March 5, 1935. T. E. MURRAY 1,993,072

BOILER

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Fig. 1

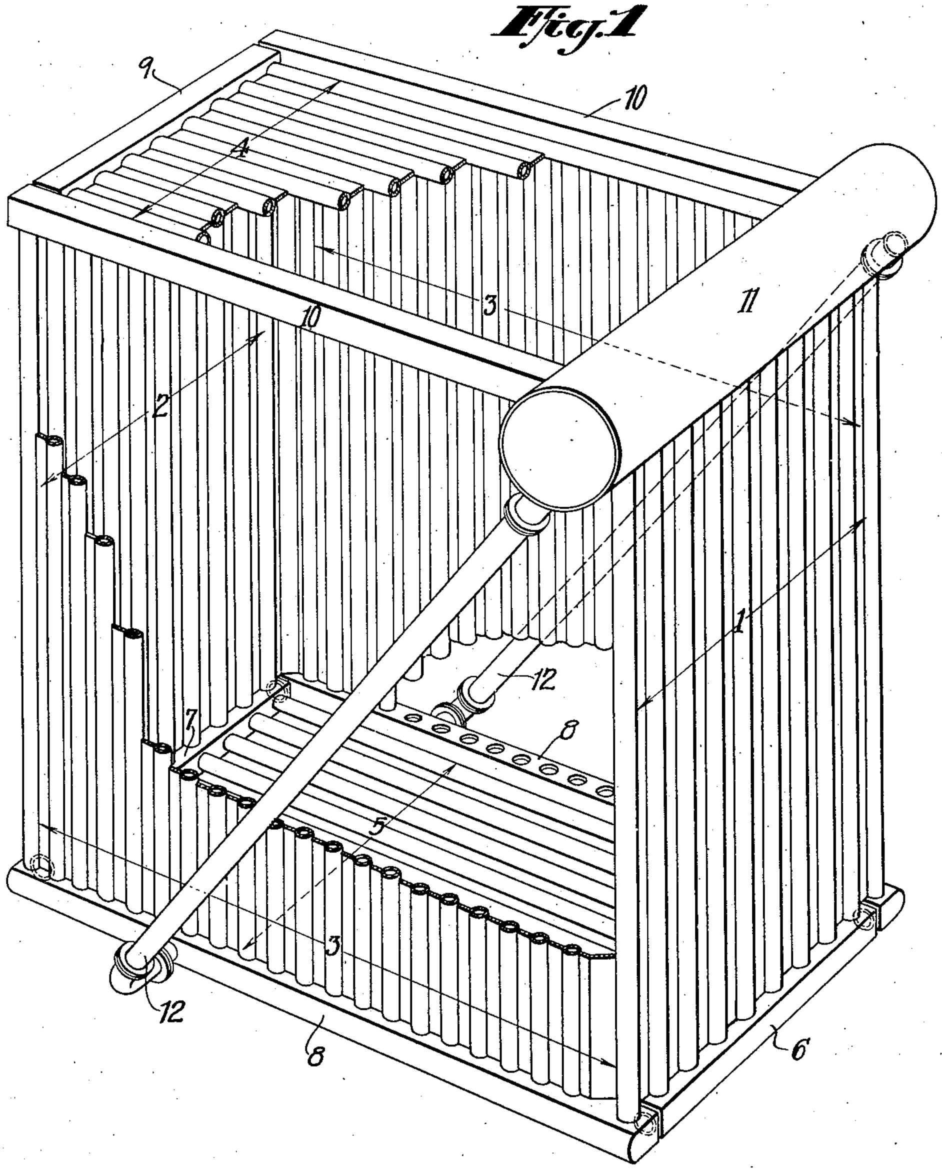

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Fig. 2.

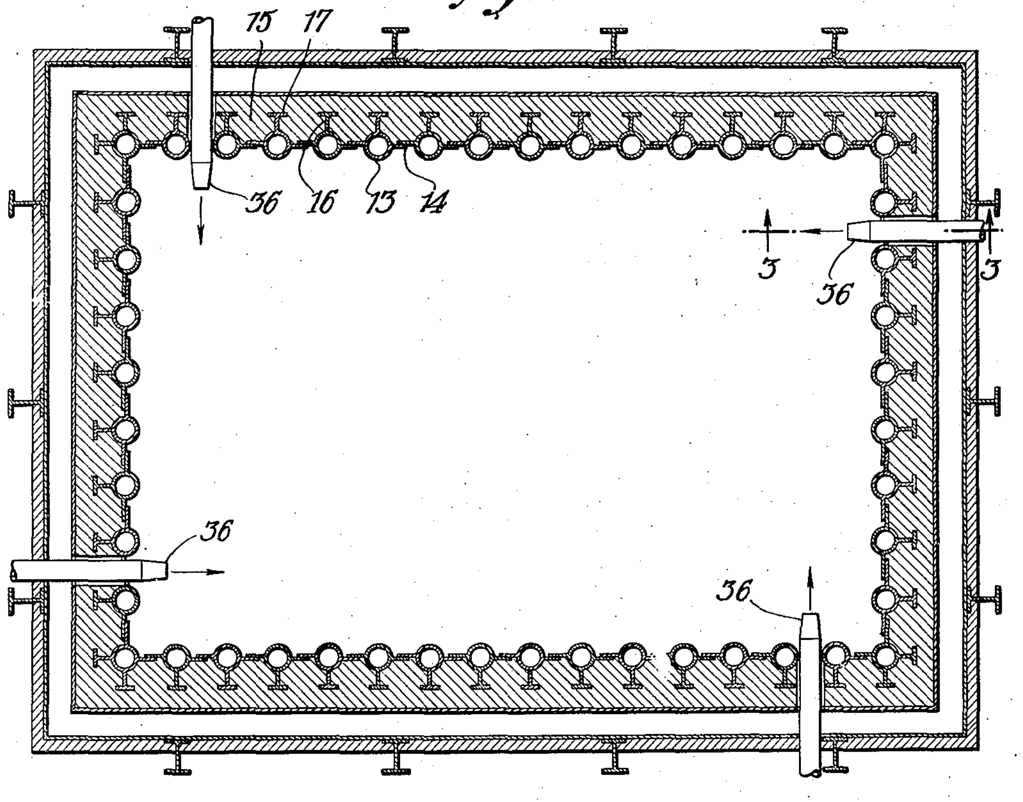

Fig. 3.

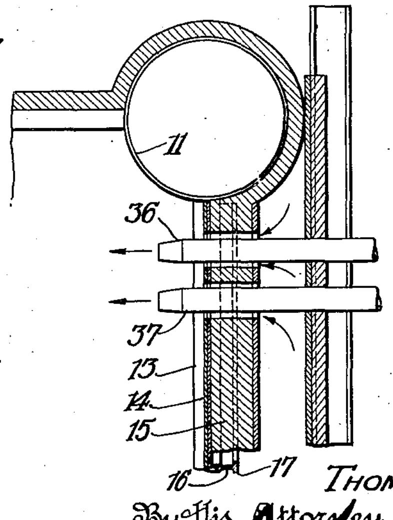

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Fig. 4.

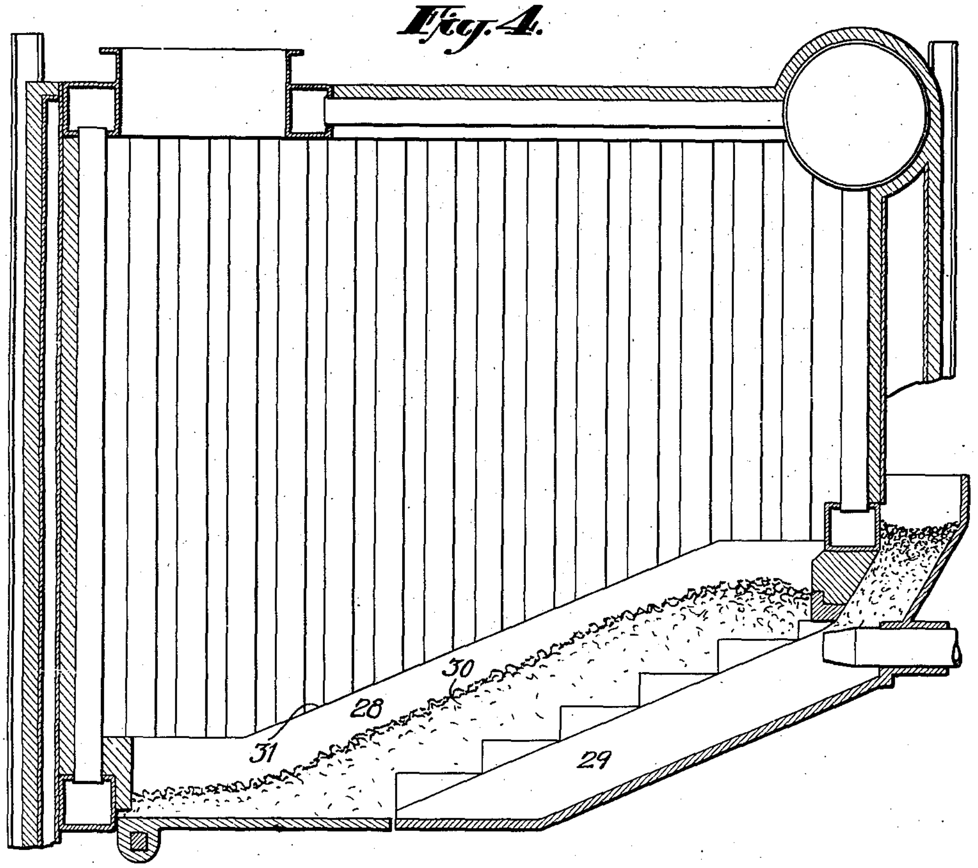

Fig. 5.

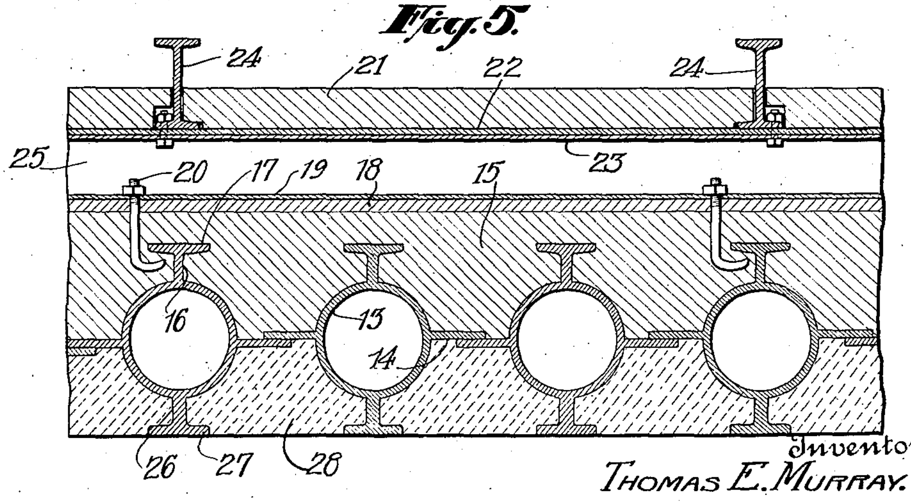

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Fig. 6.

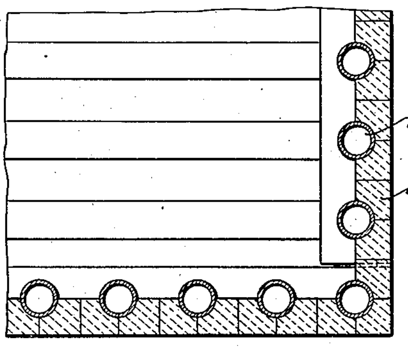

Fig. 7.

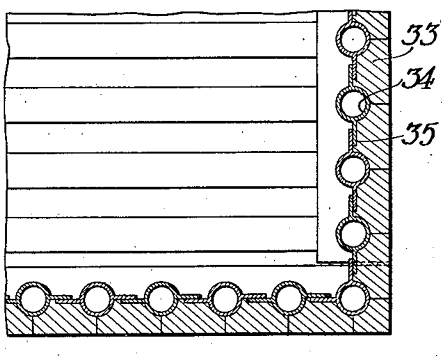

Fig. 8.

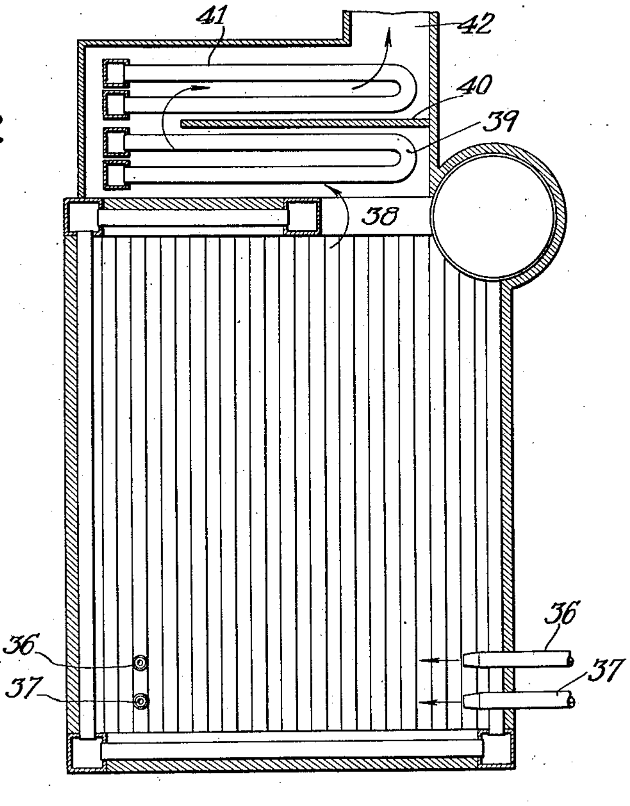

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Fig.10.

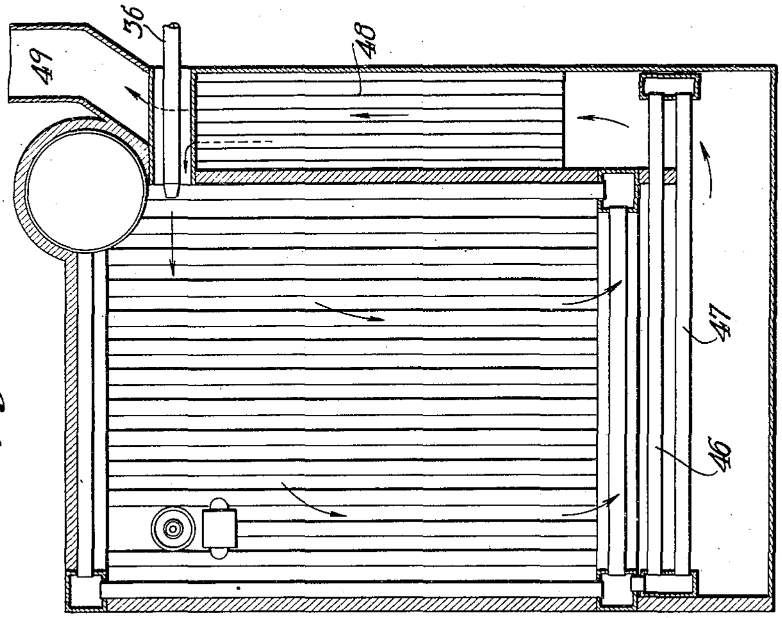
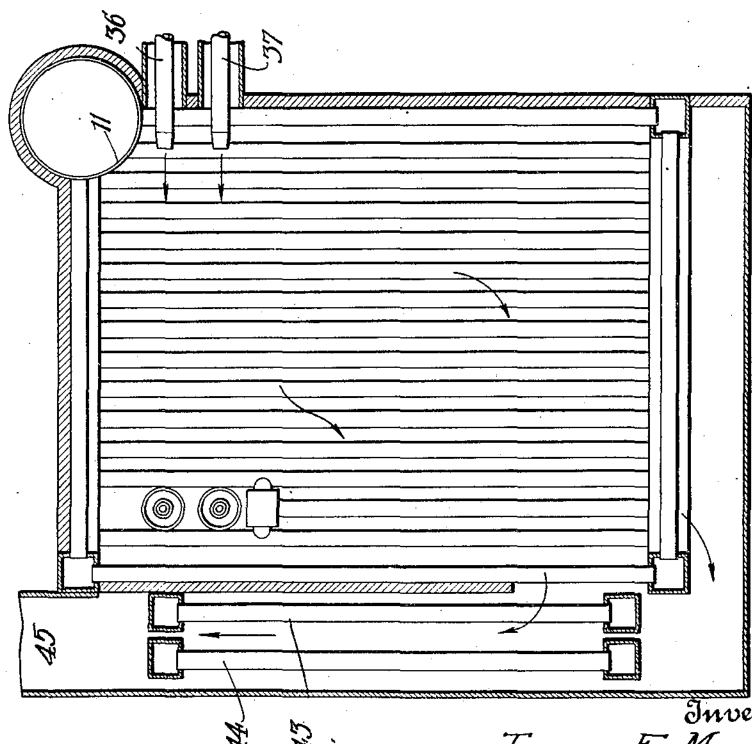


Fig.9.



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Patented Mar. 5, 1935 1,993,072

UNITED STATES PATENT OFFICE

1,993,072

BOILER

Thomas E. Murray, Brooklyn, N. Y.; Joseph Bradley Murray, Thomas E. Murray, Jr., and John F. Murray, executors of said Thomas E. Murray, deceased, assignors to Metropolitan Engineering Company, a corporation of New York

REISSUED DEC 3 - 1940

Application October 9, 1925, Serial No. 61,386

6 Claims. (Cl. 122—235)

In certain previous applications, particularly No. 642,725, patented Feb. 11, 1930, Patent No. 1,746,711, I have described boilers having walls or banks of water tubes exposed to the direct radiant heat of the burning fuel, whereby the rating or production of steam is very much increased as compared with boilers of previous types.

The present invention is directed to a boiler in which this principle is utilized to the fullest possible extent, and is directed to various other features described in detail hereinafter. The accompanying drawings illustrate embodiments of the invention.

Fig. 1 is a perspective view, partly broken away to show the interior, of a system of tubes arranged on the six sides of a rectangular furnace or combustion chamber.

Fig. 2 is a horizontal section showing the tubular walls surrounded by refractory material and a supporting structure.

Fig. 3 is a section on the line 3—3 of Fig. 2.

Fig. 4 is a vertical section of a stoker-fired boiler.

Fig. 5 is a horizontal section of the lower part of one of the boiler walls.

Figs. 6 and 7 are partial horizontal sections illustrating modifications.

Figs. 8, 9 and 10 are vertical sections illustrating different uses of the hot gases passing out of the combustion chamber.

Referring first to Fig. 1 there are front walls 1, back walls 2 and side walls 3 composed of vertical tubes spaced apart with flanges extending across the spaces, and similar longitudinal tubes arranged to form a top wall 4 and bottom wall 5. The firing nozzles or grate and the passages for the gases are omitted from this figure, as are also the surrounding walls of refractory material. These details may be varied in design and arrangement, as illustrated for example in the other figures.

The tubes of the front and rear walls 1 and 2 and of the bottom wall 5 communicate at their lower ends with headers 6 and 7. The tubes of the opposite side walls 3 communicate with bottom headers 8 which are connected at their ends to the ends of the headers 6 and 7. A header 9 on the upper ends of the tubes 2 communicates with the tubes 4 of the top wall and also with the ends of the upper headers 10 of the side walls. A steam drum 11 receives steam directly from the tubes of the front wall 1 and of the top wall 4 and also from the upper headers 10. The steam is taken off from the drum in any usual way. The water from the drum passes out of its ends by down-comers 12 to the lower headers 8. The tubes and headers which are shown horizontal may be slightly inclined upward in the direction of flow if preferred, and the circulation may be provided for in various other ways.

The water entering the lower headers 8 passes into the headers 6, the bottom wall 5 and the lower ends of the front, back and side wall tubes. Thence the wet steam and water pass upward to the headers 9 and 10, the top wall 4 and the upper end of the front wall 1, where they pass into the drum 11.

The fuel is burned in the combustion chamber enclosed by the tubular walls, so that all the tubes are exposed to the direct radiant heat of the burning fuel and steam is generated at a very high rate and very efficiently.

As illustrated in Fig. 2, the individual tubes 13 are provided each with two flanges 14 overlapping those of the adjacent tubes, so as to substantially close the space between them, while leaving the tubes free to expand or contract independently of one another, and to be separately renewed when necessary. A layer or wall of refractory or insulating material is arranged outside of the tubes. Preferably this consists of plastic insulating material 15 tied to the tubes by means of flanges 16 on the latter having lateral extensions 17 embedded in the plastic material. The flanges 14 and 16 are secured to the tubes by welding, or other methods.

Outside of the plastic material 15 there is (see Fig. 5) preferably a facing 18 of cement and a steel plate 19 fastened by means of anchors 20 embedded in the insulating material and out of contact with the tubes to avoid conduction of heat therefrom.

The vertical walls of the boiler made as described are preferably surrounded by a wall of brickwork or other masonry 21 built up against an insulating plate 22 and a steel plate 23 bolted to columns 24 which support the roof of the boiler or other parts of the surrounding structure. The space 25 between the outer and inner walls serves as an insulating air space and may also be used as a preheating passage for the air used for combustion.

In some boilers it is desirable to protect parts of the inner face of the water walls from too great heat or, for other reasons, to interpose a shield between parts of the tubing and the combustion chamber. In such cases the parts of the tubes to be shielded are provided with flanges 26, preferably having lateral extensions 27, and a layer of plastic material 28 is applied, imbedding the flanges 26 and being thus reinforced and tied to the tubular structure.

In Fig. 4 the entire bottom wall is occupied by a stoker 29 on which the coal is indicated at 30. The line 31 indicates the top of the refractory protecting material 28. This part of the side walls and rear end wall is practically in immediate contact with the fuel. The shield 28 prevents burning out of the tubes and also prevents undue cooling of the fuel.

Fig. 6 illustrates certain modifications in detail. Tubes 32 are used without fins, the spaces between the tubes being filled by refractory bricks 33 shaped to provide grooves for the tubes and to constitute an enclosing wall.

Fig. 7 also illustrates an enclosing wall of refractory bricks 33. The tubes 34 in this case are provided with overlapping flanges 35 (similar to those in Fig. 5), but without flanges to tie in the refractory material.

The materials which I have referred to herein as "refractory" are not necessarily adapted to withstand extremely high temperatures, as the term is often understood in the art of furnace construction. They need be only sufficiently refractory to withstand the temperatures to which they are severally exposed; which for some of these materials are not very high.

Instead of using a grate fired boiler I prefer to use pulverized coal or similar jet fuel introduced through nozzles 36 (Fig. 2), arranged to inject the fuel in jets at different angles so as to secure a thorough admixture during combustion and a uniform distribution of the gases against the different water walls. Preferably the burners or nozzles are arranged in sets of two or more 36 and 37 grouped together as in Fig. 3 to provide for a wide variation in capacity of the boiler. When running at the highest rating all the nozzles in a group will be used. For a lower rating a smaller number of nozzles in each group may be used, securing the same velocity of the jets for a decreased quantity of fuel.

Fig. 8 shows an arrangement of the nozzles at the lower end of the chamber and the exhaust gases from the boiler proper passing by an outlet 38 to and around tubes 39, a baffle 40 and tubes 41 and thence out by a flue 42. The tubes 39 and 41 may be any supplementary heating devices such as economizers, air heaters or superheaters, or even supplementary boiler tubes.

According to Fig. 9, the fuel is admitted at the top and the waste gases pass downward as indicated by the arrows to supplementary heating tubes 43 and 44, and thence out by way of flue 45.

According to Fig. 10, the fuel enters at the top and passes down between the bottom boiler tubes to supplementary tubes 46 and 47 and thence through an air heater 48 to the flue 49, the heated air being used for combustion or other desired purpose.

Various other modifications may be made by those skilled in the art, without departing from the invention as defined in the following claims.

What I claim is:—

1. A boiler having a combustion chamber all the side walls of which comprise separate upright steam generating tubes, each wall being closed to prevent the passage of the heating gases between said tubes and each wall being in line between the outermost tubes of the walls adjacent to it so as to form a complete enclosure with each of the tubes exposed to the radiant heat of the burning fuel.

2. The boiler of claim 1 in combination with refractory material on the outer sides of the tubes and projections on the tubes embedded in the refractory material and tying it to the tubes.

3. The boiler of claim 1 in combination with headers at the top and bottom respectively of said tubes, the headers at the bottom being in direct communication with each other and those at the top being in direct communication with each other.

4. A boiler having a combustion chamber all the side walls of which comprise separate upright steam generating tubes, each wall being closed to prevent the passage of the heating gases between said tubes, and each wall extending continuously between the ends of the walls adjacent to it so as to form a complete closure with refractory material on the outer sides of the tubes and tied to the tubes.

5. A boiler having a combustion chamber all the side walls of which comprise separate upright steam generating tubes, each wall being closed to prevent the passage of the heating gases between said tubes, and each wall extending continuously between the ends of the walls adjacent to it so as to form a complete closure, in combination with refractory material on the outer sides of the tubes and projections on the tubes embedded in such refractory material and tying it to the tubes.

6. The boiler of claim 5, and refractory material on the inner sides of the tubes covering only the lower portion thereof, leaving the upper portion exposed directly to the heating gases.

THOMAS E. MURRAY.