Feb. 13, 1968 E. F. FEHR 3,368,531

VAPOR GENERATOR

Filed June 7, 1966

FIG. 1

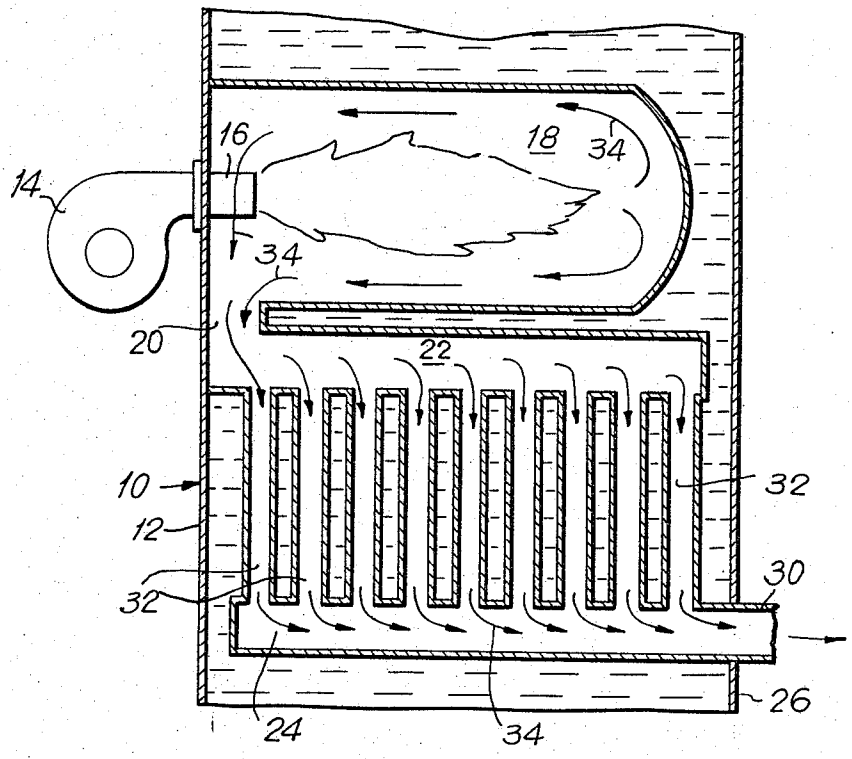
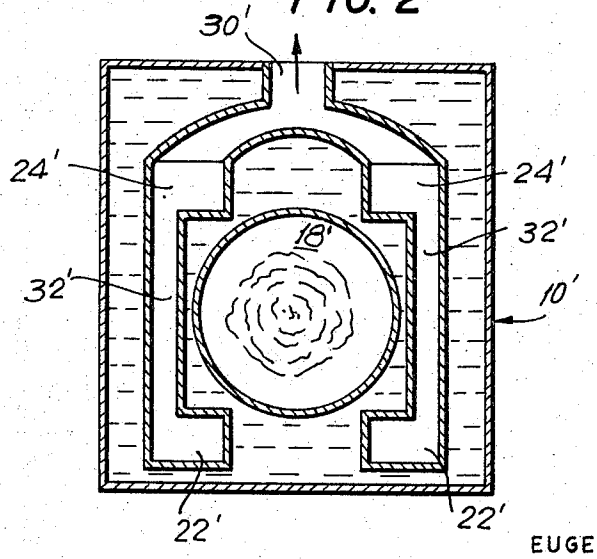


FIG. 2



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VAPOR GENERATOR

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ABSTRACT OF THE DISCLOSURE

A vapor generator is disclosed as having a burner arranged in the forward end of a fire box extending longitudinally of the furnace. A pair of spaced mains extend parallel to the longitudinal direction of the fire box, and the fire box communicates with one of these mains. The two mains are interconnected by a plurality of ducts extending in parallel relation between the two mains. The second of the two mains has an outlet connected to the flue.

In a modification of the invention, there are two input mains connected to the fire box and each input main is connected by a plurality of parallel ducts to a respective output main, the two output mains being connected to the flue.

This invention relates in general to the construction of vapor generators, and in particular to a new and useful vapor generator having a plurality of heating gas passages arranged so that the total length of gas flow is substantially the same for each gas passage.

In oil-fired boilers or vapor generators, and particularly in respect to cast iron sectional boilers, the flue are arranged such that the rearmost sections carry the largest amount of the flue gas, simply because, after burning, the gases pass through the rearmost section on the shortest path up through the chimney. As a consequence, the velocities of the flue paths are highest at the rearmost section at the location which is furthermost from the oil burner head. The flue gases at the rearmost sections also have the highest temperatures and give off the greatest amount of heat to the heating water. The heating surfaces are thus irregularly stressed and the boiler not fully utilized.

The disadvantages of the prior art are eliminated in accordance with the invention by the design of boiler in which the gases which are formed in the fire box are directed backwardly through a gas passage adjacent the burner head to a collecting main. Thereafter, the gases are distributed along the collecting main through one of a plurality of interconnecting passages to a second collecting main. The collecting main are arranged substantially parallel to the axis of the fire box, whereas the interconnecting passages extend substantially at right angles thereto. Gas which flows into the first collecting main will be distributed between one of a multiplicity of the cross passages into the second collecting main which is coextensive with the first. The discharge of the second collecting main is to a chimney connection at its outermost end so that, regardles of which interconnecting or cross passage the gas flows through, it must travel over the same flow distance in order to traverse a portion of the first collecting main, an interconnecting passage and the remaining portion of the second collecting main to travel to the chimney.

Accordingly, it is an object of this invention to provide an improved combustion gas flow passage construction for a vapor generator.

A further object of the invention is to provide a vapor generator having a plurality of gas passages or mains arranged substantially parallel to a fire box with a connecting passage from the fire box to the first gas main which is located adjacent the burner head so that combustion gases which are generated in the fire box must flow backwardly toward the head and into the first gas passage, and which further includes a plurality of interconnecting passages between two spaced mains which are parallel to the fire box, which interconnecting passages extend at a right angle to the fire box axis, and with an additional connection of the last parallel main to the chimney, so that the gas flow will be through a portion of each of the parallel gas paths and through any one of the plurality of interconnecting passages so that the total flow of gas distance, regardless of which interconnecting passage it moves through, from the fire box to the chimney will be the same.

A further object of the invention is to provide a vapor generator which is simple in design, rugged in construction and economical to manufacture.

The various features of novelty which characterize the invention are pointed out with particularity in the claims annexed to and forming a part of this specification. For a better understanding of the invention, its operating advantages and specific objects attained by its use, reference should be had to the accompanying drawings and descriptive matter in which there are illustrated and described preferred embodiments of the invention.

In the drawings:

FIG. 1 is a longitudinal sectional view of a boiler constructed in accordance with the invention;

FIG. 2 is a transverse sectional view of another embodiment of boiler constructed in accordance with the invention.

Referring to the drawings in particular, the invention embodied therein in FIG. 1 includes a boiler, generally designated **10**, having a front wall **12** in which is mounted an oil burner **14**. The oil burner **14** includes a head portion **16** which is located within a substantially cylindrical fire box **18**. The major portion of the fire box **18** is surrounded by the liquid containing portion of the boiler and it includes a connection **20** through which combustion gases which are generated in the fire box **18** may flow into a first gas passage or main **22**, which is elongated in the same direction as the fire box **18**. The second gas path or main **24** is arranged substantially parallel to the longitudinal axis of the main **22** and the fire box **18** and it is connected at the rear end thereof, adjacent the rear wall **26** of the furnace, to a chimney or flue **30**.

In accordance with the invention, a plurality of interconnecting passages **32**, which extend substantially normal to the axes of the mains **22** and **24**, interconnect the two mains and provide separate flow passages for portions of the flue gases therebetween. With such a construction, the gases which are generated in the fire box **18** will be reversed at the rear end of the fire box and flow in the direction of the arrows **34**, first downwardly through the connecting passage **20** and then into the collecting main **22**. The gases may then flow either directly from the connecting main **22** through the first of the passages **32** to the collecting main **24**, or they may flow a considerable distance along the collecting main **22** and eventually through one of the passages **32** to the collecting main **24**. All of the gases which flow to the collecting main **24** are delivered, as indicated by the arrows **34**, out through the chimney **30**. Thus it can be seen that gas which flows first all along the collecting main **22** to the end passage **32** adjacent the rear wall **26**, and hence to the collecting main **24**, will travel just as far as the gas which first enters the through-passages **32** adjacent the front wall **12** and then must flow along the complete length of the collecting main **24**.

In the modified arrangement indicated in FIG. 2, there is provided a boiler **10'** having a fire box **18'** which com-

municates adjacent the front wall (not shown) with two spaced collecting mains 22', 22', which are located below the fire box 18'. A plurality of passages 32' interconnect the lowermost collecting mains 22', 22' with uppermost collecting mains 24', 24'. The two uppermost collecting main 24', 24' are connected to a chimney or flue 30' adjacent the rear wall of the furnace (not shown).

In the embodiment of FIG. 2, the combustion gases must thus first flow from the fire box 18' to one or the other of the lowermost collecting mains 22', 22'. Thereafter, the gases flow up along the pasages 32', 32' into the uppermost collecting mains 24', 24'. The interconnecting passages 32' between each of the mains 22' and 24' are arranged in a manner similar to that indicated in FIG. 1 so that there will be equal distance of gas flow for the flue gases regardless of which one of the connecting passages 32' the gas flows through to the chimney 30'.

In the construction indicated, the collecting mains 22 and 24 may be of cylindrical configuration and provide equal flow area, and the passages 32 which interconnect the mains may also provide for equal flow area therethrough. In this manner, the gas is evenly distributed through the collecting mains and the interconnecting passages in its flow path to the chimney. Thus, a uniform distribution of the flue gases over all of the heating surfaces is achieved. In the preferred arrangement of the invention, the fire box, the collecting mains and the cross passages are all surrounded by liquid to be vaporized, and the walls thereof thus represent separate heating surfaces. A vapor generator constructed in this manner will thus provide uniform distribution of the heating power throughout. The fire box, collecting mains and the interconnecting ducts may be formed of cast iron or may have a welded steel construction. Also, the vapor generator may be designed as a sectional generator formed by a plurality of individual sectional elements arranged in a longitudinal direction from one side of the boiler to the other.

While specific embodiments of the invention have been shown and described in detail to illustrate the application of the inventive principles, it will be understood that the invention may be embodied otherwise without departing from such principles..

What is claimed is:

1. A vapor generator comprising a casing defining a chamber of liquid to be vaporized, a tubular fire box extending into the liquid chamber from one side of said casing, means for directing high temperature gases into said fire box from the one side of said casing, a plurality of collecting mains elongated in substantially the same direction as said fire box and arranged in spaced substantially parallel relationship, a plurality of ducts defining gas flow passages interconnecting adjacent ones of said collecting mains at spaced locations along the length thereof, passage means formed adjacent said one side of said casing defining a high temperature gas passage between said fire box and an adjacent one of said collecting mains for the flow of gases from said fire box into the adjacent one of said collecting means, and a flue

connected to the last one of said collecting mains adjacent the end thereof remote from the said one side of said casing, whereby the gases, after issuing from said fire box, must traverse a part of one of said collecting mains, then through one of said plurality of interconnecting ducts and then must flow the remaining distance of the next adjacent collecting main to said flue so that the total flow path of the gas regardless of which of the interconnecting ducts it may flow through will be the same in each instance.

2. A vapor generator according to claim 1, wherein said collecting mains are arranged substantially parallel to said fire box and said interconnecting ducts extend substantially perpendicular to said collecting main.

3. A vapor generator according to claim 1, wherein said casing, said fire box, said collecting mains and said ducts are made of cast iron.

4. A vapor generator according to claim 1, wherein said generator is designed as a sectional generator formed by a plurality of individual sectional elements arranged in a longitudinal direction from one side of said boiler to the other.

5. A vapor generator according to claim 1, wherein said casing, said fire box, said ducts and said collecting mains are formed of a steel-welded construction.

6. A vapor generator according to claim 1, wherein said plurality of ducts comprises a first duct adjacent said fire box and extending substantially parallel thereto, and a second duct spaced from said first duct and extending substantially parallel to said first duct and said fire box.

7. A vapor generator according to claim 6, wherein said second duct is arranged in said casing at a lower elevation than said first duct.

8. A vapor generator according to claim 1, wherein said plurality of collecting mains includes first and second collecting mains arranged on each side of said fire box and connected adjacent said one side of said casing to said fire box, and third and fourth collecting mains arranged adjacent the upper portion of said fire box, said interconnecting ducts connecting said first and third collecting mains and said second and fourth collecting mains, respectively.

9. A vapor generator according to claim 8, wherein said means for directing high temperature gases into said fire box includes an oil burner and wherein said interconnecting ducts extend substantially vertically in said casing.

10. A vapor generator according to claim 8, wherein said collecting ducts are substantially rectangular tubular elements.

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