

Dec. 16, 1930.

C. E. HAWKE

1,785,583

COMBUSTION CHAMBER

Filed Dec. 27, 1926

2 Sheets-Sheet 1

Fig. 1.

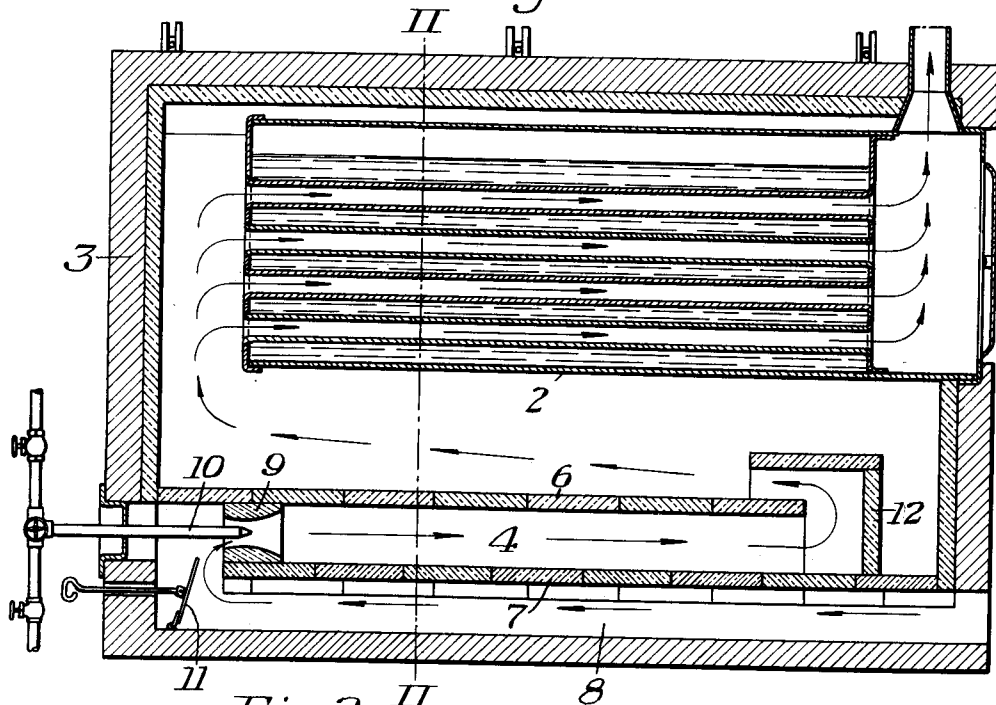


Fig. 2.

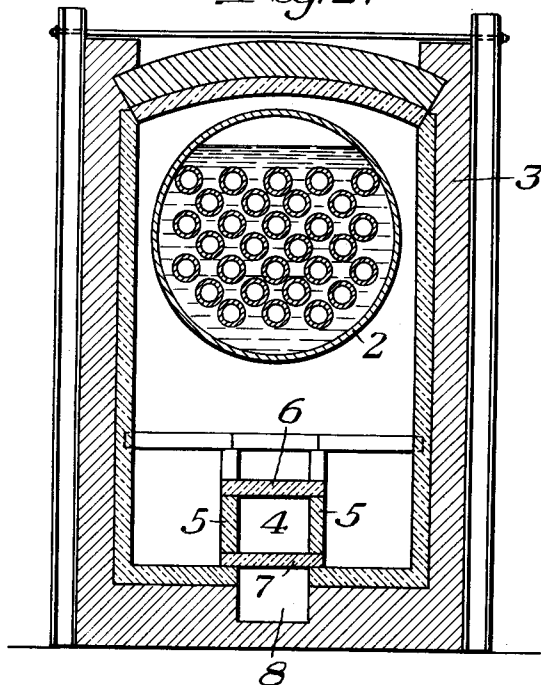
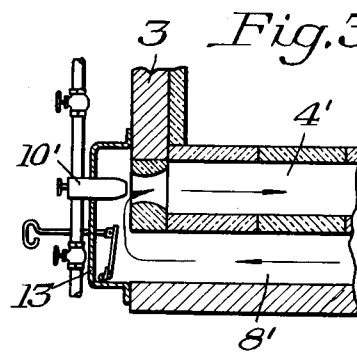


Fig. 3.



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by his attorneys
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Dec. 16, 1930.

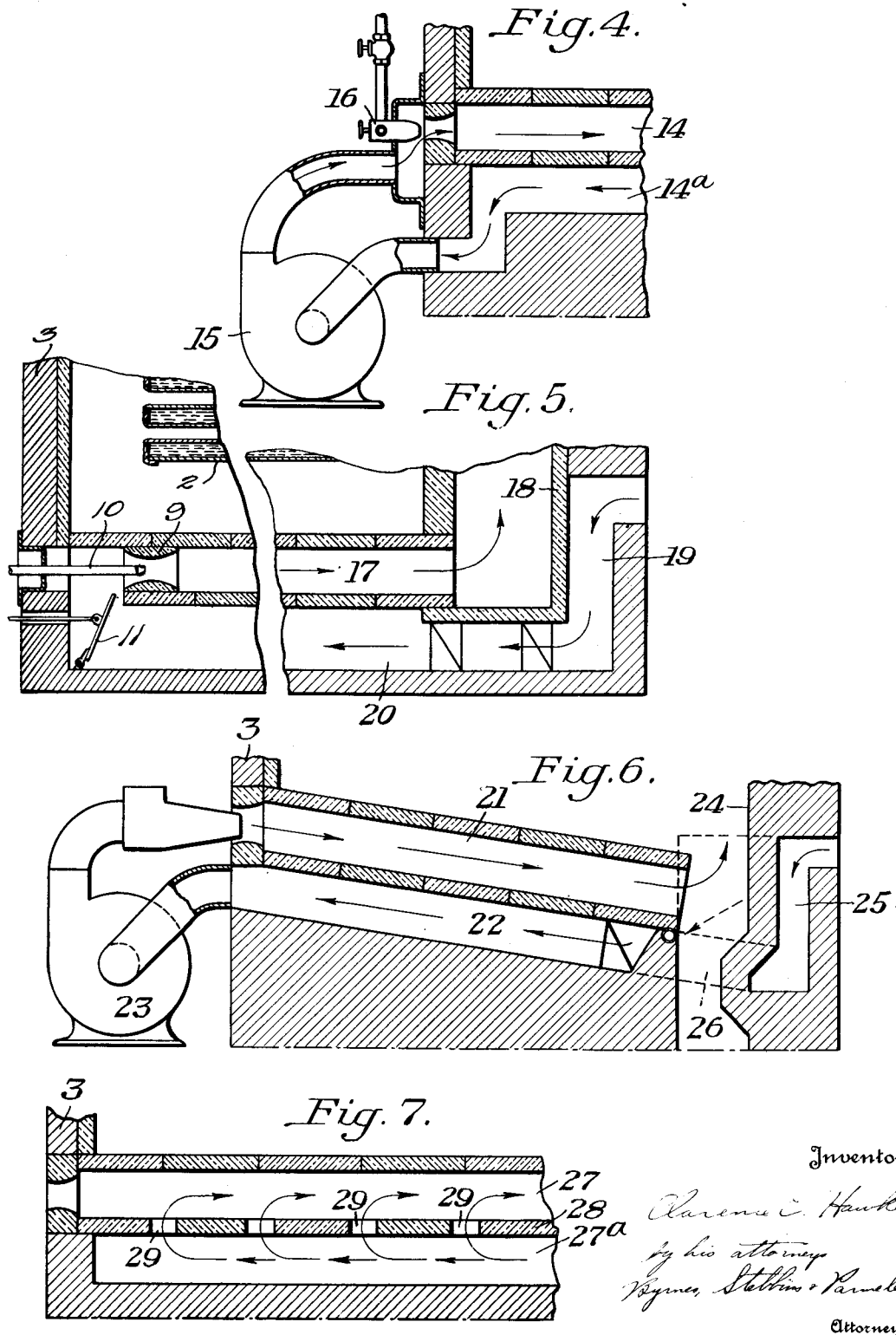
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2 Sheets-Sheet 2



UNITED STATES PATENT OFFICE

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COMBUSTION CHAMBER

Application filed December 27, 1926. Serial No. 157,108.

The present invention is for an improvement in fuel burning apparatus, and relates more particularly to combustion chambers of the radiating combustion type as described in United States Patents 1,371,773, 1,371,774 and 1,550,340 to H. B. Cannon.

The patents above mentioned disclose fuel burning chambers in which gas, liquid or powdered fuel may be burned, and which comprises an elongated passage formed of a refractory material of high thermal conductivity, such as silicon carbide, and having a fuel burner at one end thereof.

The usual method of installing a radiating combustion chamber of the Cannon type has been to set the furnace on the floor of the heating chamber so that only the two sides and the top of the furnace are able to dissipate heat by radiation. The floor tiles of such a combustion chamber are cooled to a certain extent by conduction and radiation from other parts of the furnace, but it has been found by actual measurement that the temperature of the bottom of the combustion chamber is always higher than the temperature of the sides and the top of the chamber.

It has been proposed to reduce the temperature at the bottom of the combustion chamber by supporting the combustion chamber on piers, but this expedient has not proven successful in practice and the portions of the radiating chamber resting directly on the piers have been found to become much hotter than the refractories in the other part of the chamber, this of course being due to the fact that these portions are not free to radiate heat directly to the cold absorbing surfaces.

In certain types of installations employing radiating combustion chambers it is desirable that the refractories be maintained at a comparatively low temperature. This is particularly true in cases in which pulverized fuel is being burned and in which the molten ash has an erosive action on the refractories, this action greatly increasing with the increase in temperature. A further disadvantage of the present type of construction is that the foundations under the combustion chamber are distorted and sometimes actually melted due to the higher temperatures in the bottom tiles

of the combustion chamber from which there is no direct radiation. Another undesirable result of this unequal heating of the combustion chamber arises from the uneven expansion in the combustion chamber which has a tendency to open the joints thereof, causing leakage of the combustion gases and poor control of the combustion.

According to the present invention it is proposed to provide means for air-cooling the bottom of the combustion chamber, and to provide means for circulating a draft of cooling air around or in direct contact with those portions of the chamber which otherwise become heated to the greatest extent. According to my invention it is proposed to utilize the air which thus becomes preheated in the combustion of the fuel. I thereby not only preserve the refractories and prevent overheating of the bottom tiles of the combustion chamber, eliminating the inherent disadvantages of such heating, but also obtain more efficient combustion of the fuel by the preheating of the air.

My invention may be readily understood by reference to the accompanying drawings showing certain preferred embodiments of my invention. In the drawings—

Figure 1 represents a vertical longitudinal section through a boiler fired by a combustion chamber of the Cannon type and where in one form of my invention is incorporated;

Figure 2 is a transverse vertical section in the plane of line II—II of Figure 1;

Figure 3 is a detail view showing a slight modification for adapting the design to an air atomizing furnace and induced draft;

Figure 4 shows an arrangement which may be employed where a system of forced draft is utilized;

Figure 5 is a fragmentary view of the rear end of the combustion chamber showing means for also cooling the deflecting tile at the end of the combustion chamber;

Figure 6 shows an inclined combustion chamber with an arrangement particularly adapted for the combustion of powdered coal; and

Figure 7 shows a slightly modified ar-

rangement in which the air is introduced into the combustion chamber at various points.

Referring to the drawings, and particularly to the construction shown in Figures 1 and 2, 2 designates a boiler of any suitable construction located in a furnace 3 having a radiating combustion chamber 4 therein below the boiler. The radiating combustion chamber is in the form of an elongated tunnel formed of side tiles 5, top tiles 6 and bottom tiles 7. This combustion chamber is preferably formed of silicon carbide or other material having a high coefficient of thermal conductivity. The side walls 5 are supported on the bottom tiles 7. The side walls 5 of the combustion chamber are supported on the bottom tiles 7, and the bottom tiles 7 are supported at their side edges only, as clearly shown in Figure 2, the furnace having a central flue 8 therein directly under the bottom tiles 7. At the forward end of the combustion chamber 4 is an end tile 9 into which projects a fuel nozzle 10. At 11 there is indicated a damper which may be provided between the flue 8 and the forward end of the combustion chamber to control the flow of air through the flue into the combustion chamber. At the opposite end of the combustion chamber there is preferably provided a vertical tile 12 for deflecting the flame and hot gases of combustion upwardly into the fire box of the furnace.

In the operation of the invention there is an induced flow of air from the open end of the flue 8 toward the closed end thereof, and this air is drawn into the combustion chamber. In passing along the flue 8 the air comes in contact with the bottom tiles 7 of the combustion chamber, and the tiles 7 are thus cooled, while the air is preheated prior to being introduced into the combustion chamber. The area of the bottom tiles which is not directly cooled by contact of the air therewith is relatively small, and none of this portion of the tile is subjected to the direct action of the flame in the combustion chamber due to the fact that the upper surface is protected by the side walls 5.

In the arrangement shown in Figure 3 there is an arrangement wherein the burner 10' is located outside the furnace, and a casing 13 of metal serves to direct the air from the lower flue 8', corresponding to the flue 8 of Figure 1, into the combustion chamber 4'. This arrangement is particularly adapted for the so-called air atomizing burner, whereas the construction shown in Figures 1 and 2 is for the so-called steam atomizing burner. These types of burners are well known in the art and form no part of the present invention.

In the arrangement shown in Figure 4, 14 designates the radiating combustion chamber and 14^a is the air circulating passage under the combustion chamber. A blower 15 is pro-

vided for drawing air through the passage 14^a and forcing it into the radiating combustion chamber. The burner is indicated at 16.

In Figure 5 there is illustrated a modification for cooling the deflecting tile at the end of the combustion chamber. In this figure, 17 designates the combustion chamber and 18 is a deflecting tile spaced away from the discharge end thereof against which the hot gases of combustion impinge upon emerging from the combustion chamber. In order to secure a cooling of the tile 18, which under normal conditions becomes intensely hot, there is provided a flue 19 extending vertically down the outside of the tile 18 and communicating with a flue 20 extending under the combustion chamber, the flue 20 being similarly disposed to the combustion chamber as the flue 8 in Figure 1.

In the arrangement shown in Figure 6 the combustion chamber 21 is set at an incline with the forward end elevated above the discharge end. An air passage 22 is provided under the combustion chamber 21, this passage 22 being arranged in the same manner with respect to the combustion chamber that the flue 8 of Figure 1 is arranged. A blower 23 serves to maintain a forced circulation. At the discharge end of the combustion chamber is a vertical wall 24, and for the purpose of cooling this wall there is an air intake flue 25 which communicates through an offset flue 26 with the flue 22.

In the construction shown in Figure 7 the radiating combustion chamber is designated 27 and the air circulating flue under the chamber is designated 27^a. In the bottom 28 of the combustion chamber are a plurality of holes or ports 29 communicating with the flue 27 and through which air passes from the flue into the radiating combustion chamber. This arrangement may be used with either gas or powdered coal, and is advantageous in some cases where it is desirable to lengthen the combustion flame.

While I have shown and described certain preferred embodiments of the invention, it will be understood that the invention may be otherwise embodied, and that various changes and modifications may be made in the illustrated embodiments within the contemplation of my invention and under the scope of the following claims.

I claim:

1. In a fuel burning apparatus, a radiating combustion chamber, a deflecting wall at one end of the combustion chamber, and an air passage immediately at the rear of the deflecting wall and extending under the radiating combustion chamber so that air passing therethrough may wipe the outside of the said deflecting wall and the bottom of the combustion chamber, and means for conducting air from the flue into the combustion chamber.

2. In a fuel burning apparatus, a radiating combustion chamber, a deflecting wall at one end of the combustion chamber, and an air passage at the rear of the deflecting wall and extending under the radiating combustion chamber, the other end of said flue communicating with the interior of the radiating combustion chamber.

3. In a fuel burning apparatus, a radiating combustion chamber of the type especially constructed for the dissipation of heat through the walls thereof to an external means for utilizing the heat, a supporting structure therefor, an air circulating passage between the supporting structure and the combustion chamber, said passage being closed against the escape of air around the sides of the combustion chamber, means for inducing a flow of air through the passage, means for conducting such air from the passage into the chamber, and means located entirely outside the chamber for utilizing the heat radiated therefrom.

4. In a fuel burning apparatus radiating combustion chamber especially constructed for the dissipation of heat through the walls thereof to an external means for utilizing the heat, a supporting structure for said chamber, a flue between the combustion chamber and said supporting structure, the bottom of the combustion chamber constituting the top of the flue, a burner at one end of the combustion chamber, a passage connecting the burner end of the chamber with the corresponding end of the flue, means for forcing a current of air through the flue, and means external of the chamber for utilizing the heat radiated therefrom.

In testimony whereof I have hereunto set my hand.

CLARENCE E. HAWKE.