Dec. 3, 1929. H. J. SAUVAGE 1,737,732

HEATER

Original Filed Jan. 13, 1928 3 Sheets-Sheet 1

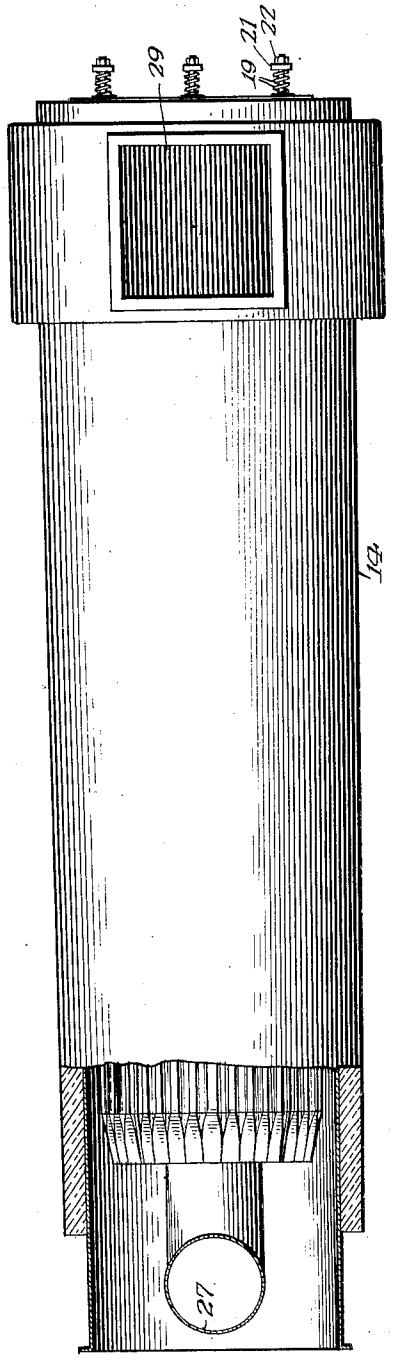


Fig. 1

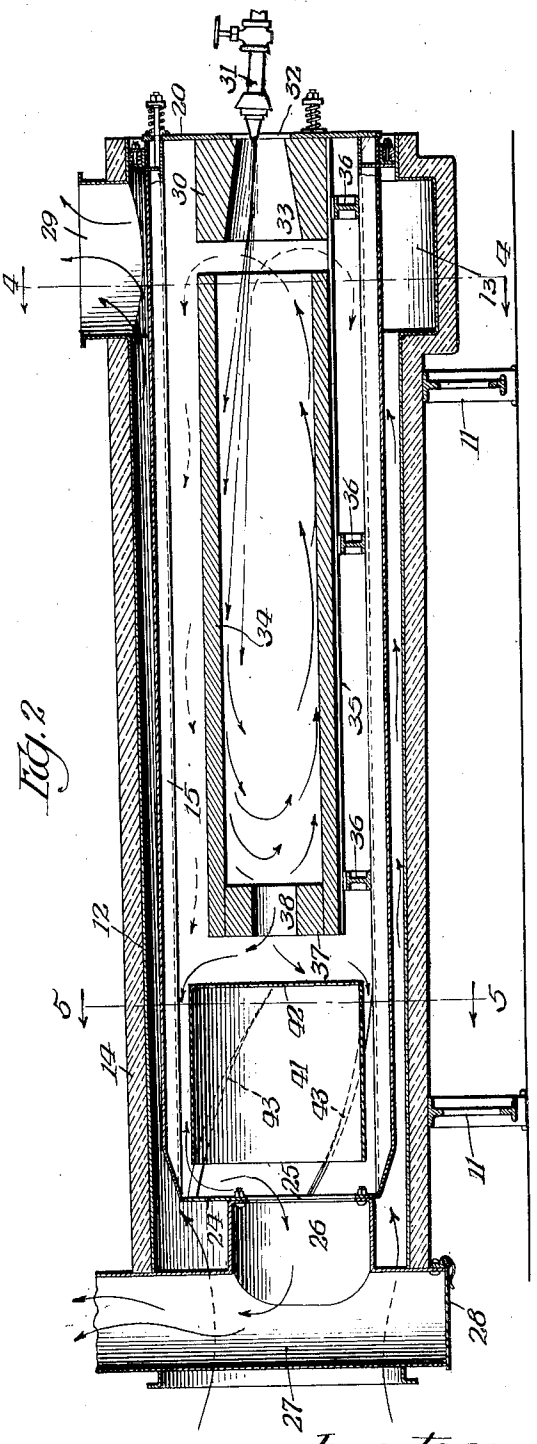


Fig. 2

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Fig. 3

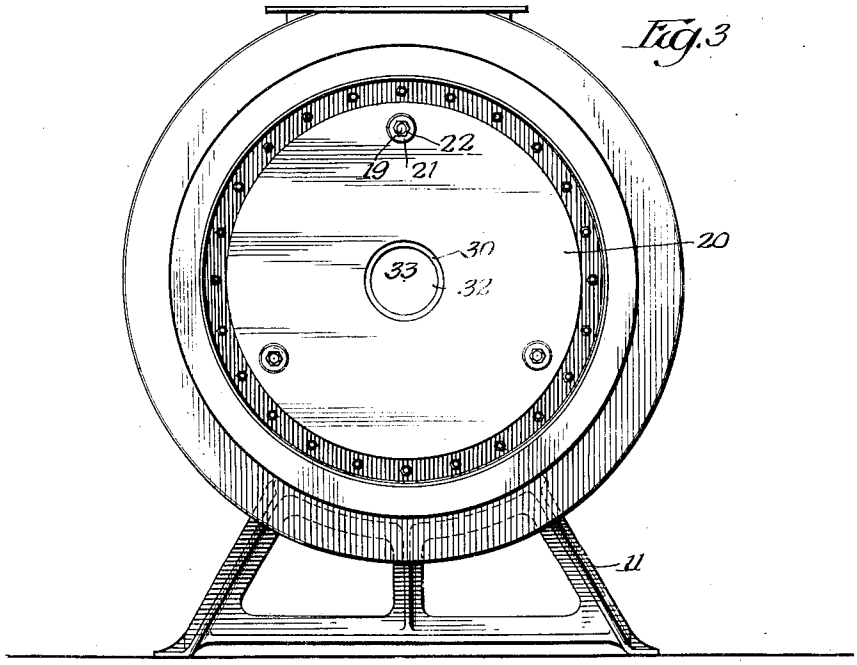
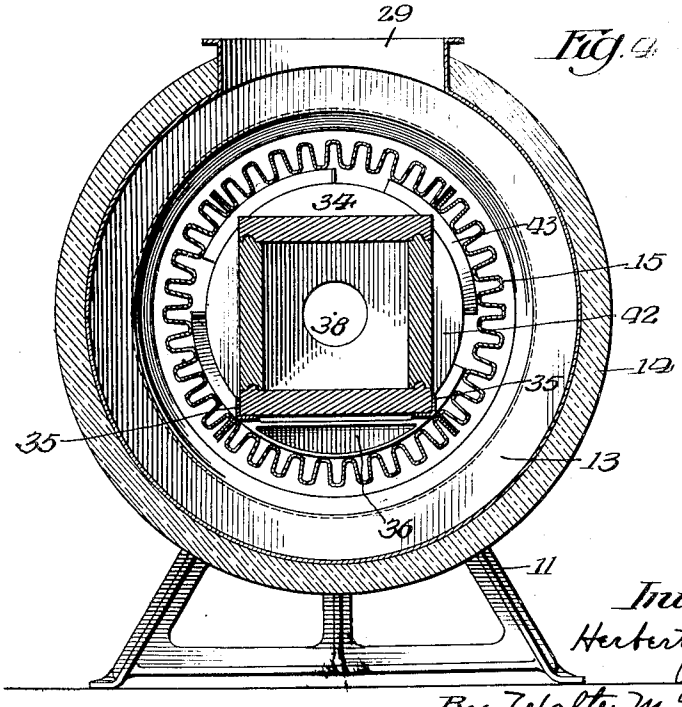


Fig. 4



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Fig. 5

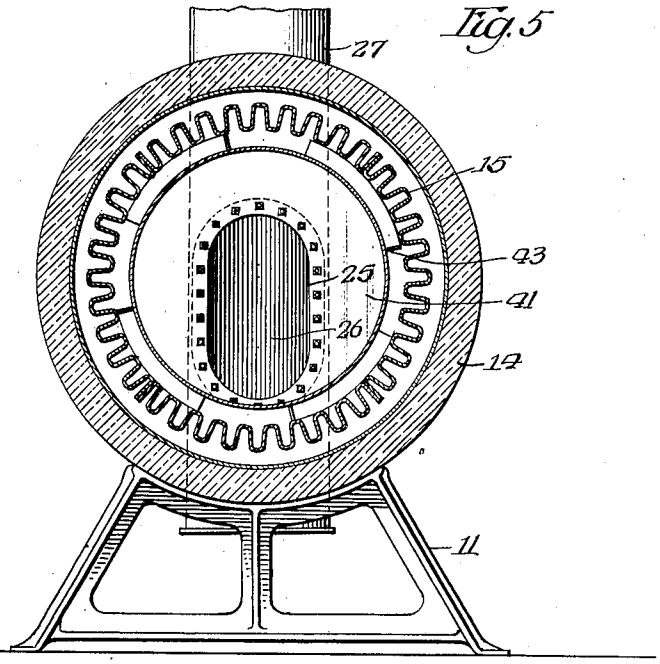


Fig. 6

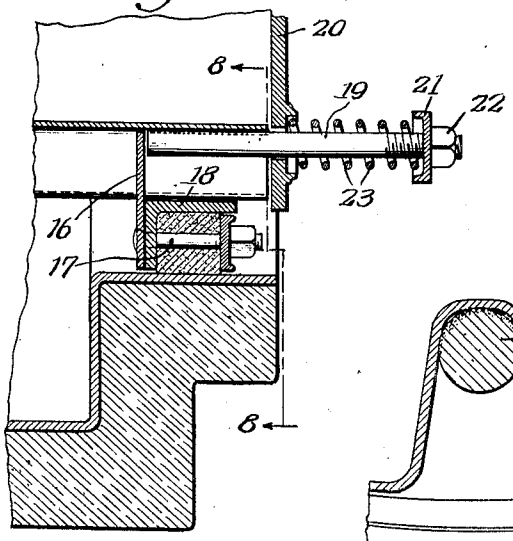


Fig. 7

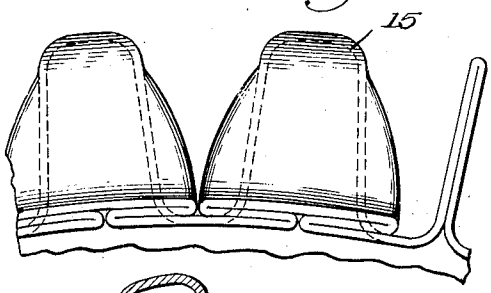
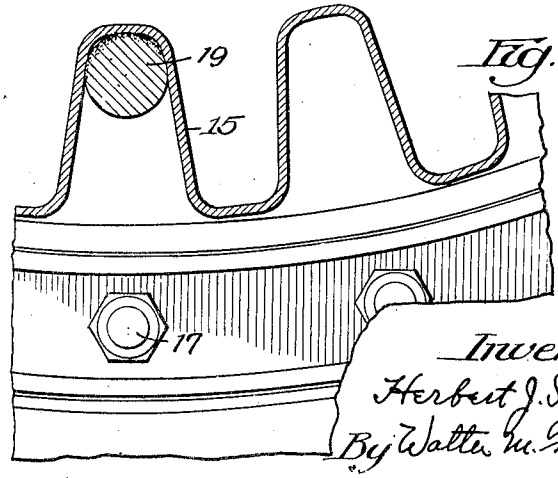


Fig. 8



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Patented Dec. 3, 1929 1,737,732

UNITED STATES PATENT OFFICE

HERBERT J. SAUVAGE, OF CHICAGO, ILLINOIS

HEATER

Application filed January 13, 1928, Serial No. 246,592. Renewed May 1, 1929.

My invention pertains to appliances for heating air, gases or vapors by means of burning fuel, and the leading purpose of the invention is the provision of an apparatus of this type which is highly efficient and effective in operation, simplicity of structure and economy of manufacture representing also desirable attributes.

A further aim of the invention is the production of a heater which will not become damaged or injured through cessation of the flow of fluid undergoing heating or through termination of the operation of the apparatus.

In order to enable those skilled in this art to fully understand the invention, both from structural and functional viewpoints, in the accompanying drawings I have illustrated a present preferred embodiment of the invention, like reference characters being used to designate the same parts throughout the several views.

In these drawings,—

Fig. 1 is a plan view of the new heater, partly broken away near one end to illustrate the internal construction;

Fig. 2 is a central, vertical, longitudinal section through the appliance;

Fig. 3 is an enlarged, front-end view of the heater;

Fig. 4 is a vertical cross-section on line 4—4 of Fig. 2;

Fig. 5 is a vertical, transverse section on line 5—5 of Fig. 2;

Fig. 6 is a sectional detail of the mounting of the front plate of the heater;

Fig. 7 is a fragmentary end view of the corrugated metal cylinder; and

Fig. 8 is an enlarged section on line 8—8 of Fig. 6.

Referring to these drawings, it will be noted that the heater or furnace is mounted on a pair of supports 11, 11 and comprises a cylindrical, sheet-metal housing or casing 12 having an enlargement 13 near one end, such element 12, together with the portion 13, being covered with suitable, heat-insulating material 14, such as is common in the trade, and containing a large percentage of magnesia.

Within such housing, there is a smaller, longitudinally-corrugated or hollow-ribbed, sheet-metal cylinder or shell 15, the lengthwise, hollow, external ribs of which are gradually flattened and closed at one end, as shown more particularly in Figs. 1 and 7.

At the front or firing end of the heater or furnace, such corrugated cylinder is supported externally by means of a notched, metal ring 16 fastened by bolts 17 to an angle-bar ring 18 located inside of the outer casing, and the front end of such cylinder is closed by a round plate 20 slidingly mounted on a plurality of threaded studs 19, 19 extended through holes in the plate, the inner ends of such studs occupying channels of the corrugated cylinder and welded to the walls thereof, the protruding portions of such studs having washers 21 and nuts 22 with coiled springs 23 interposed between the washers and the outer face of the plate, whereby, if an explosion or undue pressure should occur within the cylinder, it will be automatically released by the outward movement of the plate, which will return to closed position as soon as the excess pressure terminates, such plate really constituting a self-closing or automatic valve of substantial size.

The rear end of cylinder 15 is formed with a plate 24, having a central aperture or port 25 through which connects the interior of the cylinder with the horizontal branch 26 of an upright flue 27, extended through the outer shell 12, for the escape of the gases of combustion, the lower end of such passage being closed by a trap door or hinged valve 28.

As is clearly shown, the front end of the space between the outer surface of the corrugated cylinder 15 and the inner surface of the housing 12 is closed or sealed by the plate or ring 16, which is properly shaped to fit the external, wavy contour of the cylinder, but the rear end of the housing 12 is open for the admission of the air to be heated, which is supplied by a blower or pump, not shown.

The front end of the annular space referred to between the elements 15 and 12 is joined to a hot-air exit or discharge flue 29 which is connected to the enlargement 13 for the ready delivery of the heated air, which has a single passage only along the outer surface of the

corrugated cylinder from its admission port or opening to its discharge passage, as will be readily understood from a consideration of Fig. 2 of the drawing.

The heater includes also a nozzle or burner 31 in front of a central aperture 32 in the plate 20, which is in register with a passage 33 through a fire-clay or other suitable firing-block 30 located just inside of the end plate 20, such nozzle or burner being desirably slightly upwardly directed.

Cylinder 15 also houses a refractory combustion-chamber 34, of irregular cross-section, mounted on longitudinal angle-bars 35, 35 carried by suitable supports 36, 36, the firing-block specified being also carried on the front end portions of such angle-bars.

The front, open mouth of the combustion-chamber is spaced away from the firing-block as depicted, whereby to permit the escape at that point from the chamber of the greater portion of the combustion gases after they have traversed the length of the chamber and returned to such entrance.

A refractory block 37 closes the rear end of the combustion-chamber, and it has the central aperture or port 38 therethrough for the discharge or delivery of a small part only of the gases of combustion from the chamber, whereby to prevent the presence of a gas pocket at the back or inner part of such chamber, thus assuring its uniform and complete heating throughout its length.

All of the walls of the combustion-chamber are preferably made of carborundum, which at present, is the best refractory material known to perform the desired functions, although other materials may be used to less advantage.

The carborundum possesses the property of transmitting heat very rapidly, and most of the heat of combustion is transferred to the corrugated-metal cylinder and the air flowing over it as radiant heat from the walls of such combustion-chamber.

As is shown, the combustion-chamber is shorter than its encasing, metal, hollow-ribbed cylinder or shell 15, and the latter, to the rear of and spaced from the chamber-member, accommodates a sheet-metal, cylindrical baffle-member 41 closed at its end 42 adjacent to the chamber-member, the cylindrical, outer face of the element 41 being equipped with a plurality of spirally-disposed ribs 43, 43 which project at one end beyond the member 41 to the end wall 24 of the corrugated cylinder, the outer edges of such fins bearing against the inner walls of the corrugations of the surrounding cylinder, and in this way supporting the member 41 in the position specified.

Thus the hot gases of combustion, which must necessarily flow past the baffle-member, are, by contact with the spiral fins, given a swirling or centrifugal action by reason of the curved arrangement of the fins or ribs, hence more or less forcibly carrying such gases into the corrugations and against the inner, metal face of the cylinder.

The operation of the heater or furnace occurs practically as follows:—

The flame, or combustion gases from the burner, is projected or extends into the upper portion of the combustion-chamber, and the gaseous products of combustion flow to the inner or far end of the chamber, where a small portion only of them escapes through the opening 38, the major portion of such hot gases, however, being compelled to reverse and flow out the open, front end of the chamber and through the space between the outer surface of the chamber-member and the inner, grooved surface of the corrugated cylinder.

All of the hot gases from both exits of the chamber are compelled to flow over or around the baffle-member, and, by their centrifugal action, are thrust into and travel along the grooves or channels of the inner face of the cylinder 15, finally flowing through the port 25, passage 26 and discharge flue 27.

The burning of the fuel in the chamber heats the walls of the latter to incandescence, and the greater portion of the heat developed is transmitted directly as radiant heat to the corrugated member, the hot gases also in direct contact with such member carrying some of the heat thereto.

The air to be heated, forced through the appliance, makes a single, direct pass along the outside of the corrugated member, and it is effectively and efficiently heated thereby.

It is known that to abstract the heat from a metal body by a current of air flowing thereover, the higher the velocity of travel of such air the greater will be the heat removal or transfer.

Consequently, in the present improved heater, by having one direct pass only of the air over and around the metal cylinder or shell, with no reversals, which would cause a substantial loss in static head, I am able to use much higher air velocities than are employed in present-day, air heaters, with the natural resultant improvement in the efficiency of operation of the apparatus.

It is to be noted that by corrugating the metal of the heating cylinder or shell a substantial body of metal is provided to absorb the radiant heat transmitted from the hot walls of the combustion-chamber, and such form and style of heat-transferring, metal shell affords a large surface for contact with the escaping gases, as well as a corresponding surface for direct association with the current of air undergoing treatment.

The corrugated form of the metal cylinder is also useful because of the amount of metal therein to absorb the heat of the combustion-chamber in case the supply of air passing over

the outside of the cylinder, normally at a high velocity, is stopped.

Under these circumstances, there would be nothing to carry away the heat, and, although the fuel supply were immediately terminated, the heat stored in the walls of the combustion-chamber might otherwise overheat the cylinder and cause it to sag or even to melt.

Those acquainted with this art will readily understand that this invention is not limited and restricted to the precise and exact details of structure presented, and that these may be modified within comparatively wide limits without departure from the heart and essence of the invention, and without the sacrifice of any of its substantial or material benefits and advantages.

I claim:

1. In a heater, the combination of an outer housing, a metal shell inside of said housing affording an air passage between them, a combustion-chamber member inside of and spaced away from said shell and having an opening at one end, means to project combustion gases into said chamber, through said opening, said chamber being constructed to cause the greater portion of such gases to leave said chamber through the same opening through which they enter it, and means to cause such discharged gases to flow through the space between said chamber and shell, whereby the air traversing said air passage is heated by said shell, the latter being heated by the radiant heat of said chamber-member and by the hot gases flowing in contact with the shell.

2. In a heater, the combination of an outer housing, a longitudinally-corrugated metal shell inside of said housing affording an air passage between them, a combustion-chamber member inside of and spaced away from said shell and having an opening at one end, means to project combustion gases into said chamber, through said opening, said chamber being constructed to cause the greater portion of such gases to leave said chamber through the same opening through which they enter it, and means to cause such discharged gases to flow through the space between said chamber and shell, whereby the air traversing said air passage is heated by said shell, the latter being heated by the radiant heat of said chamber-member and by the hot gases flowing in contact with the shell.

3. In a heater, the combination of an outer housing, a metal shell inside of said housing affording an air passage between them, a carborundum combustion-chamber member inside of and spaced away from said shell and having an opening at one end, means to project combustion gases into said chamber, through said opening, said chamber being constructed to cause the greater portion of such gases to leave said chamber through the same opening through which they enter it, and means to cause such discharged gases to flow through the space between said chamber and shell, whereby the air traversing said air passage is heated by said shell, the latter being heated by the radiant heat of said chamber-member and by the hot gases flowing in contact with the shell.

4. In a heater, the combination of an outer housing, a longitudinally-corrugated metal shell inside of said housing affording an air passage between them, a carborundum combustion-chamber member inside of and spaced away from said shell and having an opening at one end, means to project combustion gases into said chamber through said opening, the chamber being constructed to cause the greater portion of such gases to leave it through the same opening through which they enter it, and means to cause such discharged gases to flow through the space between said chamber-member and shell, whereby air traversing said air passage is heated by said shell, the latter being heated by the radiant heat of said chamber-member and by the hot gases flowing in contact with the shell.

5. In a heater, the combination of an outer housing, a metal shell inside of said housing affording an air passage between them, a combustion-chamber member inside of and spaced away from said shell and having an admission opening near one end and a small discharge opening near its other end, means to project combustion gases into said chamber-member through said admission opening, the greater portion of such gases leaving said chamber through said admission opening, and means to cause such discharged gases to flow through the space between said chamber-member and shell, whereby air traversing said air passage is heated by said shell, the latter being heated by the radiant heat of said chamber-member and by the hot gases flowing in contact with the shell.

6. In a heater, the combination of an outer housing, a metal shell inside of said housing according an air passage between them, a combustion-chamber member inside of and spaced away from said shell and having an admission opening near one end and a smaller discharge opening near its other end of such size as to obtain substantially uniform heating of the chamber-wall throughout its length, means to project combustion gases into said chamber through said admission opening, the greater portion of such gases leaving said chamber through said admission opening, and means to cause such discharged gases to flow through the space between said chamber-member and shell, whereby air traversing said air passage is heated by said shell, the latter being heated by the radiant heat of said chamber-mem-

ber and by the hot gases flowing in contact with the shell.

7. The combination of an outer housing, a longitudinally-corrugated metal shell inside of said housing affording an air passage between them, a carborundum combustion-chamber member inside of and spaced away from said shell and having an admission opening near one end and a smaller discharge opening near its other end of such size as to obtain substantially uniform heating of the chamber-wall throughout its length, means to project combustion gases into said chamber-member through said admission opening, the greater portion of such gases leaving said chamber through said admission opening, and means to cause such discharged gases to flow through the space between said chamber-member and shell, whereby air traversing said air passage is heated by said shell, the latter being heated by the radiant heat of said chamber-member and by the hot gases flowing in contact with the shell.

8. In a heater, the combination of an outer housing, a longitudinally-corrugated metal shell in said housing providing a single, straight-direction air passage between them, a refractory combustion-chamber member inside of and spaced away from said shell, affording a combustion gas passage between said chamber member and said shell, means to cause at least a portion of said combustion gases to traverse said combustion gas passage, means to supply combustion gases inside of said chamber-member, and means permitting the discharge of such gases from the apparatus.

9. In a heater, the combination of a refractory combustion-chamber member having an opening, means to project combustion gases into said chamber, the chamber being constructed to compel the greater portion of said gases to find exit through said opening, and means permitting the discharge of such gases from the apparatus.

10. In a heater, the combination of a refractory combustion-chamber member having an admission opening and a smaller discharge opening remote therefrom, means to project combustion gases into said chamber, the greater portion of such gases finding exit through said admission opening, said discharge opening being of such size as to permit such a quantity of said combustion gases to be delivered therethrough as to maintain the walls of said chamber substantially uniformly heated, and means permitting the discharge of said gases from the apparatus.

11. In a heater, the combination of an outer housing, a longitudinally corrugated metal shell inside of said housing affording an air passage between them, a combustion-chamber member inside of and spaced away from said shell, means to project combustion gases into said chamber, a baffle-member in said shell around which the combustion gases pass, and spiral ribs on the outside of said baffle-member and reaching substantially to said shell, whereby the gases passing said baffle-member encounter said ribs and are thereby given a swirling motion projecting them into the corrugation channels on the inside of said shell.

In witness whereof I have hereunto set my hand.

HERBERT J. SAUVAGE.