Sept. 2, 1930. T. E. MURRAY 1,774,810

BOILER

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Fig. 1.

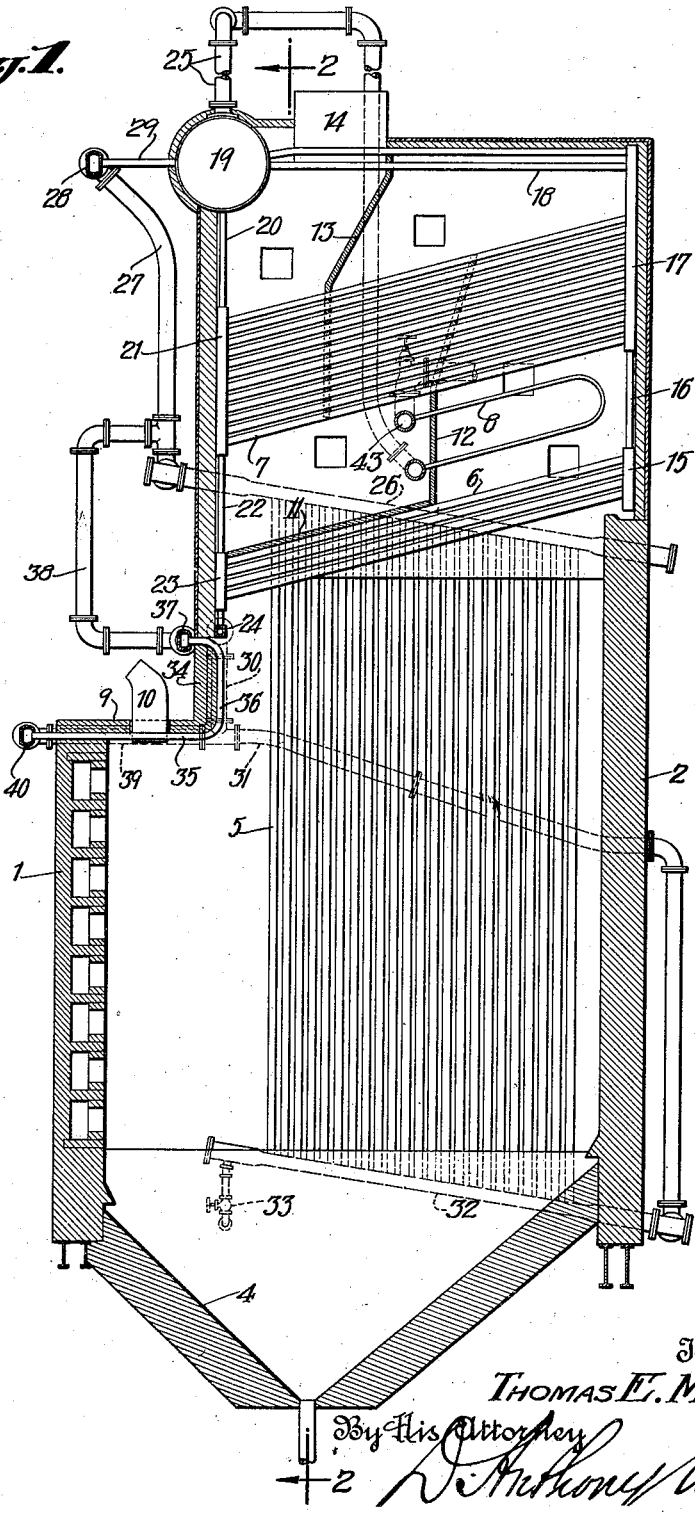

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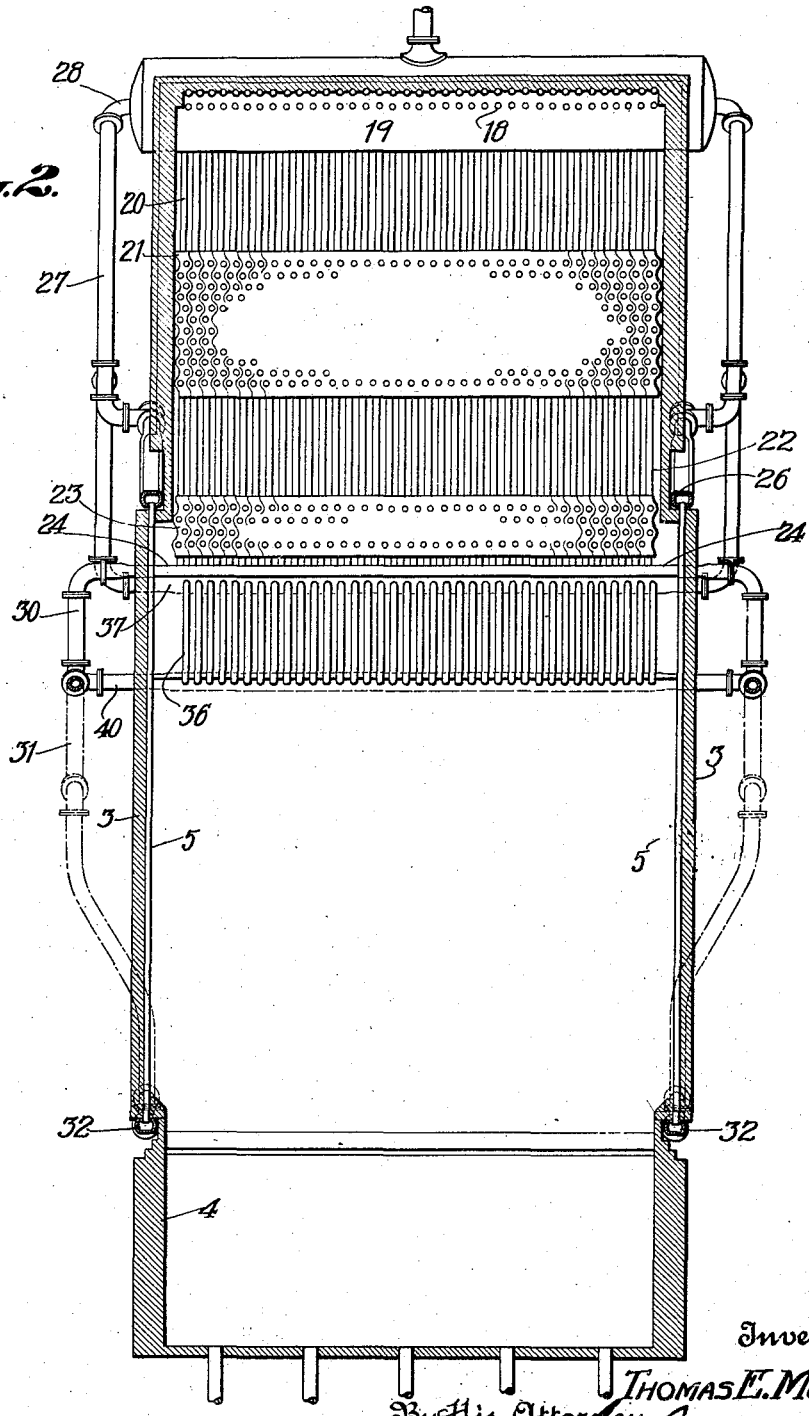
Fig. 2.



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BOILER

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Fig. 3.

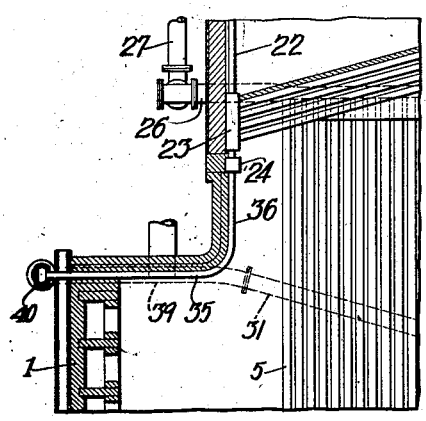

Fig. 4.

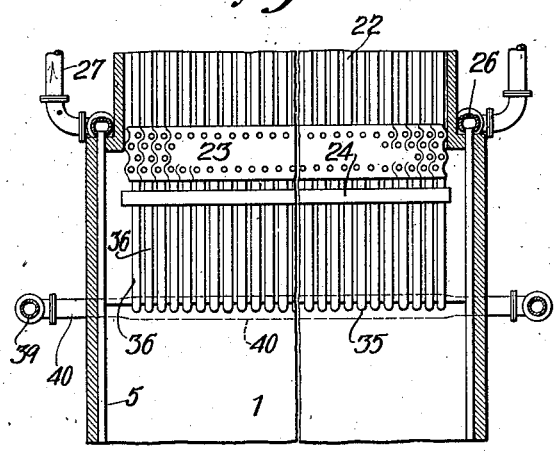

Fig. 5.

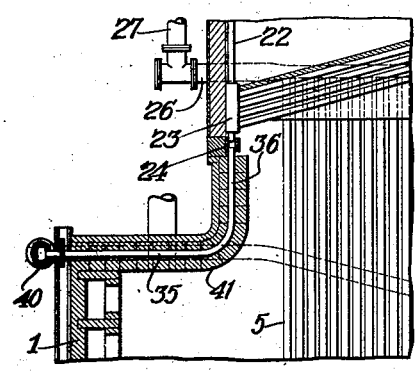

Fig. 6.

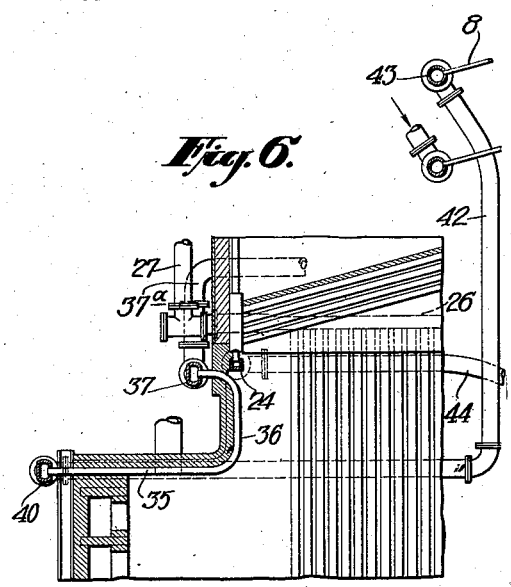

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Fig. 7.

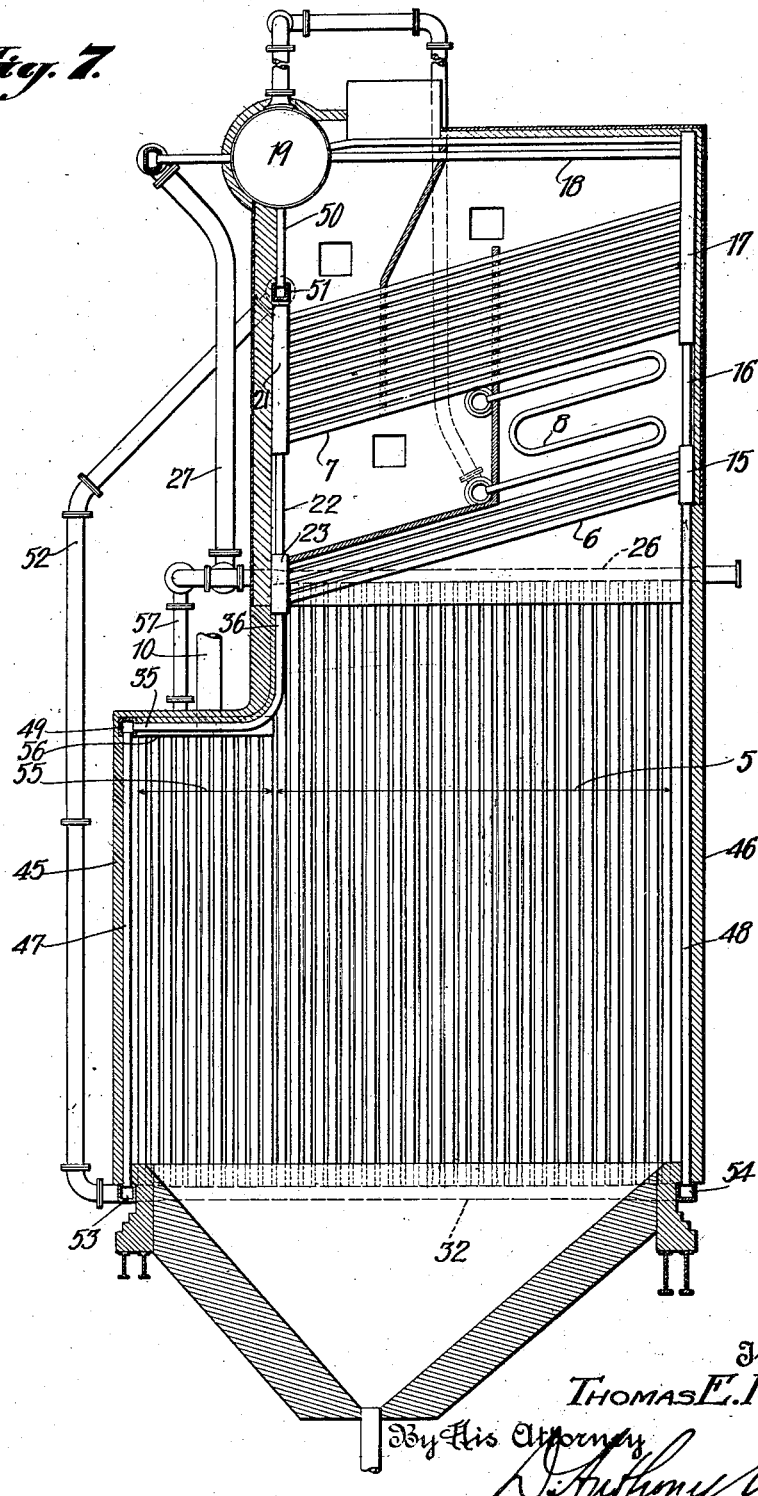

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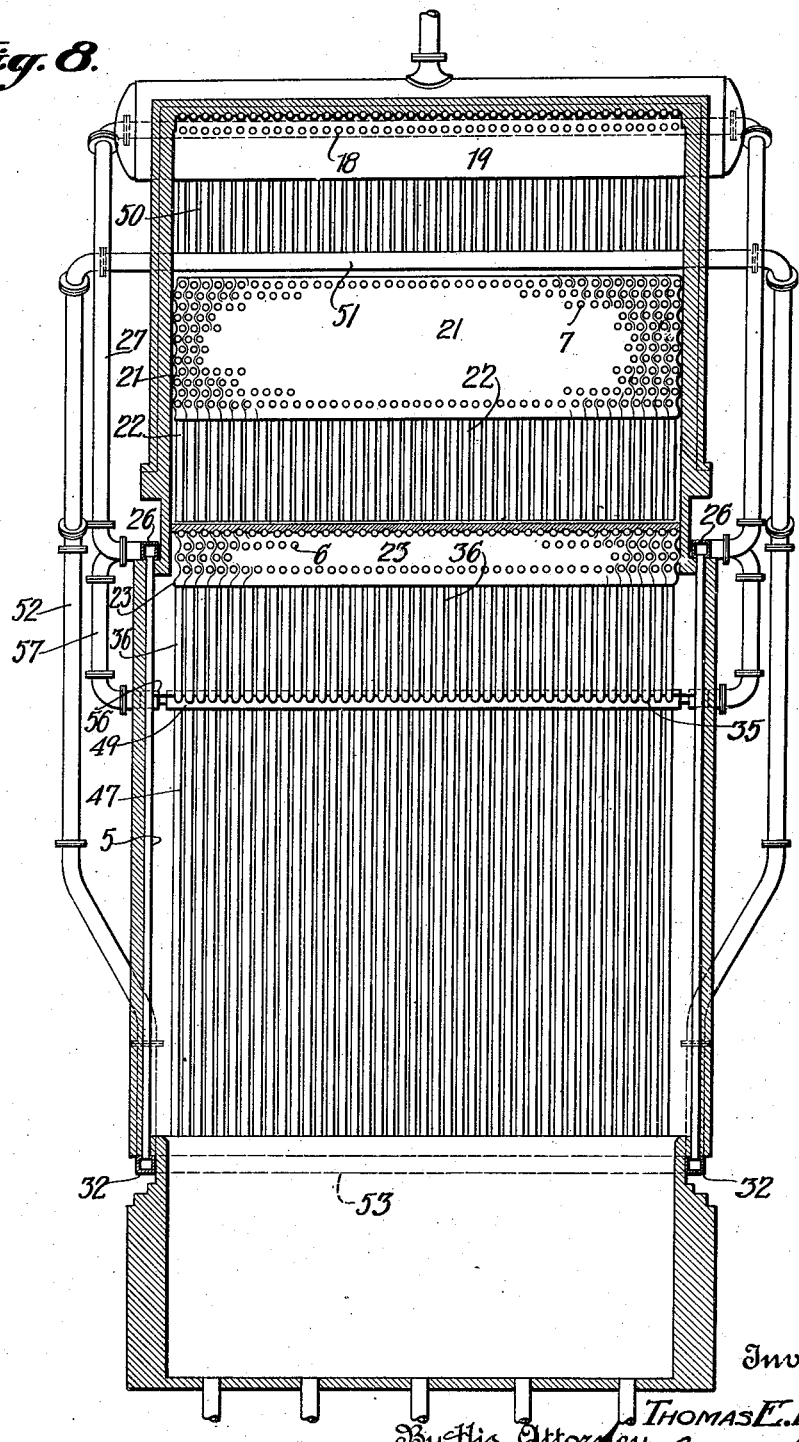
Fig. 8.



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UNITED STATES PATENT OFFICE

THOMAS E. MURRAY, OF BROOKLYN, NEW YORK; 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

BOILER

Application filed July 14, 1925. Serial No. 43,443.

In a previous application, No. 642,725, and in several additional applications, I have described boilers utilizing tubes exposed to the radiant heat of the burning fuel in the furnace and serving as shields or water linings for the walls of the furnace.

The present invention provides certain improvements especially designed for boilers of the character described in the aforesaid applications, and applicable also to boilers of other types.

The accompanying drawings illustrate embodiments of the invention.

Fig. 1 is a longitudinal section of a boiler and furnace;

Fig. 2 is a transverse section of the same approximately on the line 2—2 of Fig. 1;

Figs. 3 and 4 are sections similar to Figs. 1 and 2 illustrating a modification in detail;

Figs. 5 and 6 are sections similar to Fig. 1 illustrating further modifications in detail;

Figs. 7 and 8 are complete longitudinal and transverse sections illustrating a further modification.

Referring to the embodiments of the invention illustrated, the furnace has front and back walls 1 and 2 respectively and side walls 3, Fig. 2, at the bottom of which is an ash pit 4. Adjacent to the side walls of the furnace, in Figs. 1 and 2, are vertical water carrying tubes 5 extending up to about the top of the rear wall and side walls of the furnace. Above the furnace are located banks of slightly inclined, approximately horizontal tubes of the usual style such as the steam generating tubes 6 and 7 and the superheater tubes 8; these being encased in walls of any usual or suitable constructon. The front wall 1 is offset beyond the vertical plane through the ends of the regular boiler tubes 6 and 7 and is surmounted by a roof or arch 9. The boilers are designed to generate steam at a very rapid rate and at very high temperatures. The fuel is introduced through nozzles 10 projecting down through the arch 9. They may use powdered coal, oil, gas or other jet fuel. The combustion is initiated in the offset portion of the furnace beneath the arch. The tubes 5 lining the furnace are subjected to the direct radiant heat of the burning fuel and will generate steam very rapidly. The combustion gases pass upward between the horizontal tubes and around the baffles 11, 12 and 13 and thence out by the smoke pipe 14. The tubes which line the walls of the furnace (and this applies to all the other figures as well as to Figs. 1 and 2), may be of the ordinary simple design or they may be like the tubes described in the aforesaid prior application, spaced apart and having longitudinal flanges occupying the spaces between them so as to present a very large heating surface in proportion to the volume of water in the tubes.

The circulation in the horizontal tubes above the furnace is as follows. The heated water and steam pass to vertical headers 15 at the upper ends of the tubes 6, thence through connecting pipes 16 into vertical headers 17 at the upper ends of the tubes 7 and thence through pipes 18 to the steam drum 19; whence the water returns by pipes 20 to vertical headers 21 at the lower ends of the tube 7, thence by pipes 22 to vertical headers 23 at the lower ends of the tubes 6. The headers 23 lead downward to a transverse header 24 which may serve as a mud drum for the circulating system of the upper boiler tubes. The steam from the drum 19 passes out through the pipe 25 to the tubes of the superheater 8 and finally to the point of consumption.

The circulation for the vertical tubes 5 within the furnace is as follows. The water and steam from the upper ends of the tubes pass into horizontal headers 26 on the outside of the boiler walls which have branches 27 leading to opposite ends of a header 28 running across the front of the boiler at about the level of the steam drum and communicating with the latter through pipes 29; the water returns from the drum 19 through the headers 21 and 23 at the lower ends of the horizontal tubes to the cross header 24. From its ends, this header leads to vertical pipes 30 extended downward and thence to pipes 31 leading obliquely downward and backward to the rear ends of longitudinal headers 32 at the lower ends of the pipes 5. The headers

32 are provided with blow-off valves 33 at their forward ends.

The arch 9 and the portion 34 of the front wall immediately above it are subjected to extremely high temperatures and I propose to protect them and at the same time to provide for further generation of steam by a screen of water tubes similar to the tubes 5 which protect the side walls. These tubes 35 extend lengthwise under the arch 9, leading to vertical tubes 36 on the inner face of the wall 34 which lead out to a header 37 extending across the front of the wall. At the ends of the header 37 it is connected by pipes 38 with the pipes 27 previously referred to. The pipes 30 which lead down from the ends of the header 24 have two branches at their lower ends, one being the branch 31 previously referred to and the other being a forward branch 39. The two branches 39 extend to the front of the furnace and lead into the ends of a cross header 40 which carries the outer ends of the tubes 35. Thus the circulating system for this water wall of tubes 35 and 36 is complete, the hot water and steam going up through the pipe 38 into the drum 19 and the water passing from the latter down to the head 24 and pipe 30 to the header 40 at the lower ends of the tubes.

Instead of being arranged as a steam generating means, the tubes 35 and 36 may be connected into the water supply system to the lower header for the pipes 5. See Figs. 3 and 4. The header 24 is connected directly to the upper ends of the pipes 36, the pipes 39 leading from the ends of the header 40 communicating only with the pipes 31 which lead as in Fig. 1 to the supply headers at the lower ends of the tubes 5.

In all of the constructions illustrated the arch protecting tubes may be themselves shielded by a wall or layer of tiles 41, Fig. 5. This is particularly applicable to the arrangement of Fig. 3 in which the tubes 35, 36 are in the water supply system rather than in the steam generating system.

Fig. 6 shows the arch protecting water wall used as part of the superheating system. A pipe 42 leads downward from the header 43 at the outlet end of the superheater and leads to the ends of the header 40, whence the steam passes through the tubes 35 and 36 and thence to a header 37 as in Fig. 1, which header leads by any usual or suitable connection 37a to the steam main. From the header 24 the supply of water passes through a pipe 44 to headers at the bottom of the tubes 5.

Figs. 7 and 8 illustrate the invention applied to a furnace in which front and back walls 45 and 46 are made comparatively thin and are protected by walls of tubing 47 and 48 respectively similar to the tubing 5 which protects the side walls. In this case the circulation for the front wall 47 includes the tubes 35 and 36. The upper header 49 for the tubes 47 leads into the lower ends of the tubes 35. From 36 it passes into the headers 23 and thence upward through pipes 22 into headers 21, the latter being closed at their upper ends. Thus the water passes upward from the headers 23 and 21 through the tubes 6 and 7. The water from the drum 19 passes down by pipes 50 to a header 51 at the ends of which are branches 52 which lead to the ends of a header 53 on the lower ends of the tubes 47. This communicates with the longitudinal headers 32 at the ends of the tubes 5. The headers 32 in turn communicate with the header 54 for the tubes 48. At their upper ends the tubes 48 communicate with the headers 15, pipes 16, headers 17 and pipes 18 leading to the steam drum.

Supplementary tubes 55 are added along the side walls under the arch, connected at their lower ends to the side headers 32. The headers 26 at the upper ends of the tubes 5 are supplemented by headers 56 at the upper ends of the tubes 55, communicating by pipes 57 with the ends of the headers 26 and with the steam pipes 27 leading to the drum.

It will be observed from Figs. 2, 7 and 8 that the headers for the tubes within the furnace are shielded from the fire by being located outside of a portion of the wall.

An additional feature of improvement, which I have shown particularly in connection with Fig. 1, is in the inclining of the headers 26 and 32 so that the water will enter the lower ends of the headers 32 and will be circulated forward and upward through these headers into the successive tubes 5; and so that the water and steam from the tubes 5 will enter the headers 26 and will pass upward and forward to the ends of the latter leading to the steam drum. By this inclination of the headers I avoid the possibility of air or steam pockets and provide for a circulation which is continuously upward from the low point at which the water enters the bottom headers. The same scheme of inclining the headers upwardly and forwardly with the circulation may be applied to the different arrangements of furnace water walls shown in the other figures.

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

What I claim is:

1. A boiler having a steam drum and having a furnace with walls comprising vertical water tubes extending substantially from bottom to top of the furnace so as to be exposed to the radiant heat of the burning fuel and to generate steam at a high rate and having inlet and outlet headers, said boiler having slightly inclined, approximately horizontal steam generating tubes overhead heated by the gases passing out of the combustion chamber with their lower ends at the front,

the furnace having an arch of refractory material projecting outward beyond the front of said inclined tubes and a wall of water tubes extending along the under side of the arch and upward in line with the front ends of said inclined tubes, the inclined tubes having inlet headers at their front ends connected with the offtake from the steam drum, the arch tubes and the inlet headers of the vertical tubing being connected with the inlet headers of the inclined tubes, and the outlet headers of said vertical tubing being connected to the intake of the steam drum.

2. A boiler having a steam drum and having a furnace with walls comprising vertical water tubes extending substantially from bottom to top of the furnace so as to be exposed to the radiant heat of the burning fuel and to generate steam at a high rate and having inlet and outlet headers, said boiler having slightly inclined, approximately horizontal steam generating tubes overhead heated by the gases passing out of the combustion chamber with their lower ends at the front, the furnace having an arch of refractory material projecting outward beyond the front of said inclined tubes and a wall of water tubes extending along the under side of the arch and upward in line with the front ends of said inclined tubes and having inlet and outlet headers, the inclined tubes having inlet headers at their front ends connected with the offtake from the steam drum communicating with the inlet headers of said vertical water walls and of said arch tubes, and the outlet headers of said vertical water walls and of the arch tubes communicating with the intake of the steam drum.

In witness whereof, I have hereunto signed my name.

THOMAS E. MURRAY.