

Nov. 7, 1933.

W. F. KEENAN, JR

1,934,072

SUPERHEATER BOILER

Filed March 22, 1927

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Fig. 2

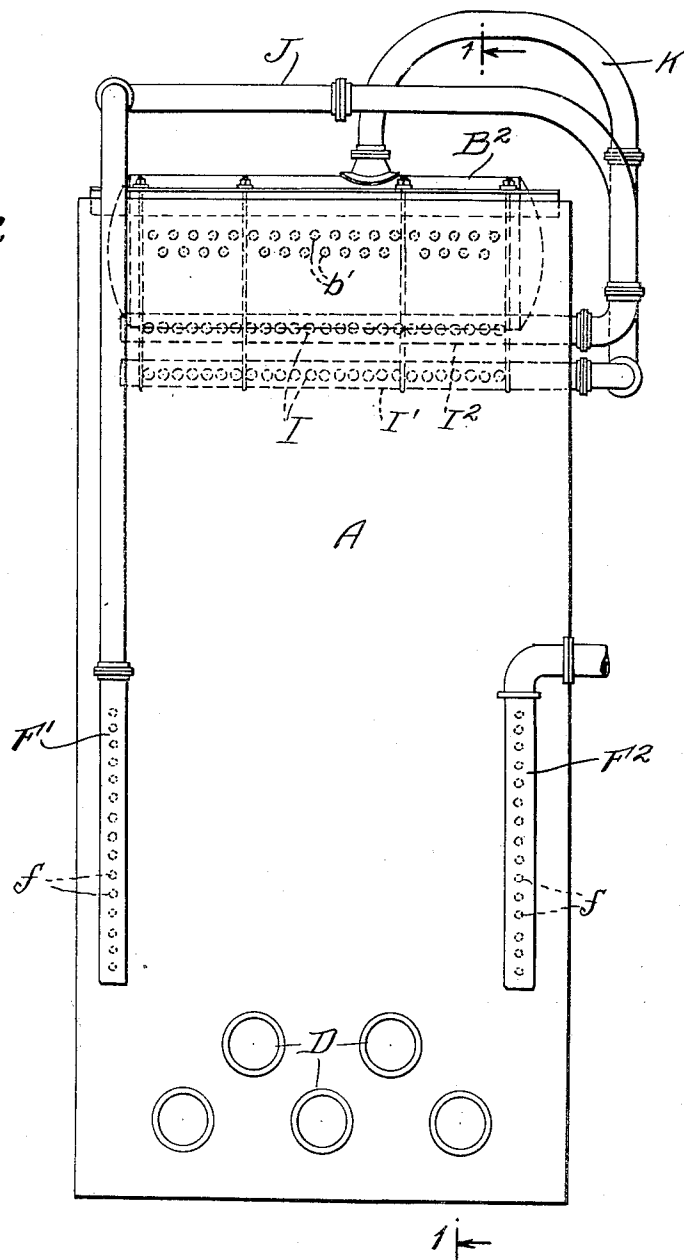
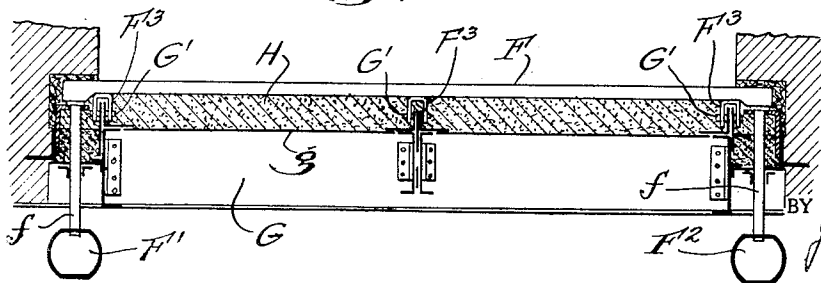


Fig. 3



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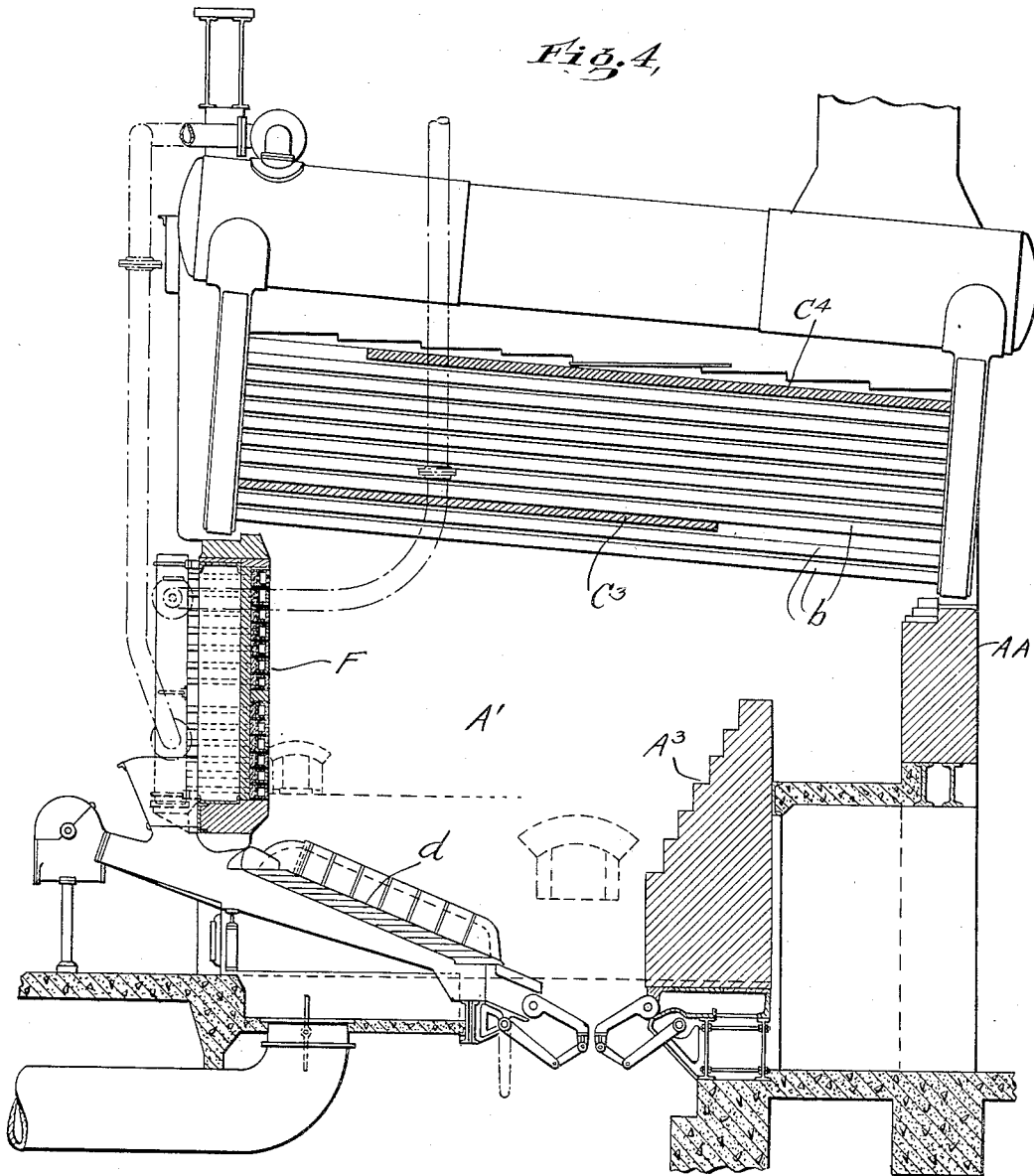
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3 Sheets-Sheet 3



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1,934,072

SUPERHEATER BOILER

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1 Claim. (Cl. 122—481)

The general object of the present invention is to provide a boiler furnace with a superheater arranged to absorb radiant heat from the combustion chamber of the boiler and so located and disposed with respect to the combustion chamber walls and the fuel burning provisions that the superheater may absorb radiant heat from the combustion chamber at a desirably rapid rate, and may exert a highly beneficial cooling action on the combustion chamber walls, and at the same time the superheater will not be subject to flame impingement.

The various features of novelty which characterize my invention are pointed out with particularity in the claim annexed to and forming a part of this specification. For a better understanding of the invention, however, and the advantages possessed by it, reference should be had to the accompanying drawings and descriptive matter, in which I have illustrated and described preferred embodiments of my invention.

Of the drawings:

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

Fig. 2 is a front elevation of a boiler;

Fig. 3 is a partial section on the line 3—3 of Fig. 1 and

Fig. 4 is a sectional elevation of a boiler of different type from that shown in Figs. 1, 2 and 3.

In Figs. 1, 2, and 3 of the drawings, I have illustrated the use of my invention in connection with a boiler A heated by the combustion of fuel burnt in suspension as powdered coal, oil or gas is burned. As shown the boiler A is of the horizontal cross drum type, though it is to be understood that the invention is capable of use with other types of water tube boilers. As shown, the boiler comprises an upper front box header B and a lower rear box header B'. The headers B and B' are connected by so-called horizontal water tubes b slightly inclined to the horizontal, as is usual. The upper portion of the front header B is connected to the steam and water drum B² by horizontal circulator tubes b', and the header B' is connected to the drum B² by nipples b². Baffles C, C', and C² may be provided to give the heating gases rising from the combustion chamber A', beneath the water tubes a multiplicity of passes across the latter before the gases reach the heating gas outlet A². The baffles C and C', as shown, are arranged to expose the lower rows of water tubes for their full length to heat radiation from the combustion chamber A' and to contact with the heating gases rising from said chamber, and to cause the heating gases to pass across the higher ends of the upper tubes in the first trans-

verse passage of the tubes by the heating gases. The boiler shown is primarily designed to be heated by the combustion of oil admitted to the combustion chamber through the inlets D' in the lower portion of the front wall of the boiler housing for the burners D. As shown, the masonry walls of the boiler housing are provided with air channels A³⁰ through which air for combustion may be drawn with the double object of cooling the walls and of preheating the air for combustion, but I have not thought it necessary to illustrate the connections for passing the air or fuel to the burners, or the details of construction of the latter, as such features of constructions are not essential features of the present invention and may be of well known type.

The front wall of the combustion chamber above the burner inlets D is lined by the radiant heat absorbing elements F of a radiant heat superheater of known type. The superheater shown comprises vertically disposed inlet and outlet headers F¹ and F², between which the elements F which are horizontally disposed, are connected to the headers at their opposite ends by transverse tubes f. The elements F are shown as of thick walled tubes rectangular in cross section and uniting to provide a smooth continuous heat absorbing surface extending from a level just below the bottom of the front boiler header B to a level somewhat above that of the upper burners D. The elements F are supported by a metallic supporting framework G which is incorporated in and forms a part of the front wall of the boiler housing and to which the elements F are connected by pins G' and yokes F³ welded to the elements. H represents suitable refractory heat insulating and gas leakage preventing material interposed between the outer sides of the elements F and a metal plate g secured to and forming a part of the frame work G. As shown, the radiant heat superheater is connected in series with a convection type superheater comprising elements I located between the water tubes b and b', but the use of a convection heated superheater in conjunction with the radiant heat superheater forms no part of the present invention. As shown, the elements I of the convection heated superheater are Foster elements of the U-tube type connected at their ends to inlet and outlet headers I' and I². J represents a steam pipe for passing steam from the outlet header I² of the convection heated superheater to the inlet header F' of the radiant heat superheater. Steam passes from the steam and water drum B² to the inlet header of the

convection heated superheater through a pipe K.

The location of the radiant heat superheater as shown in the front wall of the combustion chamber A' above the burner inlets D eliminates practically all possibility of tongues or jets of burning fuel impinging against the face of the superheater. This is highly desirable as flame impingement against the metal walls of a radiant heat superheater is quite injurious, particularly with the high temperatures obtainable in burning oil or the like fuel under efficient combustion conditions and with preheated combustion supporting air. Furthermore, the location of the radiant heat superheater illustrated and described is highly advantageous since it directly faces the rear wall of the combustion chamber toward which the burning fuel jets are directed and which therefore is adapted to radiate heat at a relatively high rate to the radiant heat superheater. In consequence, the amount of heat absorbing surface of the radiant heat superheater required for a given superheating effect is minimized, while at the same time the rear wall of the combustion chamber is subjected to a cooling action especially desirable because of the objectionably high temperature which it would otherwise attain. The location of the radiant heat superheater at the front and high end of the boiler above the burners D is convenient and desirable from the construction and maintenance standpoints as a superheater so located is readily accessible for inspection and repairs, particularly in installations in which available spaces for a steam piping, superheater headers, etc., are restricted.

While, as indicated, there are certain special advantages in locating the superheater above the burner inlets in some cases, the general advantages of locating the superheater in a vertically disposed wall of the combustion chamber away from which the fuel jets extend so as to avoid flame impingement against the superheater, and so as to absorb radiant heat from an opposing wall towards which the burning jets travel, are not dependent on whether the superheater is located above the burner inlets, or below the burner inlets, or is divided into sections located one above and the other below the inlets.

The invention may be used with advantage with boiler furnaces fired by the combustion of coal burned on a grate as shown in Fig. 4, where

the radiant heat absorbing superheater F' opposes the rear wall A³ of the combustion chamber A' of a boiler furnace AA having a stoker grate *d* inclined downwardly toward the wall A³ from the front wall of the furnace in which the superheater F' is located at a level above the high end of the stoker. C³ and C⁴ are longitudinal baffles in the bank of tubes *b*. In the operation of the boiler AA the superheater is advantageously disposed from the standpoint of heat absorption, and is in a position in which it is to a substantial extent free from exposure to flame impingement as the burning gases are directed away from, rather than toward the wall containing the superheater, as they pass toward the tube bank pass at the right of the lower longitudinal tube bank baffle C³.

In accordance with the provisions of the statutes I have illustrated and described the best form of my invention now known to me, but it will be apparent to those skilled in the art that changes may be made in the form of the apparatus disclosed without departing from the spirit of my invention as set forth in the appended claim, and that certain features of my invention may sometimes be used to advantage without a corresponding use of other features.

Having now described my invention, what I claim as new and desire to secure by Letters Patent, is:—

The combination with a steam generator combustion chamber having a pair of opposed refractory walls and water tubes arranged above said combustion chamber, of a radiant heat absorbing superheater lining one of said refractory walls and formed by a plurality of channeled metallic elements having one side directly exposed to heat radiation from said chamber and opposed refractory wall, fuel burning means arranged adjacent to said superheater, heating gas flow directing means arranged adjacent to the upper end of said combustion chamber, and said fuel burning means and heating gas flow directing means being disposed and relatively arranged to cause the heating gases to move through said combustion chamber along a general path of flow away from said superheater and towards said opposed refractory wall, thereby minimizing flame impingement against the exposed sides of said superheater elements.

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