

Jan. 4, 1938.

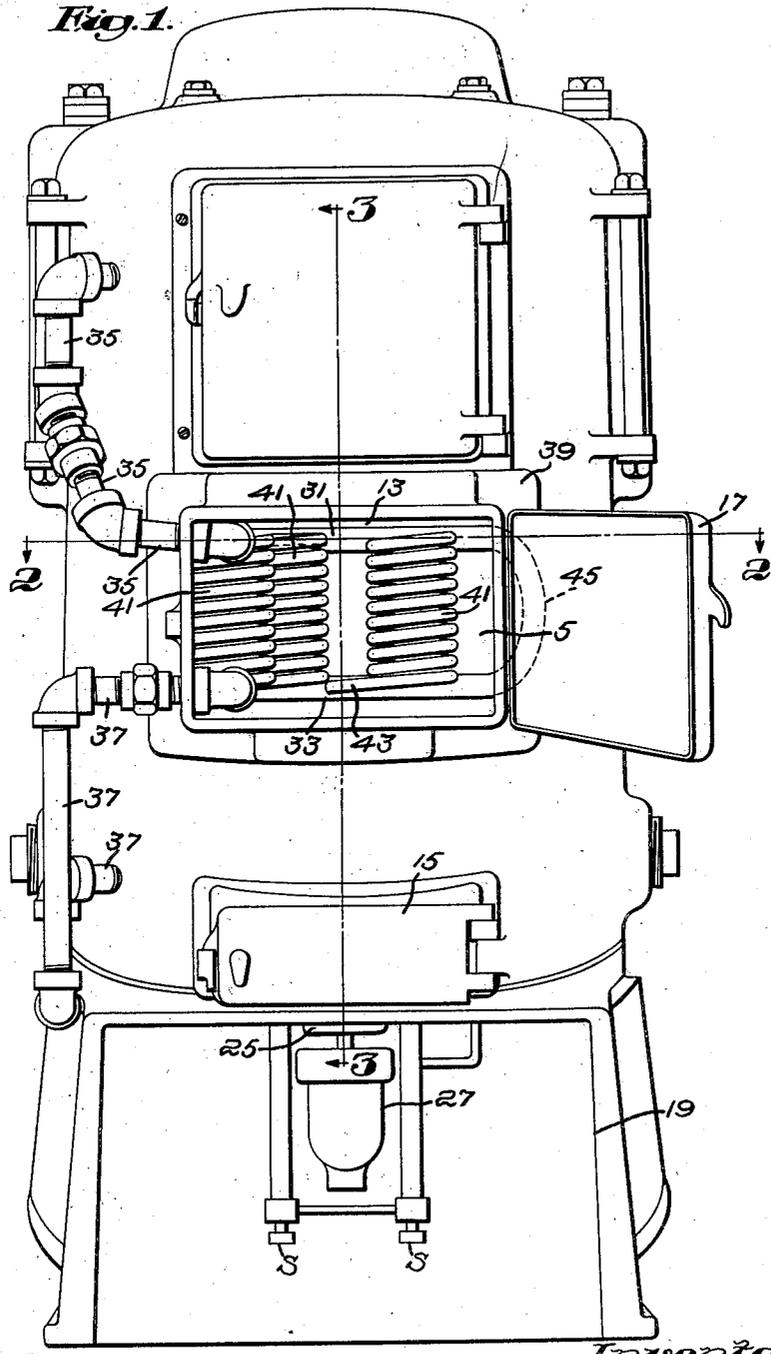
J. F. KELLY

2,104,229

BOILER

Filed Sept. 28, 1935

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

Fig. 2.

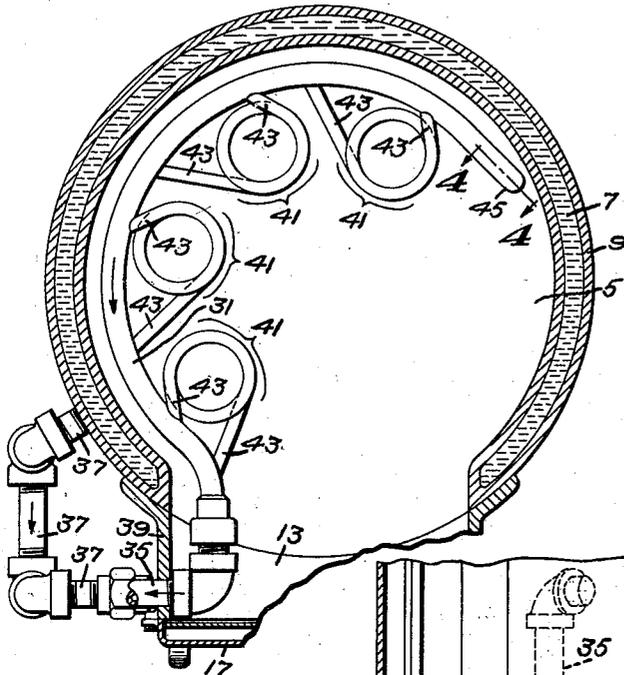


Fig. 4.

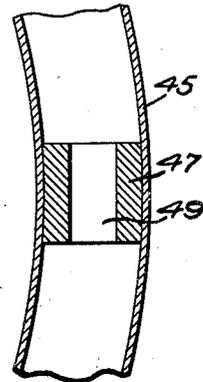
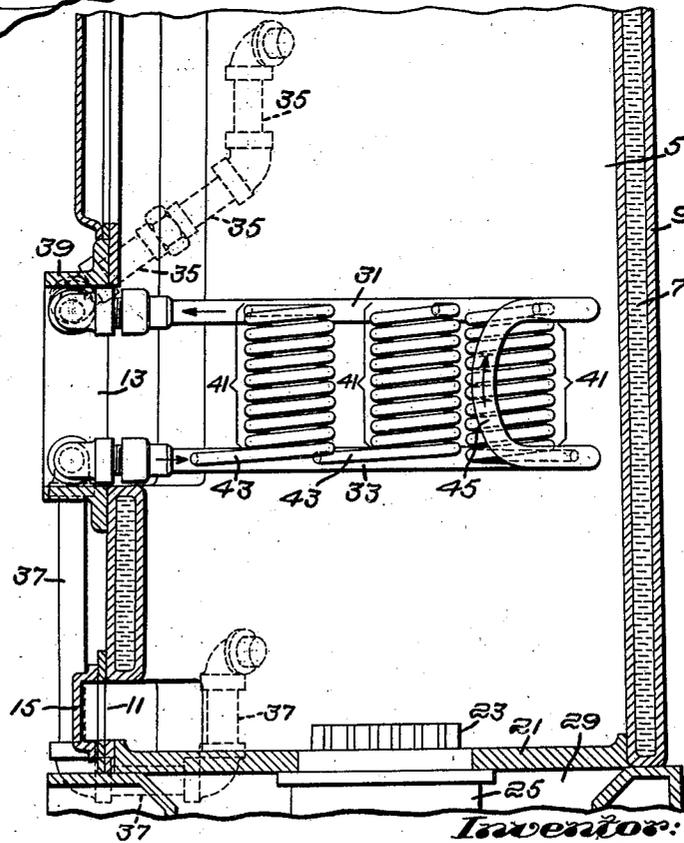


Fig. 3.



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# UNITED STATES PATENT OFFICE

2,104,229

## BOILER

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13 Claims. (Cl. 122—170)

This invention relates to an improved boiler for use in connection with liquid and gaseous fuel burners. These burners are often used in connection with boilers designed for the use of solid fuel, but the thermal conditions in the use of liquid and gaseous fuel are so different from those in the use of a solid fuel that when liquid or gaseous fuel is used the thermal efficiency is not as high as is desirable. This is evidenced by the high temperatures observed in smoke pipes and chimneys.

According to my invention, a boiler designed primarily for the use of solid fuel is so modified for the use of an oil or gas burner that the thermal efficiency is greatly increased. This is accomplished by the use of a novel coil arrangement which is added to and supplements the usual water spaces of the boiler by being located within the combustion chamber and connected at its upper and lower ends to the usual water space. For a given room temperature, there is a substantial reduction in the consumption of fuel.

There are two principal types of oil burners,—the gun type and the rotary type, and the conditions under which they are used differ. Fuel economizers suitable for use with gun type burners are not well suited for use with rotary type burners, and for use with automatic coal stokers. There are several reasons for this, among which are, first an economizer designed for use with a gun type burner interferes with and in most cases prevents servicing of a rotary type burner when used with the latter, and, second, an economizer designed for use with a gun type burner is unsuitable for use with a rotary type burner because the economizer is too low in the combustion chamber, just above the refractory deck, resulting in a lowering of the temperature of the burning oil to such a degree that complete combustion of the oil cannot take place.

The present invention aims to provide a coil arrangement which shall be well suited for use with rotary type burners. However, the economizer can also be used with pressure atomizing type, or gun type, burners provided that the economizer be correctly placed in the direct path of the flue gases. When used with a burner of the rotary type, the arrangement is such that ample room is left for any servicing of the burner, and it is placed so far above the refractory deck or hearth that it has no adverse effect on completeness of combustion.

The invention will best be understood by reference to the following description of a boiler em-

bodiment of the invention, while its scope will be pointed out more particularly in the appended claims.

In the drawings:—

Fig. 1 is a perspective view of a boiler embodying the invention;

Fig. 2 is a horizontal sectional view of the same on line 2—2 of Fig. 1;

Fig. 3 is a vertical sectional view on line 3—3 of Fig. 1; and

Fig. 4 is a sectional view on an enlarged scale on line 4—4 of Fig. 2.

Referring to the drawings and to the embodiment of the invention illustrated therein by way of example, there is shown a boiler having a combustion chamber 5, and a water space 7 about (and usually above) said chamber. The principal part of the water space is annular and it is formed within a double walled jacket 9 having a clinker door opening 11 and a fire door opening 13, provided as usual with doors 15 and 17, respectively, and there is also an ashpit door opening 19, which in the case of a rotary type burner is left open.

To adapt the boiler to the efficient use of an oil burner of the rotary type, it is customary to install in place of the grate a refractory deck or hearth 21, through the center of which a rotor 23 of an oil burner 25 protrudes into the combustion chamber 5, while the remainder of the burner, including its motor 27, is within an ashpit 29.

According to my invention, there is placed within the combustion chamber a subsidiary water unit comprising upper and lower manifolds 31 and 33, disposed horizontally within the combustion chamber and connected exteriorly with the water space 7 by pipe connections 35 and 37, which in this example conveniently extend through the side of a fire door frame 39. The manifolds, as shown, are generally parallel with and adjacent to the water space 7, and there is a substantial, vertically disposed portion of the combustion chamber (see Fig. 2) unobstructed by and bounded by the water unit, and affording easy access to the top of the oil burner.

The manifolds are connected to each other by a plurality of pipes 41, herein helically coiled about vertical axes, and having terminal portions 43 which (see Fig. 2) are obliquely disposed with relation to the manifolds (i. e., they curve or slope toward the inlet ends of the manifolds), to facilitate the flow of water from one manifold into and through each coil and from the latter into the other manifold. In the present example, for convenience, the manifolds are formed of a single piece of pipe with a U-shaped

portion 45, which, in effect, is a pipe connecting the manifolds.

To prevent short-circuiting, the cross-sectional area of each pipe connection between the manifolds is less than the cross-sectional area of each manifold, and in fact the combined cross-sectional areas of the pipe connections, including the U-shaped portion 45, is approximately equal to the cross-sectional area of each manifold. This is conveniently accomplished in the present example by making the manifolds of seven-eighths inch outside diameter copper tubing with a wall thickness of .065", by making the coiled pipes of one-half inch outside diameter copper tubing with a similar wall thickness, and by inserting in the U-shaped portion 45 a "wedge" or bushing 47 having a passage 49 therethrough three-eighths of an inch in diameter, approximately equal to the internal diameter of each of the pipes 41. Inasmuch as the sum of the cross-sectional areas of the pipes 41 and the passage 49 is substantially equal to the cross-sectional area of each of the manifolds, it follows that the column of relatively cooler water entering the lower manifold will be divided into several smaller columns which will flow upwardly through the pipes 41 and the passage 49 into the upper manifold with an equal flow of water through all of the connections between the manifolds and without short-circuiting which would otherwise occur. It should, of course, be understood that the construction thus shown and described is simply an illustrative example and the best embodiment of the invention now known to me, and that other constructions are possible within the spirit and scope of the invention as defined in the claims.

By making the connections from the manifolds to the water space on the outside of the boiler, the conversion of the boiler is greatly facilitated because it is easy to drill and tap the openings on the outside into the water jacket and to fit and assemble the necessary pieces of pipe, the elbows and the union couplings instead of working in the cramped space within the combustion chamber, and because the upper connection can be made at a relatively high point above the combustion chamber. In practice, to secure best results, I provide baffles within the combustion chamber to deflect the gases against the subsidiary water unit, but I have not shown them because they are not necessary to a proper understanding of my invention. These baffles are, of course, removable when access to the top of the oil burner is desired.

Having thus described one embodiment of my invention but without limiting myself thereto, what I claim, and desire, by Letters Patent, to secure is:

1. The combination with a boiler having a combustion chamber, a water space about said chamber and an opening from the exterior to said chamber, of a subsidiary water unit comprising upper and lower manifolds disposed laterally of the center of said chamber, each manifold being connected to said water space and disposed horizontally within said combustion chamber, and a plurality of pipes, each coiled about a vertical axis and each communicating at its upper and lower ends, respectively, with said upper and lower manifolds, the outer radius of each coil being less than the distance from its said axis to said manifolds, the terminal portions of each pipe being generally horizontal and sloping horizontally toward the inlet ends

of said manifolds, said terminal portions being attached to the sides of said manifolds.

2. In a subsidiary water unit for connection to the water space of a boiler, the combination of a pipe having two generally parallel leads, one having an inlet at its terminal portion and the other having an outlet at its terminal portion, and a U-shaped bend remote from said inlet and said outlet, and a plurality of coiled pipes communicating on the one hand with one of said leads, and communicating on the other hand with the other of said leads.

3. In a subsidiary water unit for connection to the water space of a boiler, the combination of a pipe having two generally parallel leads, one having an inlet at its terminal portion and the other having an outlet at its terminal portion, and a U-shaped bend remote from said inlet and said outlet, and a plurality of coiled pipes communicating on the one hand with one of said leads, and communicating on the other hand with the other of said leads, the aggregate, effective cross-sectional area of said coiled pipes and said U-shaped portion being substantially equal to the cross-sectional area of each of said leads.

4. In a subsidiary water unit for connection to the water space of a boiler, the combination of a pipe having two generally parallel leads, one lead having a terminal portion presenting an inlet and the other terminal portion presenting an outlet, and a connecting portion connecting said leads remote from said inlet and said outlet, and a plurality of coiled pipes communicating on the one hand with one of said leads and on the other hand with the other of said leads, said coiled pipes being disposed entirely at one side of both leads and attached to said leads at said side.

5. The combination of a boiler having a combustion chamber, a water space about said chamber and a lateral opening from said chamber to the exterior of said boiler, and a subsidiary water unit comprising upper and lower manifolds disposed laterally of the center of said chamber, each manifold being connected to said water space and disposed horizontally within said combustion chamber, and a plurality of pipes coiled about vertical axes between said manifolds and the center of said chamber, and each communicating at its upper and lower ends, respectively, with said upper and lower manifolds, the vertical dimension of said unit being less than the vertical dimension of said opening.

6. The combination of a boiler having a combustion chamber, a water space about said chamber and a lateral opening from said chamber to the exterior of said boiler, and a subsidiary water unit comprising upper and lower manifolds disposed laterally of the center of said chamber, and following the contour of said water space, and a plurality of pipes coiled about vertical axes and disposed entirely within the central space bounded by said manifolds, each pipe communicating at its upper and lower ends with said upper and lower manifolds, respectively, the lower terminal portions of said pipes sloping toward the inlet of said lower manifold, and the upper terminal portions of said pipes sloping toward the outlet of said upper manifold.

7. In a subsidiary water unit for connection to the water space of a boiler, the combination of two generally parallel manifolds disposed about an open space and generally concentric with an axis, one manifold having an inlet and the other

an outlet, and a plurality of pipes coiled about axes generally parallel with each other and with the first-named axis, one set of terminals of said pipes communicating with one of said manifolds and sloping toward its said inlet, and the other set of terminals of said pipes communicating with the other of said manifolds and sloping toward its said outlet.

8. In a subsidiary water unit for connection to the water space of a boiler, the combination of a single pipe having two generally parallel portions, one having an inlet and the other an outlet, and a connecting portion remote from said inlet and said outlet, said generally parallel portions being disposed about and generally equidistant from an axis, and a plurality of pipes disposed about said axis and having two sets of terminals, one set communicating with one of said generally parallel portions and the other set communicating with the other of said generally parallel portions.

9. In a subsidiary water unit for connection to the water space of a boiler, the combination of two generally parallel conduits, one having an inlet and the other an outlet, and a plurality of other conduits having a set of terminals connected to one of said parallel conduits and sloping toward its said inlet, and another set of terminals connected to the other of said parallel conduits and sloping toward its said outlet.

10. The combination with a boiler having a combustion chamber, a water space about said chamber, and a lateral opening from the exterior to said chamber, of a subsidiary water unit comprising upper and lower manifolds disposed lat-

erally of the center of said chamber, each manifold being connected to said water space and disposed horizontally within said combustion chamber, and a plurality of pipes, each coiled between its ends, and each communicating at its upper and lower ends, respectively, with said upper and lower manifolds, and disposed entirely laterally of said manifolds and between said manifolds and the center of said chamber, the vertical dimension of said unit being less than the vertical dimension of said opening.

11. The combination with a boiler having a combustion chamber, a water space about said chamber and a lateral opening from the exterior to said chamber, of a subsidiary water unit comprising upper and lower manifolds disposed about the vertical axis of said chamber, each manifold being connected to said water space and disposed horizontally within said combustion chamber, and a plurality of pipes, each communicating at its upper and lower ends, respectively, with said upper and lower manifolds, the lower terminal portions of said pipes sloping toward the inlet of said lower manifold, and the upper terminal portions of said pipes sloping toward the outlet of said upper manifold.

12. A heat exchange coil comprising a U-shaped tube and a coil extending between the arms of said U-shaped tube.

13. A heat exchange coil comprising a U-shaped tube and a plurality of coils extending between the arms of said U-shaped tube and connected to said arms at longitudinally spaced points.

JOSEPH F. KELLY.