

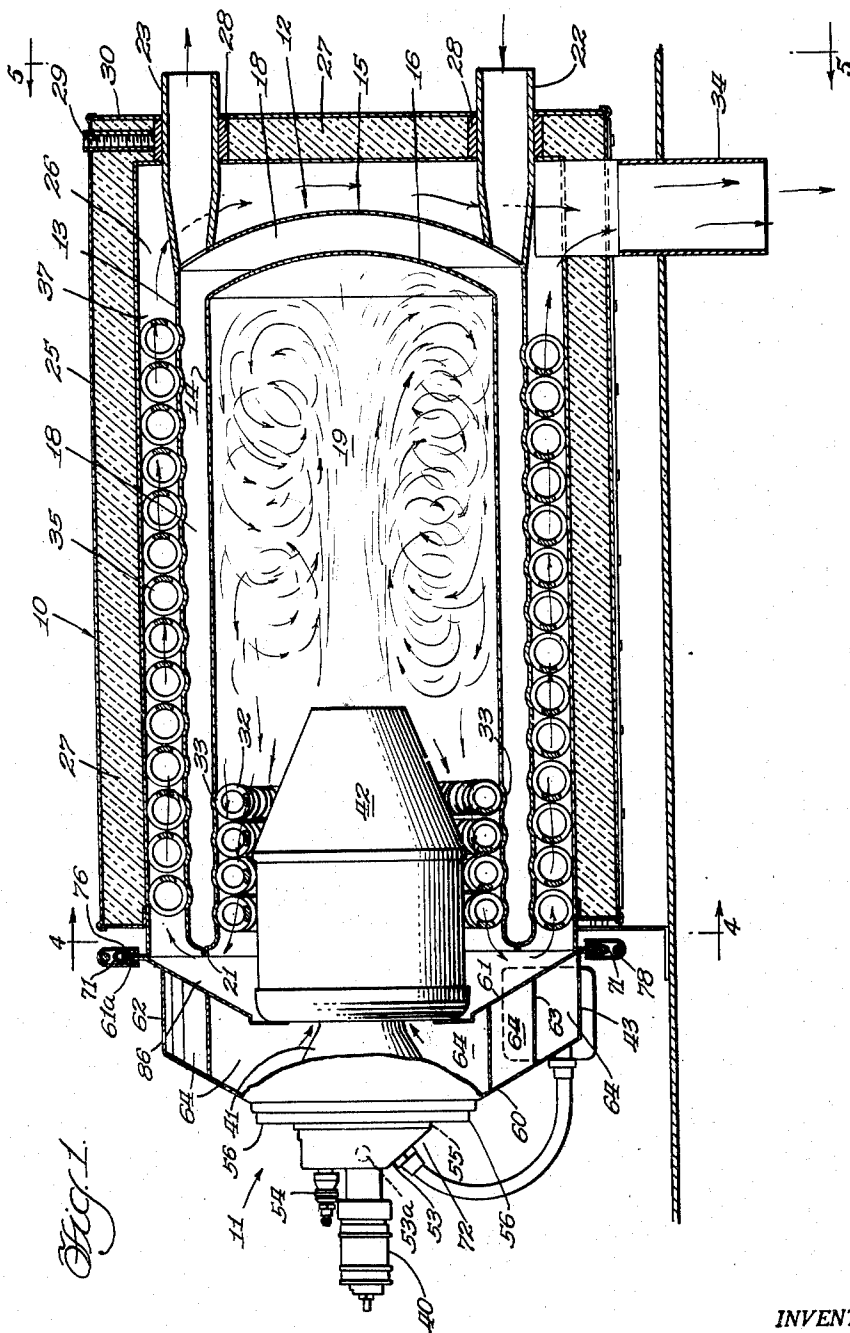
April 13, 1954

A. CLARKSON
HEAT GENERATOR

2,674,981

Filed April 28, 1948

3 Sheets-Sheet 1



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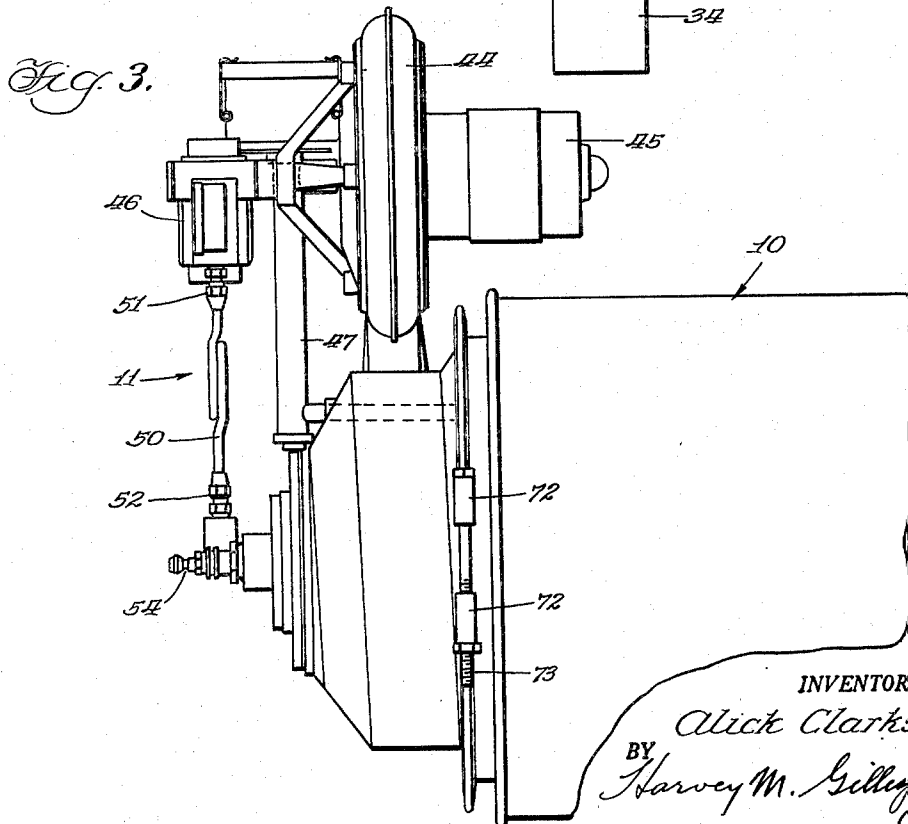
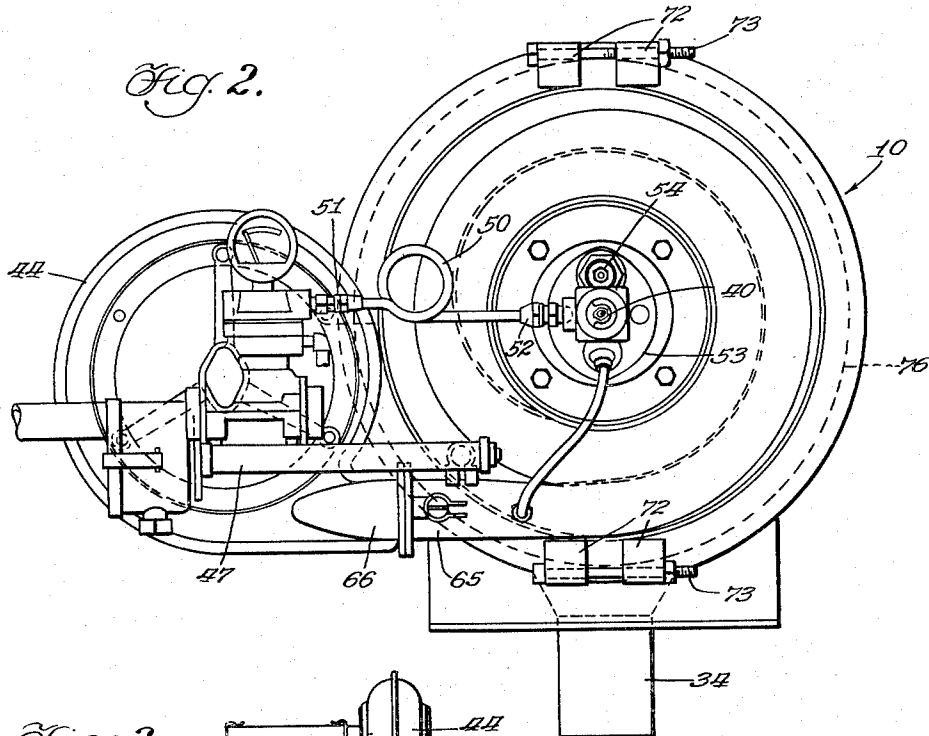
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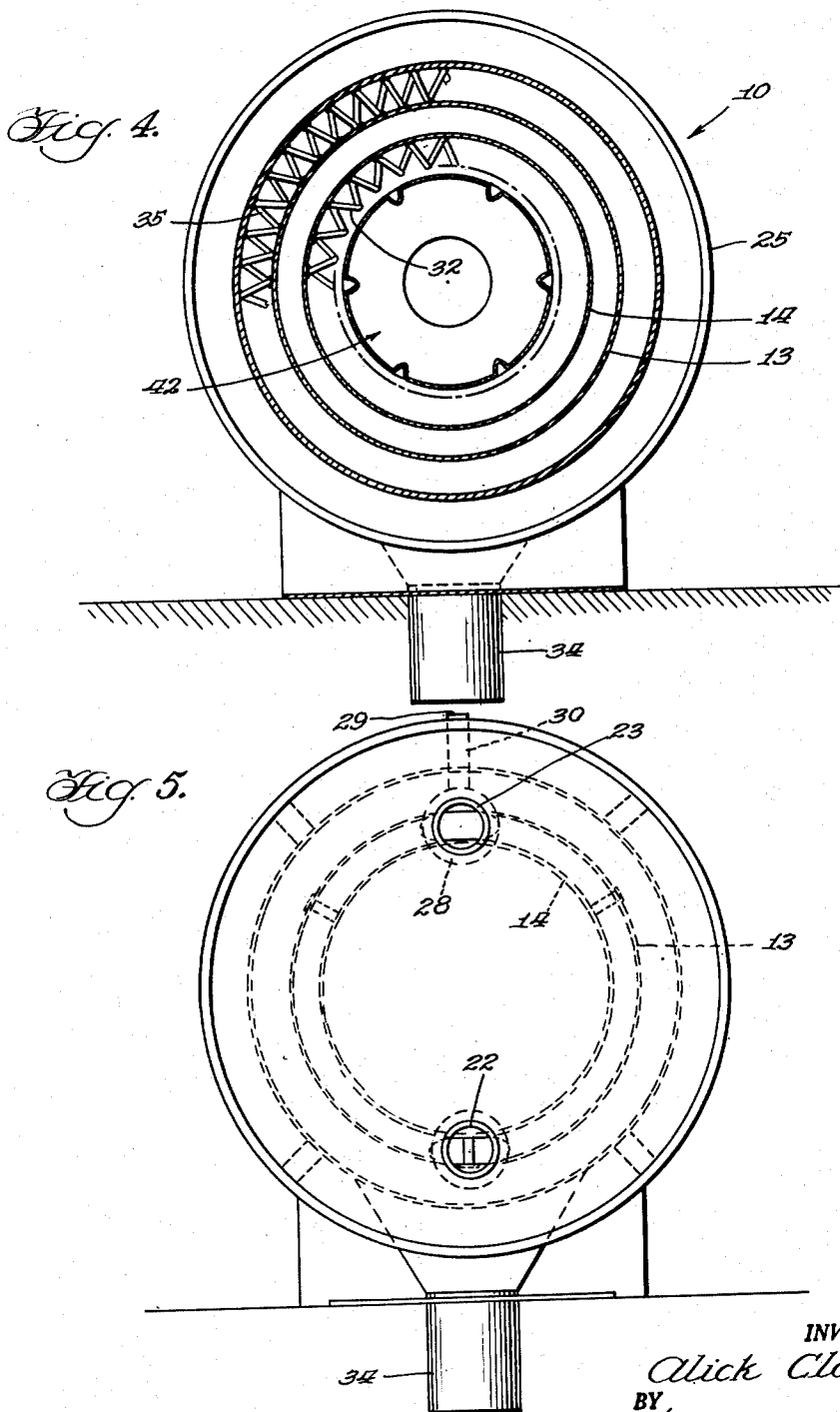
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UNITED STATES PATENT OFFICE

2,674,981

HEAT GENERATOR

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Application April 28, 1948, Serial No. 23,728

10 Claims. (Cl. 122—136)

1

This invention relates to improvements in heat generators suitable for heating water and/or generating steam for heating systems and for other uses.

A principal object of the invention is to provide an improved Heat Generator of the above general character which is so constructed as to achieve:

1. A high degree of thermal efficiency to insure operating economy at both high and low fire operation.

2. A high degree of compactness, to meet the limitations of space for heaters in many situations, for example, in motor driven buses and in portable heating and power equipment.

3. Maximum adaptability to quick servicing of the boiler and fuel burning equipment.

4. High turbulence in the combustion chamber so as to insure complete combustion of relatively large quantities of liquid and gaseous fluids in a relatively small combustion space and at the same time minimizes the combustion noise by maintaining the supply of high velocity combustion air substantially constant.

The first feature of this invention resides in improved means for facilitating exchange of heat, comprising heat-exchanger fins in the form of metal helices metallically bonded to portions of the inner and outer shells of the boiler. In the embodiment of the invention described in this specification, the metal helices are attached to the cylindrical surfaces of the inner and outer shells of a boiler by means of spot welds and thereafter galvanizing the helices and the surfaces of the shells. The galvanized coating provides a good metallic bond and results in depositing enough metal along the areas of contact between the helices and the boiler shells to insure efficient heat conduction from the helices into the metal of the boiler shells. The helices are so applied to the boiler that they effectively intercept the stream of hot gases of combustion without unduly obstructing the draft. This is accomplished in the present instance by laying the helices circumferentially of the boiler shell; and for the purpose of improving the metallic bond I prefer to corrugate the boiler shell to form peripheral grooves in which the helices are seated. These grooves also facilitate deposition of a heavy coating of bonding metal at the contact areas. This feature has proved highly effective as a heat-exchange provision and is one which can advantageously be employed not only in water boiler construction but in analogous situations where efficient heat exchange provisions are required.

2

The second feature of the invention resides in a boiler construction which is compact and therefore particularly suited for use in situations where space for heating equipment is limited. The boiler preferably consists of concentric inner and outer shells telescoped together and each closed at one end and welded or otherwise suitably secured together at their other ends. This construction provides a combustion chamber of the re-entrant type, since it is entirely closed, except at the end into which an oil burner protrudes. This construction, therefore, is highly advantageous because high turbulence can be maintained in the fire chamber to insure complete combustion.

This construction presents a third feature in that the apparatus as a whole can be readily dismantled for repair of the burner or for cleaning the interior of the water jacket. For example, the welded joint of the inner and outer shells can be readily opened by means of a cutting torch and thereafter rewelded together after cleaning. In some situations this joint may be bolted or riveted. The burner, including the blower, fuel pump and associated parts, constitutes a single unit which can be quickly removed and replaced. Also the burner nozzle, the spiral conduit and fire-pot constitute a sub-unit. The spiral conduit is flanged to match a flange on the boiler unit and is detachably clamped thereto; and the nozzle and fire-pot are, in turn, bolted to opposite sides of the spiral conduit. This arrangement makes for extreme compactness of design and greatly facilitates taking the sub-unit apart and re-assembling the same.

The fourth feature of the invention has to do with reduction or elimination of burner roar, and, at the same time, the maintenance of a steady flame, which is less apt to become extinguished inadvertently than one which burns with pulsating irregularities. I have found that a major part of the burner roar which is characteristic of oil burners generally is due to undulations of the air supply occurring at an audible rate and arising from the fact that the centrifugal type blowers employed do not produce an air discharge of the desired constant velocity and pressure. A blower of that type is relatively highly efficient and well suited for generating the required pressure, but the air delivered is not of constant velocity and pressure. Consequently the combustion takes place in the form of pulsating impulses. I have been able successfully to cope with this problem and thus substantially to suppress burner roar, without resorting to a less efficient type blower, by inter-

posing between the blower and the burner, a relatively long column of air. The long column of high velocity air serves as an equalizer to smooth out the pressure undulations, so that the pressure at the burner end is devoid of audible variation. By forming the air duct of spiral configuration, I am able to incorporate the long air column principle in a heating unit of the small size. The manner in which the spiral conduit is combined with the burner to form an exceedingly compact unit constitutes an important part of my inventive concept.

Additional objects and novel features of this invention will become apparent as the ensuing detailed description progresses.

The accompanying drawings illustrate, by way of example, an oil-burning water heater embodying the several above-enumerated novel features.

In the drawings:

Fig. 1 is a partial vertical section taken along the axis of a horizontal boiler and associated oil-burner unit;

Fig. 2 is a front elevation of the heater unit;

Fig. 3 is a plan view of the heater unit;

Fig. 4 is a transverse section at line 4-4 of Fig. 1; and

Fig. 5 is a rear elevation as viewed from line 5-5 of Fig. 1.

The heater unit, as above defined, comprises a boiler unit 10 and a burner unit 11. In this instance the latter is an oil-burning unit; but the invention is not limited in that respect.

The boiler unit

The boiler unit 10 comprises a boiler, per se, identified by numeral 12 and consisting of an outer shell or wall element 13 and an inner shell or wall element 14. The two wall elements or shells are concentric and each closed at one end by header plates 15 and 16, respectively. The said shells are spaced to form a water jacket 18, which surrounds the inner shell 14 and also includes the space between the header plates 15 and 16. The interior cavity 19 of shell 14 constitutes the combustion chamber; the end of said inner shell remote from the header plate 16 being left open to receive a portion of the burner unit, and is bent outwardly to form a junction with the adjacent end of the outer shell 13. The said adjoining ends are herein shown as welded together all around, as indicated at 21, but in some instances this joint may be secured by bolts or rivets. Conduits 22 and 23 are connected with openings in the bottom and top of outer shell 13 and serve as water intake and discharge fittings, respectively. These are adapted to be connected to the hot water distribution piping, and they function at the same time as means for securing the boiler within an outer housing of the boiler unit, so that it can readily be withdrawn for cleaning and other servicing operations.

The outer housing of the boiler unit is identified by reference numeral 25 and consists of a suitable sheet metal structure having a cylindrical chamber 26 designed to receive the boiler, and lagged on all sides, except the front, with suitable thermal insulation 27. As an alternative, the insulation 27 may be omitted and the outer casing formed into an additional water jacket connected to the inner water jacket 18.

The conduits or fittings 22 and 23 extend through tubular bushings 28 which are disposed between and secured to the inner and outer plates of the back wall of the housing 25, and are firm-

ly but detachably secured to said bushings by means of clamping screws 29, which are threaded into tubular lugs 30 welded to bushings 28 and projecting radially so as to be accessible from the peripheral surface of the housing.

When the clamping screws 29 are loosened and the hot water piping disconnected from fittings 22 and 23, the boiler can be withdrawn from the housing 25 through the open front end thereof.

Attached to the internal wall surface of inner shell 14 are shown a plurality of helices 32, preferably four, each of which encompasses the entire internal circumference of said inner shell, and each is seated in an annular groove 33 formed in the inner shell. Said grooves serve to appropriately space the helices 32 laterally and they also function to increase the area of contact between the shell and the helices. The purpose of helices 32 is to expedite transfer of heat into and through inner shell 14 to the water in the water jacket 18. In order to do so efficiently they are formed to expose large area to the hot gases of combustion and have adequate cross-sectional area to conduct the heat rapidly. Their contact with the boiler shell is such as will expedite transfer of heat into the metal of the shell, permit free expansion and contraction of the several parts and at the same time do not unduly obstruct the gaseous products of combustion on their way to the exhaust conduit 34.

The helices 32 are made of iron or steel with widely spaced convolutions, as shown in Fig. 4, to permit passage of the products of combustion. They are welded to the inner shell and further metallically bonded thereto by means of a galvanized coating of sufficient thickness to provide a heavy deposit of metal in the crevices formed by the helices and the adjoining boiler shell and thus provides highly efficient paths through which heat is transferred by conduction from the helices into the boiler shell.

Additional helices 35, of the same kind as the helices 32 above described, are secured in the same way to the outer surface of outer shell 13, and similarly bonded metallically to said outer shell. Helices 35 are disposed in an annular passageway 37 between the outer shell 13 and the housing 25, through which passageway the products of combustion pass on their way to the exhaust conduit 34.

The burner unit

The major components of the burner unit 11 are: a burner nozzle 40; a nozzle housing 41; a fire pot 42; a spiral conduit 43; a blower 44 driven by an electric motor 45; a fuel pump 46 driven by the same motor; and an "outfire" control 47. The internal constructions of the nozzle housing 41 and the fire pot 42 are not important insofar as the present invention is concerned except as a part of the means for delivering a mixture of fuel and air into the fire chamber 19 of the boiler in the form of a central shaft or jet and with sufficient force to carry the flame and partially ignited mixture to the closed end of the fire chamber. The flame and hot gases then assume a vertical rolling movement rearwardly along the walls of the combustion chamber 19 and pass out through the open end thereof into the outlet passageway containing the heat absorbing and conducting helices. The said nozzle 40, the nozzle housing 41 and the fire pot 42 are disclosed and claimed in a copending divisional application Serial No. 364,842, filed June 29, 1953. Also the specific constructions of the "out fire" control 47

has been divided out of the present application and is disclosed and claimed in U. S. Letters Patent No. 2,609,867, dated September 9, 1952.

Nozzle 40 is connected to fuel pump 46 through a length of tubing 50 and couplings 51 and 52, and is supported by a casting 53. It extends through a central opening in the casting and is secured therein by a set screw 53a. Said casting 53 is drilled and threaded to accommodate a spark plug 54, and it is secured to a disc-like sheet metal member 55 having a peripheral flange 56 through which it is removably secured to the spiral conduit structure 43. The spark plug 54 functions to ignite the gaseous mixture as it enters the fire pot 42.

The nozzle housing 41 is made of sheet metal and encircles the discharge end portion of the nozzle and serves to direct the incoming air blast into the fire pot 42. The spiral conduit 43 is made of sheet metal and comprises a housing consisting of a front plate 60, a rear plate 61, and a peripheral plate 62 interconnecting said front and rear plates. Within said housing is a spirally formed plate or strip 63 which cooperates with the housing to define a spiral passageway 64 which is connected at the outer end of a flanged intake fitting 65 (see Fig. 2). The fitting 65 is bolted to the discharge fitting 66 of the blower 64.

The rear plate 61 of the spiral conduit housing extends radially beyond plate 62 to form a peripheral flange 61a which normally is held tightly against a complementary flange 76, forming a part of the structure of housing 25, by means of two approximately semi-circular clamping members 71 of V-shaped cross-section, which serve to grip the two flanges together when forced against them edgewise. The two clamping members 71—71 are each provided at their ends with lugs 72 (see Fig. 3) arranged in pairs and designed for engagement by tension bolts 73. Said tension bolts operate to pull the V-shaped clamping members 71 into tight pinching engagement with flanges 61a and 76. Clamping members 71, together with bolts 73, function as the sole medium by which the burner unit is attached to boiler housing 25; and the entire weight of the burner unit is borne by said housing and transmitted thereto through said clamping members.

I claim:

1. A heat generator comprising an outer casing having an inner wall structure, a boiler positioned in said outer casing but spaced from the inner wall structure thereof and cooperating therewith to define an annular space surrounding the boiler and providing an outlet passageway for hot gases of combustion, the boiler comprising inner and outer wall elements which conjointly define a water jacket and the inner wall element defines a combustion chamber closed along its sides and at one end, but open at the other end to receive a combustible mixture and to discharge the hot gases of combustion, means defining a passageway leading from said open end of the combustion chamber into said annular space between the boiler and the outer casing, and separately formed heat conducting fins metalically bonded to the outer surface of the boiler and extending into said annular space between the boiler and the outer casing to increase the heat absorbing area of the boiler.

2. A heat generator according to claim 1 characterized in that the heat conducting fins are in the form of a plurality of metallic bands encircling the outer surface of the boiler and engaging the inner wall structure of said outer casing to

maintain the boiler and casing in their spaced relationship.

3. A heat generator according to claim 2 characterized in that heat absorbing fins in the form of metallic bands are also metalically bonded to a portion of the inner surface of the inner wall element of the boiler.

4. A heat generator according to claim 3 characterized in that each of the said metallic bands comprise an expanded helix.

5. A heat generator as defined in claim 4 characterized in that the inner and outer wall elements of the boiler are circumferentially corrugated and each expanded helix is seated in a corrugation and bonded to one of said wall elements of the boiler.

6. A heat generator comprising an outer casing having an inner wall structure and a boiler positioned in said outer casing but spaced from the inner wall structure thereof and cooperating therewith to define an annular passage between the boiler and the outer casing for the discharge of gases of combustion, the boiler comprising spaced apart inner and outer wall elements which conjointly define a water jacket and the inner wall element defines a combustion chamber closed along its sides and at one end but open at its other end to receive a combustible mixture and to discharge hot gases of combustion, means for delivering fuel and air under pressure into the said open end of the combustion chamber, whereby portions of the fuel and gases of combustion are projected in the form of a jet through the gaseous body within the combustion chamber to the closed end thereof, a closure plate for closing one end of said outer casing, the said plate being positioned in spaced relation to the open end of the combustion chamber and cooperating therewith to define a passageway leading from said open end of the combustion chamber into the said annular passage between the boiler and said outer casing.

7. A heat generator as defined in claim 6 characterized in that means are provided for delivering air into the combustion chamber at a high velocity comprising a blower and a relatively long conduit connecting the blower with the combustion chamber, whereby the kinetic energy of the long column of air functions to equalize the undulations of the air supplied.

8. A heat generator as defined in claim 7 characterized in that the relatively long conduit for delivering air into the combustion chamber is in the form of a spiral, one face of which is defined by said closure plate, whereby the combustion air is heated by contact with said closure plate.

9. A heat generator as defined in claim 6 characterized in that the inner and outer wall elements are in the form of concentrically arranged shells each closed at one end and secured only at its open end to the open end portion of the other shell, whereby said shells are free to expand and contract with relation to each other at different rates.

10. A heat generator comprising means defining a water jacket an inner portion of which defines a centrally arranged combustion chamber closed along its sides and at one end but open at its other end to receive a combustible mixture and to discharge hot gases of combustion, means for delivering fuel and air under pressure into the said open end of the combustion chamber, whereby portions of the fuel and gases of combustion are projected in the form of a jet

through the gaseous body within the combustion chamber to the closed end thereof, means cooperating with said water jacket to provide a concentric discharge passageway extending lengthwise of said water jacket in heat exchange relation with the water therein, a cover plate extending across the entrance end of said discharge passageway and across the open end of the combustion chamber but spaced therefrom and cooperating therewith to provide a passageway leading from the open end of the combustion chamber to said discharge passageway.

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