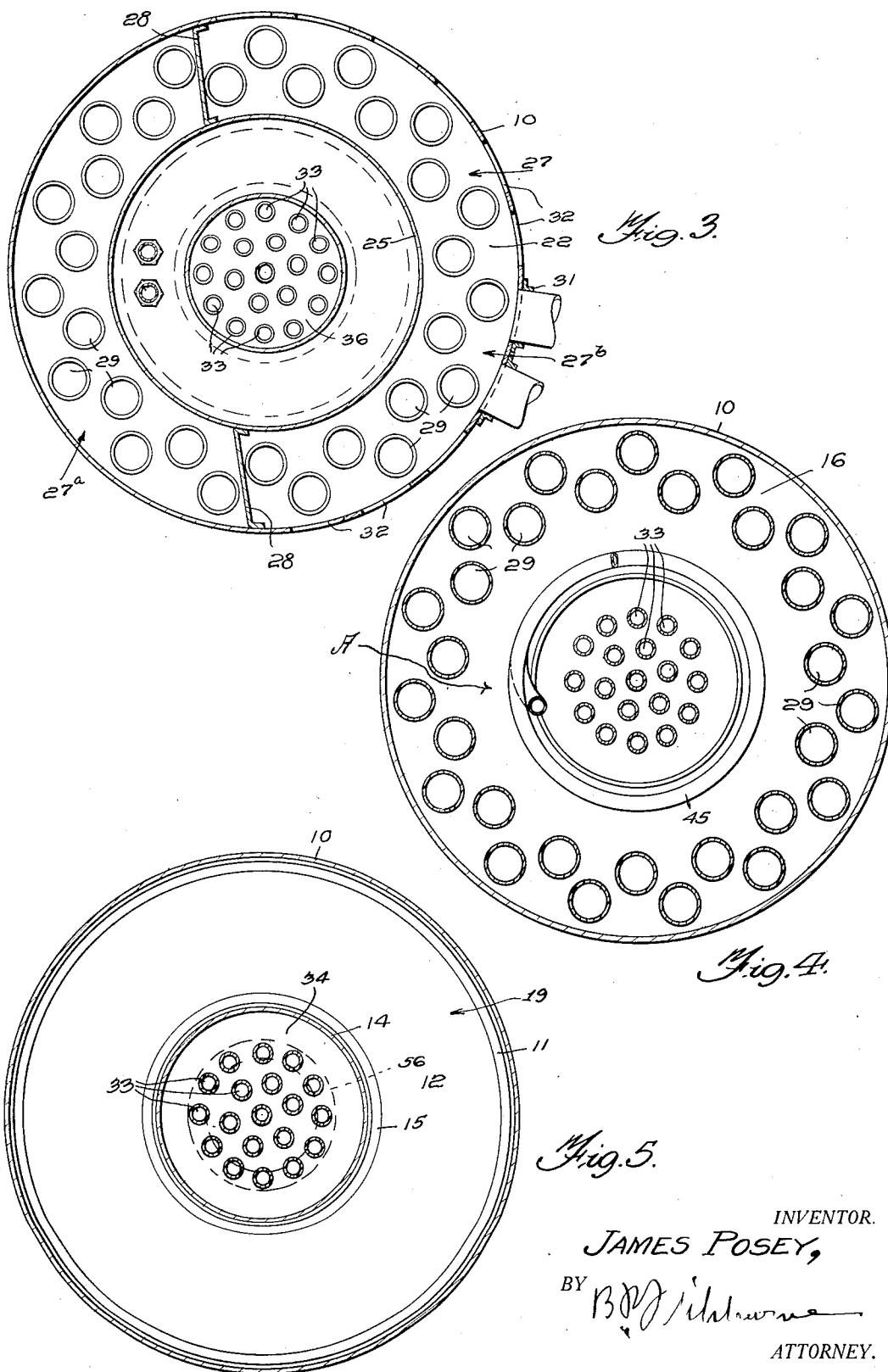
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COMBINED HEATING AND COOLING APPARATUS

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My invention relates to apparatus for regulating the temperature within a building, or the like, by the introduction of air therein at a suitable temperature.

5 In accordance with my invention, I provide an apparatus embodying a casing or shell adapted to be partly or wholly filled with water. Tubes preferably extend through the central portion of the shell and are adapted
10 to receive heated gases or products of combustion and a heat exchange is effected between these products of combustion and the water within the shell. Air receiving tubes also extend longitudinally within the casing,
15 and preferably surround the inner tubes, and the air passing through the air receiving tubes is heated from the water or steam within the casing. Air is forced through the air receiving tubes by a suitable blower and is
20 discharged to desired points of distribution. The apparatus is also adapted for cooling purposes, and a refrigerating coil is arranged within the casing and preferably surrounds the inner tubes. When the apparatus is used
25 to furnish cooled air, the casing is preferably substantially completely filled with water. The construction is such that the refrigerating coil and supporting means therefor may be removed as a unit, when desired. The
30 apparatus is of simple and compact construction and highly efficient in use.

In the accompanying drawings, forming a part of this specification, and in which like numerals are employed to designate like
35 parts throughout the same,

Figure 1 is a central vertical longitudinal section through the apparatus embodying my invention,

40 Figure 2 is a plan view of the same parts omitted,

Figure 3 is a transverse section taken on line 3—3 of Figure 1,

Figure 4 is a transverse section taken on line 4—4 of Figure 1, and

45 Figure 5 is a similar view taken on line 5—5 of Figure 1.

In the drawings, wherein for the purpose of illustration, is shown a preferred embodiment of my invention, the numeral 10 designates a vertical preferably cylindrical cas-
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ing or shell, within the lower end of which is arranged an annular angle iron 11, rigidly secured thereto by any suitable means, to form a gas-tight joint therewith. Attached to this angle iron 11 is an annular bottom
55 member 12, having a gas-tight joint therewith and with the casing 10. The casing 10 is arranged upon a suitable base 13, as shown. The numeral 14 designates a preferably cylindrical sleeve, rigidly attached at its lower end
60 to an annular angle iron 15, by any suitable means and forming a gas-tight joint therewith. This angle iron 14 is rigidly attached to the bottom member 12 and forms a gas-tight joint therewith. The numeral 16 designates
65 an annular plate or head, provided at its outer edge with a down-turned flange 17, rigidly attached to the casing 10, and forming a gas-tight joint therewith. The inner edge of the plate or head 16 is bent down into a
70 flange 18, rigidly attached to the sleeve 14, and forming a gas-tight joint therewith. The lower portion of the element 10 and elements 12, 14 and 16 form an annular air receiving chamber 19.
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The numeral 20 designates an annular top member, the outer edge of which is rigidly attached to an annular angle iron 21, forming a gas-tight joint therewith, and this annular angle iron is rigidly attached to the upper end of the casing 10, to form a gas-tight joint therewith. Arranged within the casing 10 near and spaced from the top member
80 20 is an annular plate or head 22, the outer edge of which is provided with an upstanding flange 23, rigidly attached to the casing 10 and forming a gas-tight joint therewith. An annular angle iron 24 is attached to the plate or head 24 near and spaced from its inner edge and forms a gas-tight joint therewith. The plate or head 20 projects inwardly beyond the angle iron 24, as shown. The numeral 25 designates an annular sleeve, arranged within the top of the casing 10, in spaced concentric relation thereto, and the lower end of this sleeve is rigidly attached to the angle iron 24 and forms a gas-tight joint therewith. The upper end of the sleeve
85 25 is rigidly attached to an annular angle iron 26, and forms a gas-tight joint therewith, and
100

this angle iron is rigidly attached to the annular top member 20 and forms a gas-tight joint therewith. The upper portion of the element 10 and the elements 20, 22 and 25 produce an upper annular air receiving chamber 27. This chamber 27 is divided into an intake compartment 27^a and a discharge compartment 27^b by partitions 28. The compartment 27^b is larger than the compartment 27^a. Between the air chambers 19 and 27 is a heating chamber A.

Air receiving tubes 29 are arranged vertically within the chamber A, and are secured at their lower ends in the plate or head 16, and at their upper ends in the plate or head 22, and establish communication between the chambers 19 and 27.

The numeral 30 designates an air supply pipe, leading into the chamber 27, and receiving air under suitable pressure from a rotary blower or the like. This air is fed into the compartment 27^a. Attached to the casing 10 are couplings 31, in communication with the compartment 27^b through openings 32. Suitable pipes, not shown, are connected with the couplings 31, and lead to the different rooms, or the like, to be supplied with air at the desired temperature.

The heating unit of the apparatus embodies heating tubes 33, preferably arranged in spaced annular groups, and arranged centrally within the chamber A and spaced from the air receiving tubes, as shown. The lower ends of the tubes 33 are connected with a circular plate or head 34, and discharge beneath this plate. The plate 34 is provided at its edge with a down-turned annular flange 35, which is rigidly attached to the lower portion of the sleeve 19, and forms a gas-tight joint therewith, as shown. The upper ends of the heating tubes 33 are attached to a circular plate or head 36, and discharge above the same. The heating tubes and the plates or heads attached to the ends therewith, remain permanently within the casing 10. The numeral 37 designates an annular connecting plate, detachably connected with the plate or head 36 through the medium of bolts 37, with a ring 38 arranged between these parts. The plate 37 is also detachably connected with the annular plate 22 by bolts 39, with a ring 40 arranged between these parts. The connecting plate 37 has a gas-tight joint with the plate or head 36 and the annular plate or head 22.

The numeral 41 designates a vertical smoke pipe, which rests upon the top of the plate or head 36, to receive the products of combustion from the heating tubes 33 and is readily removable from the plate 36. The top of this pipe 41 is closed by a removable cover 42. By removing the cover 42 access may be readily had to the vertical heating tubes 33, to clean them. The smoke passes from the pipe 41 through a pipe 43, leading to

any suitable point. An annular plate 44 surrounds the pipe 41 and rests upon the annular top member 20, and is readily separable therefrom. The cooling unit embodies a refrigerating coil 45, the ends of which pass through and are carried by the annular connecting plate 37. The refrigerating coil and the plate 37 are removable as a unit, the turns of the coil being sufficiently large to pass over the plate or head 36.

Water is supplied to the bottom of the chamber A through a pipe 46, which leads into the sleeve 14. The water is fed to the pipe 46 from a pipe 47 equipped with a valve 48. The pipe 46 has connection with a blow-off pipe 49 equipped with a valve 50. The casing 10 is equipped with a water gauge 51 and also with a pressure gauge 52. A pipe 53 leads into the top of the chamber A and is equipped with a safety valve 54, and an automatic damper regulator 55, which may control the action of a gas burner 56, arranged beneath the plate or head 34. Any suitable form of burner may be employed.

The operation of the apparatus is as follows:

When used as a heating apparatus, the refrigerating coil 45 may remain in place. The chamber A is preferably only partly filled with water, up to about the level 57 or higher. The burner 56 is now set into operation and the heated gases or products of combustion pass upwardly through the heating tubes 33 and heat exchange is effected between these gases and the water, whereby the steam is generated which fills the chamber A. This steam surrounds the air receiving tubes 29. The casing 10 being closed to the atmosphere, a pressure may be built up therein above atmospheric pressure. The fan or blower forces the air into the compartment 27^a of the upper air receiving chamber 27 and this air passes downwardly through the sets of tubes 29 upon the left side of the partitions 28 and enters the lower air receiving chamber 19. The air travels through this air receiving chamber 19 and then passes upwardly through the set of tubes 29 upon the right side of the partitions 28 and enters the compartment 27^b, and then discharges through the various openings 32. There are a larger number of tubes 29 leading into the compartment 27^b than leading into the compartment 27^a and this is provided to take care of the increased volume of the air due to its expansion, and thus reduce the resistance to the travel of the air, due to friction.

I have found that some degree of success may be had by operating the apparatus without water in the chamber A. The heating tubes heat the air in the casing 10, and this heat is transferred to the air in the air receiving tubes.

When using the apparatus as a cooling unit, the burner is, of course, inactive and the

chamber A is preferably completely filled with water, preferably brine. The refrigerating coil is then operated in the usual manner, and the air is forced through the air receiving tubes and discharged to the desired points.

It is to be understood that the form of my invention, herewith shown and described, is to be taken as a preferred example of the same, and that various changes in the shape; size and arrangement of parts may be resorted to without departing from the spirit of my invention, or the scope of the subjoined claims.

Having thus described my invention, I claim:—

1. In apparatus of the character described, a casing, means providing an annular air receiving chamber in the lower portion of the casing, means providing an annular air receiving chamber in the upper portion of the casing, said air receiving chambers forming with the casing an intermediate heating chamber, the upper air receiving chamber being divided into intake and outlet compartments, air receiving tubes extending longitudinally within the intermediate heating chamber and leading into the air receiving chambers, heating tubes arranged inwardly of the air receiving tubes and extending longitudinally within the intermediate heating chamber, a burner for discharging products of combustion into the heating tubes and means for supplying water into the intermediate heating chamber, the water or steam within the intermediate heating chamber contacting with the air receiving tubes and the heating tubes arranged therein.

2. In apparatus of the character described, a casing means providing an air receiving chamber in one end of the casing, means providing a second air receiving chamber in the opposite end of the casing, said air receiving chambers forming with the casing an intermediate heating chamber, air receiving tubes extending longitudinally within the intermediate heating chamber and connecting the air receiving chambers, heating tubes extending longitudinally within the intermediate heating chamber and disposed inwardly of the air receiving tubes, a burner for discharging products of combustion into the heating tubes, and means for supplying water into the intermediate heating chamber, the water or steam within the intermediate heating chamber contacting with the air receiving tubes and the heating tubes arranged therein.

3. In apparatus of the character described, a casing, means providing an air receiving chamber near one end of the casing, means providing a second air receiving chamber near the opposite end of the casing, said air receiving chambers forming with the casing an intermediate heating chamber, air receiving tubes extending longitudinally with-

in the intermediate heating chamber and connecting the air receiving chambers, heating tubes extending longitudinally within the intermediate heating chamber, a burner for discharging products of combustion into the heating tubes, and means for supplying water into the intermediate heating chamber, the water or steam within the intermediate heating chamber contacting with the air receiving tubes and heating tubes arranged therein.

4. In apparatus of the character described, a casing, means providing an air receiving chamber near one end of the casing, means providing a second air receiving chamber near the opposite end of the casing, said air receiving chambers forming with the casing an intermediate heating chamber, air receiving tubes arranged within the intermediate heating chamber and connecting the air receiving chambers, heating tubes within the intermediate heating chamber, a burner discharging products of combustion into the heating tubes, a blower connected with one air receiving chamber, and means for supplying water into the intermediate heating chamber, the water or steam within the intermediate heating chamber contacting with the air receiving tubes and heating tubes arranged therein.

5. In apparatus of the character described, a casing, air receiving tube means arranged within the casing, heating tubes arranged within the casing inwardly of the air receiving tube means, a burner to discharge products of combustion into the heating tubes, and means to supply water into the casing, said water or steam within the casing contacting with the air receiving tube means and the heating tubes arranged therein.

6. In apparatus of the character described, a casing, means providing an air receiving chamber near one end of the casing, said chamber having a generally central passage, means providing a second air receiving chamber near the opposite end of the casing, said second chamber having a generally central passage, said air receiving chambers forming with the casing an intermediate heating chamber, air receiving tubes arranged within the intermediate heating chamber near its side and connecting said chambers, heating tubes arranged within the intermediate heating chamber inwardly of the air receiving tubes and disposed adjacent to said passages, a burner for discharging products of combustion through the heating tubes, and means to supply water to the intermediate heating chamber, the water or steam within the intermediate heating chamber contacting with the air receiving tubes and the heating tubes arranged therein.

7. In apparatus of the character described, a heating chamber for receiving water and

closed to the atmosphere whereby steam pressure may be built up therein above atmospheric pressure, a plurality of separate air receiving tubes arranged within the chamber, an air supply compartment connected with corresponding ends of certain of the tubes, an air outlet compartment connected with the same corresponding ends of the remaining tubes, an air receiving chamber connecting the opposite corresponding ends of all of the tubes, heating tubes arranged within the heating element, and means for supplying heated gases into the heating tubes, the water or steam within the heating chamber contacting with the air receiving tubes and the heating tubes arranged within the heating chamber.

8. In apparatus of the character described, a water receiving chamber closed to the atmosphere whereby steam pressure may be built up therein above atmospheric pressure, a plurality of separate air receiving tubes extending longitudinally within the chamber near the outer portion thereof, means for supplying air under pressure to corresponding ends of certain of the air receiving tubes, a discharge element connected with the same corresponding ends of the remaining air receiving tubes, common means of communication between the opposite corresponding ends of all of the air receiving tubes, a plurality of separate heating tubes extending longitudinally within the chamber and free from communication with the air receiving tubes and arranged inwardly of the same, the water or steam within said chamber contacting with the air receiving tubes and heating tubes arranged therein, and a burner discharging products of combustion into the separate heating tubes.

9. In apparatus of the character described, a heating chamber closed to the atmosphere for receiving water whereby pressure above atmospheric pressure may be built up therein, annular air receiving chambers arranged near the ends of the heating chamber and free from communication therewith, a plurality of separate heating tubes passing centrally through the heating chamber and free from communication therewith, a burner for discharging products of combustion into the heating tubes, a plurality of separate air receiving tubes arranged within the heating chamber and connecting the air receiving chambers and arranged in groups surrounding the heating tubes, and means for dividing one air receiving chamber into intake and outlet compartments.

10. In apparatus of the character described, a heating chamber for receiving water, air receiving chambers arranged near the ends of the heating chamber, separate longitudinal air receiving tubes connecting the air receiving chambers, means for dividing one air receiving chamber into a plurality of

compartments which are of substantially different sizes, a plurality of separate heating tubes arranged within the heating chamber and free from communication with the interior of the same and the air receiving chambers, means to supply heated gases to the heating tubes, and means for supplying air under pressure to one compartment, the water or steam within the heating chamber contacting with the air receiving tubes and heating tubes arranged therein.

11. In apparatus of the character described, a vertical heating chamber for holding water, annular air receiving chambers arranged near the top and bottom of the heating chamber, separate air receiving tubes within the heating chamber and connecting the air receiving chambers, heating tubes extending longitudinally within the heating chamber and free from communication with the annular air receiving chambers and arranged inwardly thereof, a burner disposed beneath the heating tubes, and a removable smoke pipe covering the tops of the heating tubes whereby access may be readily had to the interior of the heating tubes for cleaning them, the water or steam within the heating chamber contacting with the air receiving tubes and heating tubes arranged within the heating chamber.

12. In apparatus of the character described, a heating chamber, air receiving chambers arranged near the ends of the heating chamber, air receiving tubes arranged within the heating chamber and connecting the air receiving chambers, heating tubes arranged within the heating chamber, and means for supplying heated gases to the heating tubes, the fluid within the heating chamber contacting with the air receiving tubes and heating tubes arranged within the heating chamber.

13. In apparatus of the character described, air receiving chambers, an intermediate chamber disposed between the air receiving chambers for holding water, air receiving tubes connecting the air receiving chambers and arranged within the intermediate chamber and disposed in a peripheral group to provide an inner space, temperature varying means arranged within the inner space for acting upon the water held within the intermediate chamber, means for dividing one of the air receiving chambers into inlet and outlet compartments and means for supplying air under suitable pressure to the inlet compartment.

In testimony whereof I affix my signature.
JAMES POSEY.