Sept. 4, 1928. 1,683,046

T. E. MURRAY

BOILER

Filed July 1, 1925

Fig. 1.

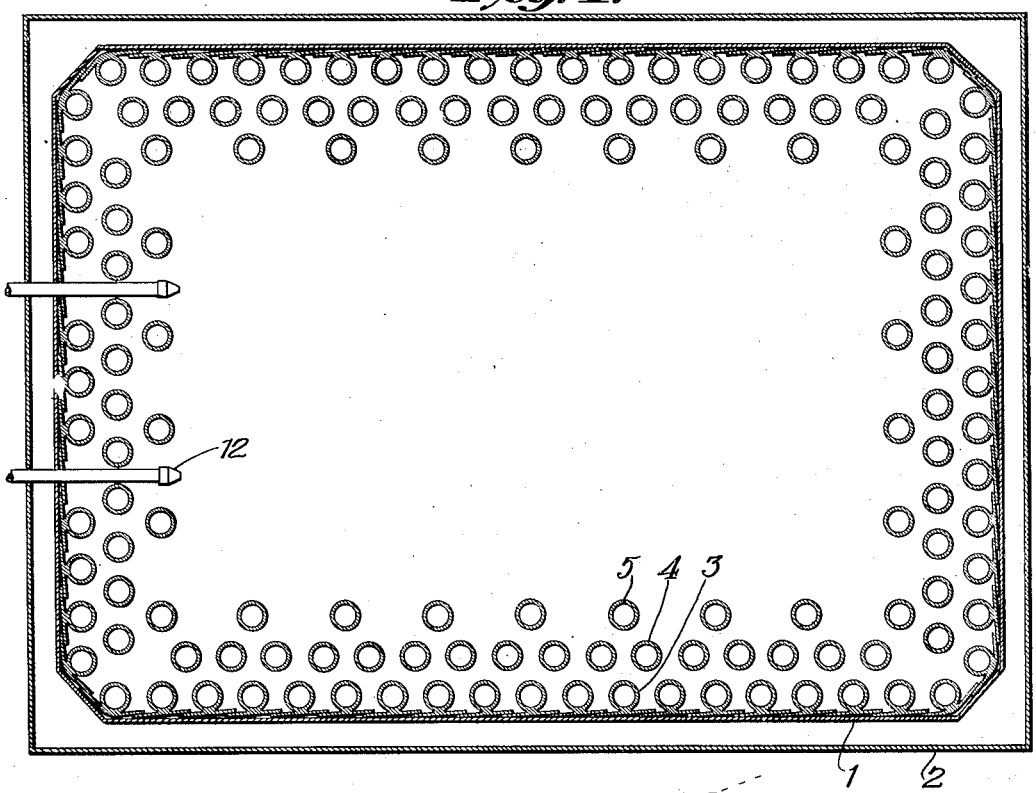
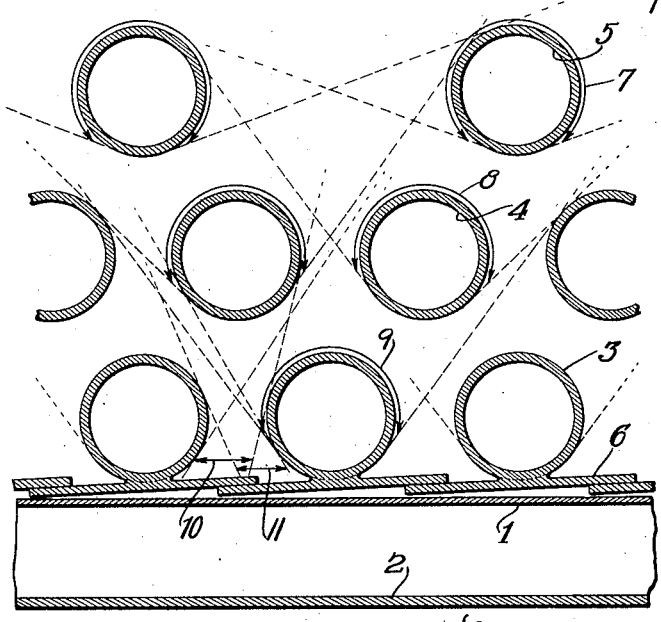


Fig. 2.



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UNITED STATES PATENT OFFICE.

THOMAS E. MURRAY, OF BROOKLYN, NEW YORK.

BOILER.

Application filed July 1, 1925. Serial No. 40,746.

In my application No. 642,725 and other previous applications, I have described boiler constructions using tubes which are exposed directly to the radiant heat of the burning fuel in the combustion chamber, whereby there is attained a heating effect very much greater than that obtained by the mere circulation of the hot gases out of direct line with the burning fuel and whereby boilers can be run at a very much higher rating than has heretofore been possible.

The present invention is directed to boilers operating on a similar principle. The accompanying drawings illustrate an embodiment of the invention.

Fig. 1 is a horizontal section of the combustion chamber;

Fig. 2 is an enlarged detail thereof.

The combustion chamber is surrounded by a metal wall 1 and preferably a second wall 2 spaced outside of the first so as to leave an air space for insulation and, if desired, for preheating the air for combustion. Within the main walls there is an inner wall of tubular members spaced apart and presenting to the radiant heat of the burning fuel an area greater than that of the outer or main wall, these tubes carrying water and being connected to the main circulating system of the boiler (or to a separate circulating system in some cases).

Various arrangements of the tubing may be provided. In the case illustrated, I provide an outermost row of tubes 3, an intermediate row of tubes 4 and an innermost row of tubes 5. The outer tubes 3 may be provided with flanges 6 on their rear faces overlapping so as to shield the main wall 1 and to catch all the heat rays projected from the burning fuel in the center constituting the combustion chamber. The other tubes may also be provided with flanges, but preferably they are plain so that there shall be no interferences with the passage of the heat rays between them.

The tubes of the outer row and those of the middle row are separated from each other by substantially the same spacing, those of one row being staggered with relation to those of the other. The tubes 5 of the innermost row are double-spaced and located in line between two of the tubes 5. With this arrangement it will be seen that there is a very large surface exposure to the radiant heat from the central part of the chamber. The dotted lines indicate the directions of the heat rays. The entire chamber being filled with the flaming fuel, the tubes 5 are exposed to direct radiant heat over about 10½ inches in a 12 inch circumference as indicated by the line 7; for the tubes 4 there is an exposure of about 9 inches in 12 as indicated by the line 8. For the tubes 3, as indicated by the line 9, there is an exposure of about 7 inches. The exposure of the fins as indicated by the lines 10 and 11 is about 30% of the total area. The total surface exposure is obviously much greater than the area of the outer wall 1. The figures given are approximate, and various other arrangements in principle and location, and also in size of the tubes may be designed so as to secure approximately the same results.

The furnace is arranged with nozzle burners 12 for projecting powdered, liquid or gaseous fuel. This may be in volume sufficiently to fill the chamber to substantially the height of the tubes with incandescent gases so as to get the maximum radiant effect.

The invention is particularly designed for high pressure stationary boilers, though it is applicable to various types of boiler. The same principle may be employed with less than four water walls, one or more of the walls being of usual design and construction and protected in known ways. In that case the area of the tubular members exposed to the radiant heat should be greater than the projected area of the outer walls against which they lie and may indeed be greater than the total area of all the outer walls. The outer walls may be provided, in addition to the arrangement shown, with ordinary insulating material on their outer faces. For greater efficiency it will generally be desirable to surmount the arrangement shown by the ordinary tubing to utilize the heat units in the gases passing out of the combustion chamber. Such tubing above the chamber may be arranged in successive lines staggered as explained in connection with the drawing to secure a large exposure to the direct radiant heat.

The boiler of this invention can be designed to run at an extremely high rating. A boiler is run at 100% rating according to modern standards when each square foot of surface evaporates 3.45 pounds of water from and at 212 degrees F. This is an average figure for the entire heating sur-

face. However, some parts of the surface, those farthest from the furnace in the line of draft of the gases, are very inefficient and may not evaporate even one pound of water per square foot. On the other hand, the surface directly exposed to the radiant heat of the furnace is very efficient and may evaporate more than sixty pounds of water per square foot.

According to this invention the boiler is so constructed and arranged that the proportion or percentage of the heating surface which is directly exposed to the radiant heat of the burning fuel may be considerably increased as compared with boilers hertofore built. The limitation of present boilers with ordinary refractory walls is in the inability of the walls to withstand the extreme heat liberated from the fuel if it is attempted to run the boiler at a rating considerably increased beyond its normal capacity according to ordinary standards. It is impossible to operate boilers of the common type at more than two or three times their normal capacity without deterioration of the walls. When operating at such high ratings efficiency is sacrificed, as the proportions of the surface remote from the furnace are not efficient. The boiler of the present invention has the maximum amount of surface exposed to the direct radiant heat of the furnace and, therefore, in the most efficient location. With this design the only limitation of the capacity is the ability to supply sufficient water through the tubes to protect the metal thereof, and this may be accomplished by the use of suitable circulating systems such as I have described in other pending applications and by the use of larger water and steam pipes than usual.

With the ordinary industrial boiler it is dangerous to run beyond about 180% of its rating because of the liability of the furnace wall to fail at the higher temperatures required. Boilers of the present design can be run at a much higher rating, well above 200% of the standard, and this without injury to the walls.

The different lines of tubes illustrated may be all used for generating steam and may be in one or in several different circulating systems. Or they may be used for different purposes such as steam generating, water heating, steam superheating and the like; that is, some of them for generating fresh steam, some for superheating and others for heating feed water.

Though I have described with great particularity of detail certain embodiments of my invention, yet it is not to be understood therefrom that the invention is restricted to particular embodiments disclosed. Various modifications thereof may be made by those skilled in the art without departing from the invention as defined in the following claim.

What I claim is:

A boiler adapted to generate steam at high pressure having an outer wall and having an inner wall comprising a multiplicity of tubular members of substantially the same diameter in rows at different distances from the outer wall, with the members of the innermost row spaced farther apart than those of the next row so as to permit greater surface exposure of the latter to the radiant heat of the burning fuel.

In witness whereof, I have hereunto signed my name.

THOMAS E. MURRAY.