

Aug. 9, 1938.

W. R. WOOD

2,126,524

SLAGGING FURNACE

Filed Jan. 27, 1936

3 Sheets-Sheet 1

Fig. 1.

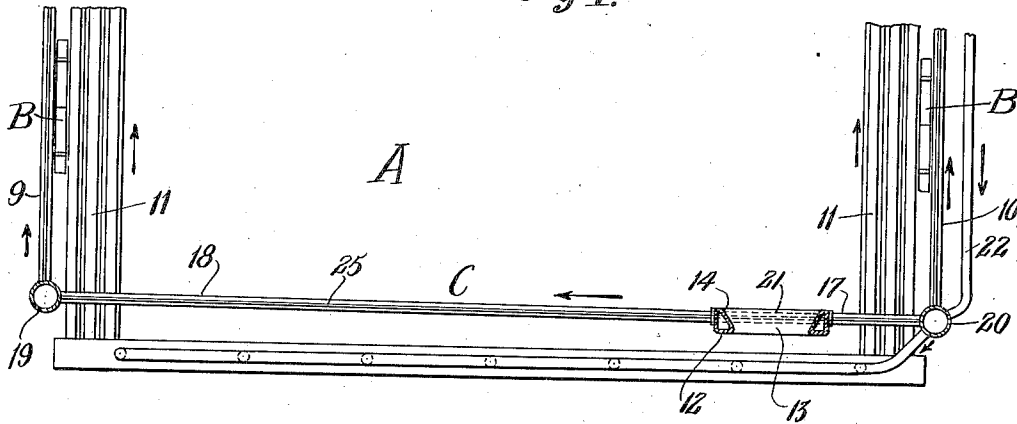


Fig. 2.

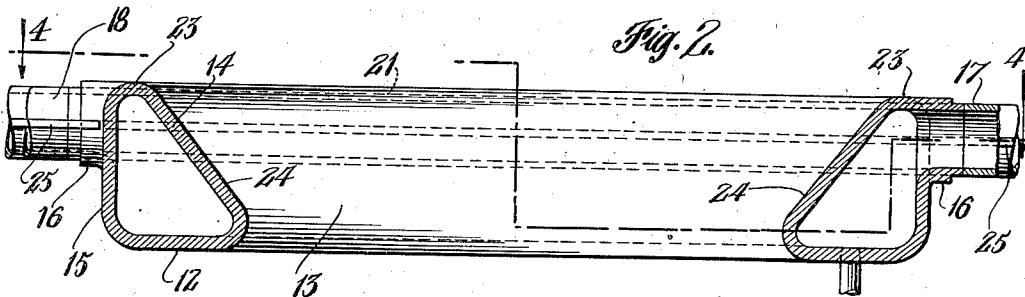
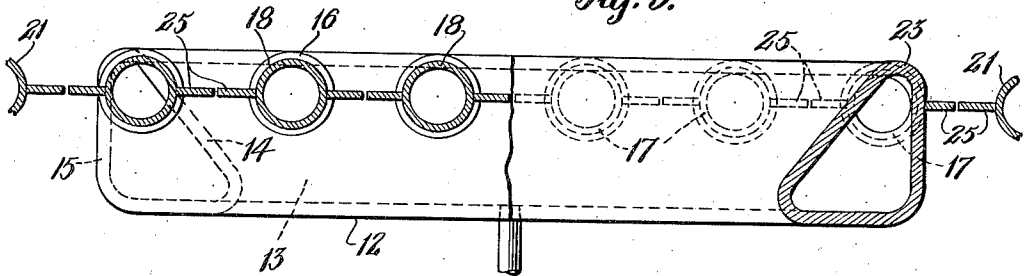


Fig. 3.



INVENTOR

Wilfred R. Wood

BY

Symmes & Lechner
ATTORNEYS

Aug. 9, 1938.

W. R. WOOD

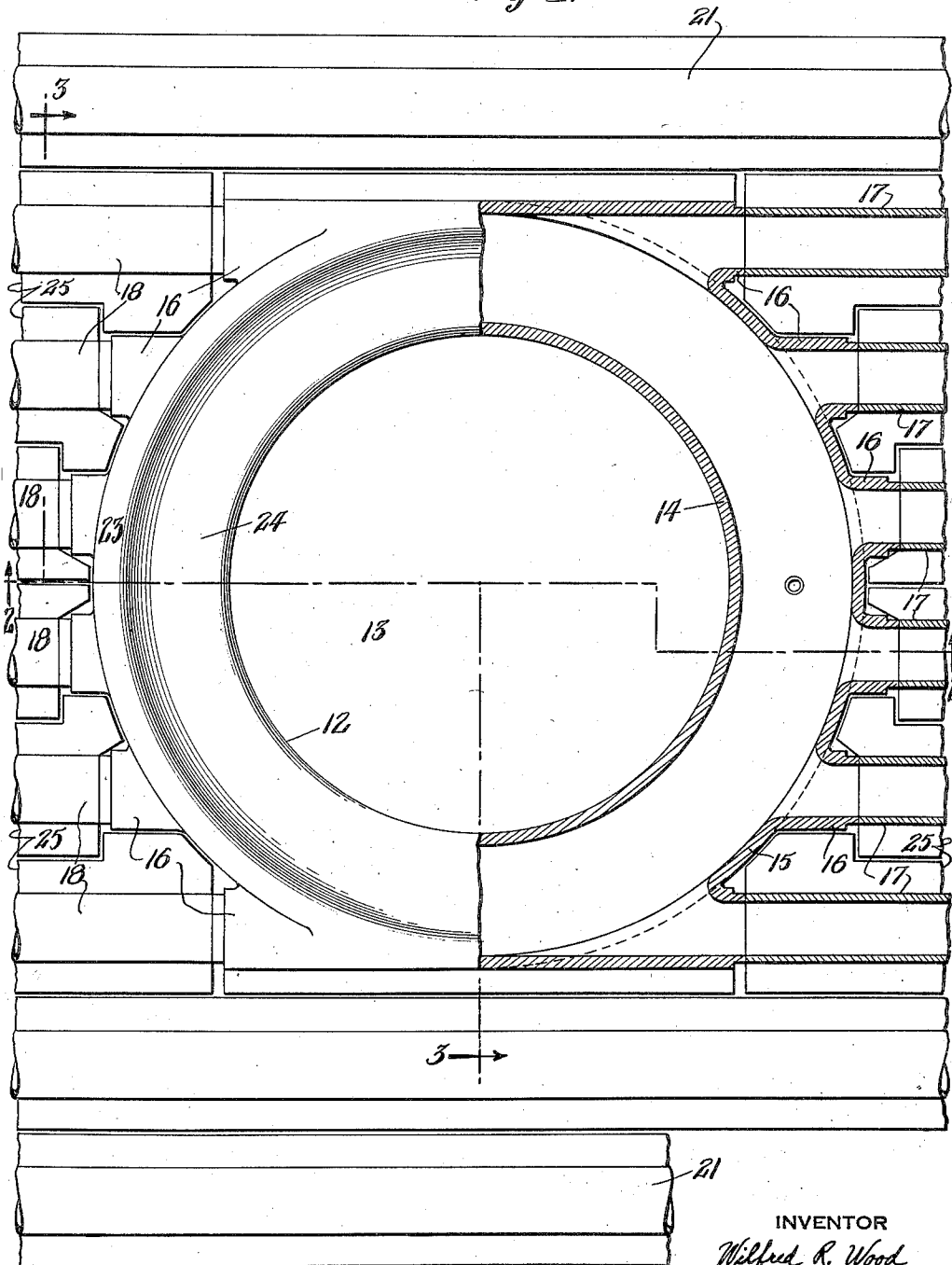
2,126,524

SLAGGING FURNACE

Filed Jan. 27, 1936

3 Sheets-Sheet 2

Fig. 4.



INVENTOR
BY *Wilfred R. Wood*
Symmett & Lechner
ATTORNEYS

Aug. 9, 1938.

W. R. WOOD

2,126,524

SLAGGING FURNACE

Filed Jan. 27, 1936

3 Sheets-Sheet 3

Fig. 5

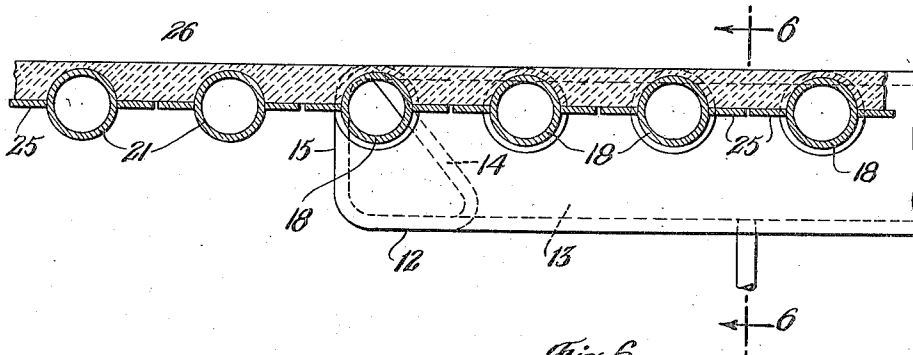


Fig. 6

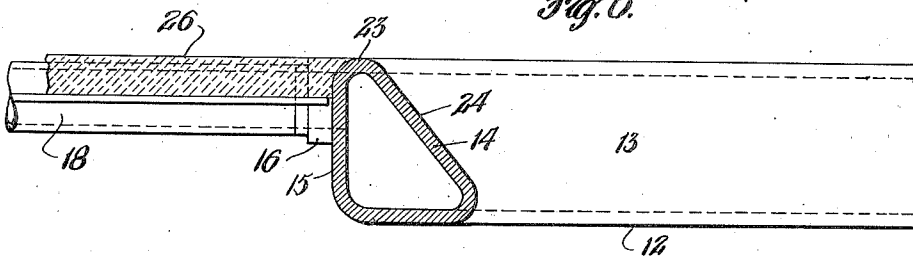


Fig. 7

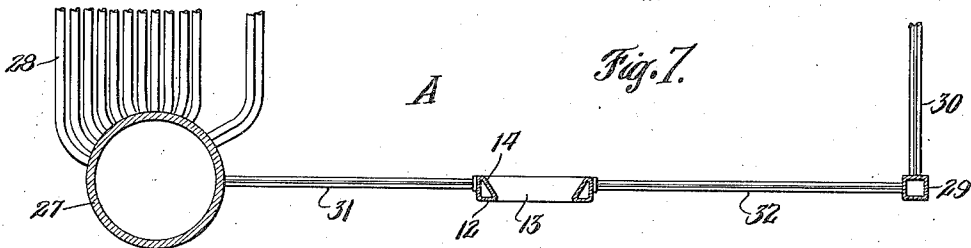
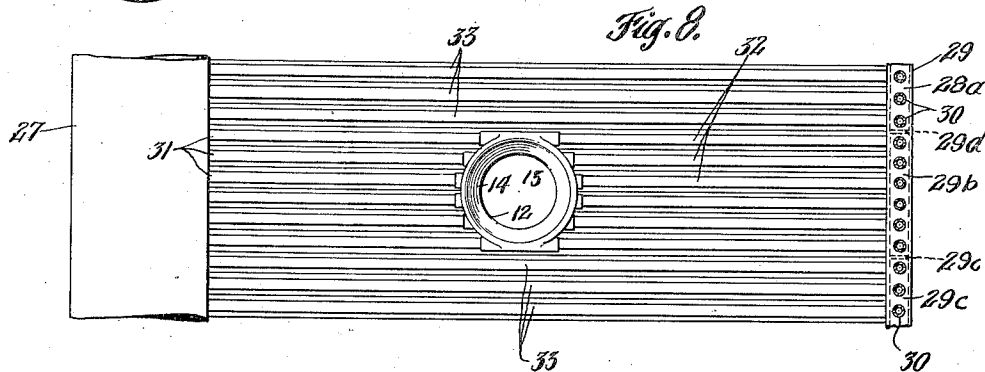


Fig. 8



INVENTOR

W. R. Wood

BY

Synnestvedt & Lechner

ATTORNEYS

UNITED STATES PATENT OFFICE

2,126,524

SLAGGING FURNACE

Wilfred Rothery Wood, New York, N. Y., assignor to Combustion Engineering Company, Inc., New York, N. Y., a corporation of Delaware

Application January 27, 1936, Serial No. 60,973

13 Claims. (Cl. 122—235)

This invention relates to slagging furnaces and its primary object is to provide an improved furnace in which the slag flows off as deposited without accumulation in a pool as is the customary practice.

Another object of my invention is the provision of improved slag discharge means for furnaces of the above character.

A further object of my invention is the provision of a bottom having a discharge opening extending therethrough which is formed by means of a hollow metallic cooled ring of novel construction.

Still another object resides in a novel arrangement of securing adequate flow of a cooling medium through the ring.

How the foregoing, together with such other objects and advantages as may hereinafter appear, or are incident to my invention, are realized, is illustrated in preferred form in the accompanying drawings, wherein—

Figure 1 is a fragmentary sectional elevation of a furnace and boiler installation embodying my invention;

Figure 2 is an enlarged fragmentary cross-section taken on the line 2—2 of Figure 4;

Figure 3 is an enlarged fragmentary cross-section taken on the line 3—3 of Figure 4;

Figure 4 is a plan view of Figure 2;

Figure 5 is a fragmentary cross-sectional view similar to Figure 3;

Figure 6 is a cross-section taken on the line 6—6 of Figure 5;

Figure 7 is a fragmentary elevational view similar to Figure 1, illustrating a modification of the invention; and

Figure 8 is a plan view of Figure 7.

The furnace and boiler installation illustrated comprises in general a combustion chamber A, burner means B for introducing finely divided fuel, such as pulverized coal, and air, into the combustion chamber, and preferably arranged for vortical firing with the fuel and flame stream directed toward the bottom, upright steam evaporating tubes 9, 10, and 11 at the rear, front and side walls respectively of the combustion chamber and a bottom indicated as a whole by the reference letter C. The tubes of the upright walls of the combustion chamber are connected to deliver into steam space of the boiler and are preferably arranged to provide continuous metallic walls for the chamber, and may be provided with laterally extending fins for this purpose.

The bottom C comprises a plurality of substantially horizontally disposed tubes and a hollow

metallic ring 12 providing a discharge opening 13 for liquid slag, which, as will appear fully hereinafter, flows off as deposited. In Figure 1, I have illustrated the ring 12 as located adjacent one of the end walls of the combustion chamber, while in Figures 7 and 8 it is located substantially centrally of the bottom.

The ring 12 may be made of cast steel and its inner wall 14 is circular so as to provide a round discharge opening. The outer wall 15 of the ring is also preferably made circular and is provided with a plurality of nipple portions 16 for certain of the bottom tubes, which, in this instance, are shown welded to the nipple portions. By referring to Figure 1, it will be seen that the bottom tubes which are connected into the ring are divided into two portions, namely, short tubes or nipples 17 and longer tubes 18, the nipples 17 being horizontally disposed and the longer tubes 18 inclining slightly upwardly from the ring to the lower header 19 of the rear wall tubes 9. The nipples 17 are connected at one end into the ring 12 and at their other ends into the lower header 20 of the front wall tubes 10.

It will be seen from the foregoing and from reference to Figures 1 and 4 of the drawings that all of the bottom tubes which are in alignment with the ring 12 are divided into two groups, the right-hand group comprising the plurality of shorter tubes or nipples 17 connected into the right-hand side of the ring and the left-hand group comprising the plurality of longer tubes 18 connected into the left-hand side of the ring. The remaining tubes 21 of the bottom extend continuously across the bottom from the header 20 to the header 19 and incline slightly upwardly from the header 20 to the header 19 to correspond to the inclination of the tubes 18.

A plurality of downcomer tubes 22 leading from water space of the boiler are connected into the header 20 for water supply to the upright wall tubes and to the bottom tubes. Since the bottom tubes are connected into the header 19, they deliver thereinto and the flow from the header is upwardly through the upright tubes 9 of the rear wall of the furnace.

I prefer to make the cross-sectional area of the ring 12 approximately equal to the combined cross-sectional area of the plurality of tubes entering one side thereof in order to reduce the resistance to flow through the ring to a minimum. By this arrangement forced feed for the ring can be avoided and the natural circulation of the boiler relied upon to ensure adequate supply of water to the ring.

In its preferred form the ring is of substantially triangular shape in cross-section with the narrow portion 23 constituting the top of the ring and the sloping surface 24 constituting the inner wall of the ring over which the slag flows. By sloping the surface 24 the inner wall of the ring is subjected more to radiant heat in the furnace than it would be if the surface was vertical. It has been found by actual experience that where this surface is vertically disposed slag will accumulate and grow and not melt off so that there is a decrease in the size of the opening, while with this surface disposed at an angle the full size of the opening is maintained to provide a continuous slag tap of predetermined size because, if there is any tendency for slag to accumulate, it immediately melts and runs off due to the exposure to the radiant heat in the furnace afforded by the sloping surface.

Another advantage of employing a ring having the cross-section shown is that the top surface thereof which is exposed to molten slag is approximately equal to the top surface of the tubes which is effectively exposed to the slag. Thus I do not expose a horizontal surface of the ring to the slag of sufficient area to cause the slag to solidify and build up at the ring higher than the level at the tubes.

Referring particularly to Figures 2 and 3, it is pointed out that the tubes entering the ring are arranged so that the tops thereof are substantially flush with the top of the ring and so that the inside tops of the tubes are flush with the inside top of the ring in order to avoid steam pockets. The intertube space may be closed by fins 25 and the space above may be filled with refractory material 26, as illustrated in Figures 5 and 6. I employ a neutral refractory such as chromium ore which is not attacked by basic slag or acid slag and which is dense and of relatively high heat conductivity and, therefore, very suitable for providing a flat surface on the slag floor which will withstand the effect of service for a long period of time, this being important in non-pooling continuously running slag operation. Thus I have provided an arrangement in which the ring is approximately flush with the surrounding floor surface so that the liquid slag will not accumulate in a pool but will run off continuously as deposited.

Referring to the circulation of the cooling medium through the bottom tubes, I find it desirable in some instances to isolate the circulation through the tubes which are connected into the ring 12 from the circulation through the other bottom tubes and I have illustrated a method of accomplishing this in Figures 7 and 8. In these figures I have shown a boiler and furnace installation having a lower drum 27 into which the tubes of an upright bank of tubes 28 are connected and a lower header 29 into which the upright wall tubes 30 are connected.

The bottom tubes which are in alignment with the ring 12 comprise a plurality of inlet tubes 31 connected at one end into the drum 27 and at their other ends into the ring, and a plurality of outlet or discharge tubes 32 connected at one end into the ring and at their other ends into the lower header 29. The remaining bottom tubes 33 are connected at one end into the drum 27 and at their other ends into the header 29. Thus flow through the bottom tubes 33 and through the inlet tubes 31, ring 12, and outlet tubes 32 is from the drum 27 to the header 29 and thence upwardly through the upright wall tubes 30.

The lower header 29 is divided into three sections 29a, 29b and 29c by dividing walls 29d so arranged that the discharge tubes 32 deliver into the separated portion or section 29b of the header 29 and that the remaining bottom tubes 33 deliver into the sections 29a and 29c.

Thus I have provided an arrangement whereby the plurality of tubes 31 and 32 are isolated, insofar as circulation is concerned, from the rest of the bottom tubes 33, receive water from the drum 27 which also supplies the tubes 33, and are connected to an isolated riser section of the upright water wall 30. This insures good water flow through the ring, which otherwise might be weakened by the added resistance of the ring, causing the water to seek the easier path through the tubes 33 which are not connected to the ring.

I claim:

1. In a bottom for slagging furnaces, the combination of hollow ring-like means providing a slag discharge opening extending through said bottom, and a plurality of inlet and outlet tubes connected into said means for the circulation of a cooling medium therethrough, said tubes being arranged so that the top portions thereof are substantially flush with the top portion of the ring-like means.

2. In a bottom for slagging furnaces, the combination of hollow ring-like means providing a slag discharge opening extending through said bottom, and a plurality of inlet and outlet tubes connected into said means for the circulation of a cooling medium therethrough, the cross-sectional area of said ring-like means narrowing from bottom to top.

3. In a bottom for slagging furnaces, the combination of hollow ring-like means providing a slag discharge opening extending through said bottom, and a plurality of inlet and outlet tubes connected into said means for the circulation of a cooling medium therethrough, said ring-like means being approximately triangular in cross-section.

4. In a bottom for slagging furnaces, the combination of hollow means providing a slag discharge opening extending through said bottom, and inlet and outlet tubes connected into said means for the circulation of a cooling medium therethrough, said hollow means having an inclined inner wall defining a sloping surface over which the discharging slag flows, said sloping surface being disposed to be subjected to radiant heat in the furnace.

5. In a bottom for slagging furnaces, the combination of hollow means providing a slag discharge opening extending through the bottom, a plurality of inlet and outlet tubes connected into said hollow means, said inlet and outlet tubes being connected into said hollow means at opposed points and being of the same area, and said hollow means having a cross-sectional area approximately equal to the combined cross-sectional area of one of said plurality of tubes and having a sloping surface over which discharging slag flows which is exposed to radiant heat in the furnace.

6. In a bottom for slagging furnaces, the combination of a hollow ring-like member providing a slag discharge opening extending through the bottom, a plurality of inlet tubes connected into one side of said member, and a plurality of outlet tubes connected into the opposite side of said member, said inlet and outlet tubes being of the same area, and said hollow ring member having a cross-sectional area approximately equal to the

combined cross-sectional area of one of said plurality of tubes and being of approximately triangular shape in cross-section with a relatively narrow annular top surface exposed to the slag.

5 7. A bottom for slagging furnaces having a substantially flat top surface and an opening extending therethrough through which liquid slag flows without collecting in a pool on said bottom, comprising hollow ring-like means defining said opening, a plurality of inlet and outlet tubes connected into said means for the circulation of a cooling medium therethrough, said tubes being connected into the upper portion of the outer upright wall of said means so that the tops of the tubes are substantially flush with the top of the ring-like means, and means filling the spaces between said tubes to substantially the level of the top of the tubes and ring-like means.

8. A bottom for slagging furnaces having a substantially flat top surface and an opening extending therethrough through which liquid slag flows without collecting in a pool on said bottom, comprising a hollow ring-like member defining said opening, a plurality of inlet and outlet tubes connected into said member for the circulation of a cooling medium therethrough, said tubes being connected into the upper portion of the outer upright wall of said member so that the tops of the tubes are substantially flush with the top of the ring-like member, and means filling the spaces between said tubes to substantially the level of the top of the tubes and ring, and bottom structure associated with the aforesaid elements to complete the furnace bottom and having its top substantially at the level of the top of said elements.

9. A bottom for slagging furnaces having a substantially horizontally disposed top surface and an opening extending therethrough through which liquid slag flows without collecting in a pool on said bottom, comprising hollow ring-like means defining said opening, a plurality of substantially horizontally disposed inlet and outlet tubes connected into said hollow ring-like means for the circulation of a cooling medium therethrough, and refractory means associated with said tubes to provide a top surface for the bottom which is substantially flush with the top surface of said hollow means.

10. In a furnace for burning slag forming fuel, the combination of a combustion chamber, a bottom for said chamber comprising spaced cooling tubes constructed and arranged to prevent slag from passing through the spaces between tubes, hollow ring-like means to which a plurality of said tubes are connected for the circulation of a cooling medium through the ring-like means,

means providing cooling medium supply to and delivery from said cooling tubes with the delivery of the tubes which are connected into the ring-like means independent of the delivery of the remaining tubes.

11. In a furnace for burning slag forming fuel, the combination of a combustion chamber, steam evaporating tubes at an upright wall of said chamber, header means into which the lower ends of said tubes are connected, a bottom for said chamber comprising spaced cooling tubes constructed and arranged to prevent slag from passing through the spaces between tubes, hollow ring-like means to which a plurality of said tubes are connected for the circulation of a cooling medium through the ring-like means, and means for supplying the cooling medium to said cooling tubes, said cooling tubes being connected to deliver into said header means, and said header means being divided to isolate the delivery of the cooling tubes which are connected into the ring-like means from the delivery of the remaining cooling tubes.

12. In a boiler and furnace installation fired with slag forming fuel, the combination of a boiler, a combustion chamber, steam evaporating tubes at an upright wall of said chamber, header means into which the lower ends of said tubes are connected, and a bottom for said chamber comprising hollow ring-like means providing a discharge opening for slag, a plurality of tubes having downcomer connection from the boiler for supplying water to said ring-like means, and a plurality of tubes leading from the ring-like means to said header means, whereby upcomer connection is provided to the boiler constituted in part by furnace wall tubes.

13. In a boiler and furnace installation fired with slag forming fuel, the combination of a boiler, a combustion chamber, steam evaporating tubes at an upright wall of said chamber, header means into which the lower ends of said tubes are connected, and a bottom for said chamber comprising hollow ring-like means providing a discharge opening for slag, a plurality of tubes having downcomer connection from the boiler for supplying water to said ring-like means, a plurality of tubes leading from the ring-like means to said header means, and means dividing the portion of said header means into which said last mentioned tubes are connected from the remainder of the header means whereby upcomer connection is provided to the boiler through part of the furnace wall tubes and independent of the remainder of said wall tubes.

WILFRED ROTHERY WOOD.