

UNITED STATES PATENT OFFICE.

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AUTOMATIC HEAT GENERATOR AND REGULATOR COMPANY.

HEATING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 411,310, dated September 17, 1889.

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To all whom it may concern:

Be it known that I, EDMUND R. WARE, a citizen of the United States, residing at Worcester, county of Worcester, State of Massachusetts, have invented a certain new and useful Improvement in a Heating Apparatus, of which the following is a specification.

Figure 1 is a rear elevation of a heater containing my invention. Fig. 2 is a front elevation. Fig. 3 is a vertical section enlarged, taken on line *x x*, looking in the direction of the arrow 1 of Fig. 4. Fig. 4 is a vertical section on line *y y*, Fig. 3, looking in the direction of the arrow 2, Fig. 3. Fig. 5 is a horizontal section on line *z z*, Fig. 4. Fig. 6 is a detail enlarged. Fig. 7 is a plan view of a detail. Fig. 8 is a vertical section on line *w w*, Fig. 7.

Like reference-letters refer to similar parts in all the figures.

This invention has for its object the construction of a heater adapted for burning fluid fuel of any of the well-known kinds, and one part of it relates to a novel arrangement of devices, whereby a very perfect combustion of fuel is attained, and whereby, also, the waste products of combustion escape from the apparatus practically without waste of heat; and this part of the invention consists, essentially, in arranging the exit for the waste products of combustion in about the same horizontal plane with that part of the heating-chamber at which the fuel is ignited, whereby the consumption of fuel is carried on without a direct draft through the heating-chamber, as will be hereinafter fully explained.

Other parts of the invention will be specifically referred to in the claims.

Having thus set forth the nature and scope of my invention, I will proceed to describe an apparatus which I have devised for carrying it into effect.

A is the inclosing wall or casing, preferably of brick, with a suitable top or deck with an inclosed chamber, which I prefer in practice to have arched at the top with a suitable non-conducting lining of some suitable material, say asbestos, as indicated at A'. Within this structure is the boiler C, having an inner and outer shell, between which there is a wa-

ter-space C'. The boiler is dome-shaped, and the lower edge of its water-leg is in a substantially horizontal plane. The inner surface is substantially continuous instead of having openings above its lower edge for the passage of the products of combustion, as is usually the case in heaters of this general construction. This boiler rests upon a platform within the brick structure.

D D is a supply-pipe projecting through the wall and through a semicircular recess or notch formed in the lower part of the boiler, which latter is provided with feet or other supports resting upon the platform. This feed-pipe is at its inner end provided with elbows and short sections opening at their discharging ends into the feeders which are arranged below the distributors D' d or within the walls of these distributors when the latter are formed as shown in Fig. 6, where they are represented as consisting of a flat bottom plate with an upturned side, and an upper corrugated plate d, having slits or throats d', whereby the fuel—such, for instance, as ordinary illuminating-gas—may be suitably mixed with a proper amount of atmospheric air preparatory to burning, substantially as is done with a Bunsen burner, the operation of which is so well known that no further reference need be made to it.

To facilitate a satisfactory combustion of fuel and an economical working of the heater, I provide the boiler with a fire-pot, into which the fuel passes.

In order to facilitate the most perfect combustion possible and to utilize most effectively the heat generated thereby, I prefer that the ignition of fuel should take place within a structure which I term a "fire-pot," and which I prefer to arrange within the lower part of the space inclosed by the water-leg, leaving an annular space between the fire-pot and the water-leg for the downward passage of the products of combustion. As I propose to use a fluid fuel of some sort, it is evident that the fire-pot need not be provided with grate-bars.

E F represent the fire-pot, the general shape of which is oval in cross-section, its walls inclosing a water-space E' within main body, and a series of water-spaces within the walls

of the parts F, which latter resemble in form bisected hollow frustums of a cone. These sections F F are arranged or located within the oval-shaped part E, (to which they are preferably secured,) and are connected there-
 5 with by water-pipes *e f*, the fire-pot itself being connected with the boiler by means of pipes *c c'* to insure the proper circulation of water or other fluid to be heated.

10 G is an outlet and H an inlet for steam or water, as the case may be. Under ordinary circumstances I propose to connect the outlet-pipe directly with a radiator or a series of radiators, and also connect the inlet-pipe to the
 15 same series, thus providing for a round-and-round circulation of steam or water.

Beneath the inlet-pipe is an air-space I, over which is located a sliding perforated sheet J, the holes *j* in the sheet permitting air
 20 to be conveniently distributed to the fire-pot and thence to the heating-chamber.

K is a flue for the escape of the waste products of combustion.

25 *k* is an opening from the flue into the chamber within which the boiler is located.

L is a plate at the front end of the air-chamber I, with openings *l l* for the passage of atmospheric air.

When in operation, the gas, mingled with a
 30 due proportion of atmospheric air, escapes through the slits *d'*, combustion taking place first between the sections F and the main body of the fire-pot. The heated products of combustion circulate within the heating-
 35 chamber B and also below the lower edge of the boiler and within the heating-chamber B' outside of the boiler, the waste products of combustion passing out through the opening *k* into the flue K.

40 From the above description and an examination of the drawings it will be readily understood that when the fuel is ignited the products of combustion will pass up through the passages which are formed in the fire-pot
 45 and are surrounded by water-spaces; thence into the central upper part of the inner heating-chamber, which is formed by the inner wall of the dome-shaped boiler; thence downward through the passage between the fire-
 50 pot and the lower part of that inner heating-chamber; thence through the passage below the lower edge of the boiler and the perforated sheet J, which in this instance serves as the boiler-support, and thence through the outer
 55 heating-chamber, which in this instance is inclosed by the outer wall of the boiler and the inner face of the wall of the casing. During this movement of the products of combustion their heat will be in great measure absorbed
 60 by the boiler and its contents, the waste products of combustion which have not been thus absorbed finally passing out through the final outlet *k*, which is on a level or thereabout (preferably a little below) the point at which
 65 ignition occurs.

The air-inlet, which in this instance consists of holes *j* in the perforated sheet, is below the

fire-pot, and I prefer to make the passages through the fire-pot between the parts E F
 smaller at the top than at the bottom to fa- 70
 cilitate a suitable draft of air, so that a sufficient quantity of atmospheric air shall be mingled with the gas to insure as perfect a combustion as may be.

By reason of the wall of the combustion- 75
 chamber being continuous, none of the products of combustion can pass through the boiler, but can escape only through the outlet below the lower edge of the water-leg which is below the plane of ignition of the fuel. 80

It is well known that in heaters of this general sort the water in the lower part of the boiler is of lower temperature than that in the upper part, and in carrying out my in- 85
 vention the waste products of combustion resulting from the burning of a fluid fuel—such, for instance, as an illuminating or a heating gas (so called)—in a chamber from which the waste products of combustion can escape only
 through an outlet so located, the temperature 90
 in the lower part of the boiler materially hinders or interferes with any tendency toward a direct and continuous draft through the heater.

In carrying out my invention I prefer to 95
 employ not only the combustion-chamber, but also the outer heating-chamber B', and with such construction that portion of the products of combustion which passes underneath the water-leg and into the outer heating-chamber 100
 B' circulates therein, and the waste products of combustion are finally passed out of the heater at *k* a little below the plane of ignition of the fuel, and while I prefer to locate the opening or outlet *k* as shown, yet a slight 105
 variation above or below will not seriously interfere with the economical working of the heater, because of the fact that the outlet for the products of combustion out from the combustion-chamber is below the water-leg and 110
 below the plane of ignition of fuel, so that there is practically no air drawn into the heater in excess of that which can be advantageously utilized in promoting an efficient combustion of gas, the result being that practically there 115
 is no more cold air drawn into the heater than is absolutely required, and hence none of the heat generated is used in heating air and moving it through the outlet for the waste products of combustion, as is the case in heat- 120
 ers of ordinary construction in which the products of combustion pass out of the combustion-chamber above the plane of ignition of fuel, and in which there is therefore a direct draft of air through the combustion-chamber. 125

Again, in my heater economy of fuel is promoted by the arrangement of the pipe H, which serves as an inlet to supply to the lower part of the boiler the fluid to be heated, which pipe enters the lower part of the boiler 130
 in close proximity to the outlet *k*, thus insuring that that part of the boiler with which the waste products of combustion engage just before leaving the heating-chamber shall be

colder than other parts of the boiler, and will therefore absorb heat which would pass out through the inlet & under other relative arrangements of parts.

5 Economy in the utilization of the heat generated by combustion is also promoted by constructing the heater with a passage from the inner heating-chamber to the outer heating-chamber at a point remote from the out-
 10 let for the waste products of combustion, thus avoiding or counteracting any tendency which might otherwise exist to induce or create a current direct from the fire-pot or inner heating-chamber outward through the
 15 outlet for the waste products of combustion. Economy is also promoted by the combination, with the main body of the fire-pot having an internal water-space, of a series of supplemental water-spaces, whereby there is
 20 formed in the fire-pot a series of vertical chambers for the passage of the products of combustion.

While I have shown and described the best mode now known to me for carrying out my in-
 25 vention, I do not wish to be limited to the exact construction or arrangement illustrated, because many modifications in the detail will readily suggest themselves to persons skilled in the art of building heaters, without depart-
 30 ing from the spirit of my improvement.

I am aware of Patent No. 361,380, which shows a dome-shaped boiler having a water-
 leg extending around the boiler with a fire-
 35 pot within the boiler and above the lower edge of the water-leg, and having also outlets in the upper part of the combustion-chamber for the products of combustion, together with an outlet for the waste products of combus-
 40 tion below the plane of ignition of fuel. But the mode of operation in that patent differs materially from the mode of operation in my heater in that, among other things, in that patent there is a direct and continuous draft upward through the combustion-chamber and
 45 outward at the upper part thereof, whereas in my invention the waste products of combustion can escape from the combustion-chamber only by passing downward below the plane of ignition and thence out below the
 50 lower edge of the water-leg.

I am also aware of Patent No. 305,477; but in that patent the waste products of combustion escape through an opening at one end of

the water-leg and above the fire-pot, so that there is a direct draft in an upward direction 55 through the fire-pot, and thence out of the boiler above the plane of ignition of the fuel.

What I claim is—

1. The combination, in a heater, of a dome-shaped combustion-chamber having a sub- 60 stantially continuous inner surface, a fluid-fuel supply-pipe, an inlet for the admission of air to the combustion-chamber, and an outlet for the waste products of combustion, said outlet being located below the plane of igni- 65 tion of fuel, whereby the waste products of combustion are compelled to pass out below the plane of ignition of fuel, substantially as set forth.

2. The combination, in a heater, of a com- 70 bustion-chamber, a boiler surrounding the combustion-chamber, a heating-chamber outside of the boiler, a fluid-fuel supply-pipe, an air-inlet, and an outlet for the waste products of combustion, said outlet being located be- 75 low the plane of ignition of fuel, substantially as set forth.

3. The combination, in a heater, of a boiler provided with an inner heating-chamber, a heating-chamber outside of the boiler, a pas- 80 sage for the products of combustion from the lower part of the inner chamber to the outer chamber; a fluid-fuel supply-pipe opening into the inner chamber, an inlet for the ad- 85 mission of air to the inner chamber, and a final outlet for the waste products of combustion, said final outlet being located on a level or thereabout with the point at which igni- 90 tion of the fuel occurs, substantially as set forth.

4. In a heater, the combination, with the boiler-support and the fluid-fuel supply, the dome-shaped boiler provided with an internal combustion-chamber having a substan- 95 tially continuous inner surface and arranged with its lower edge above the boiler-support, of the inclosing-casing, whereby there are formed two chambers with a passage below the boiler for the products of combustion from the combustion-chamber to the outer 100 heating-chamber, substantially as set forth.

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Witnesses:

CORA L. CADWALLADER,
 CELESTE P. CHAPMAN.