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FURNACE

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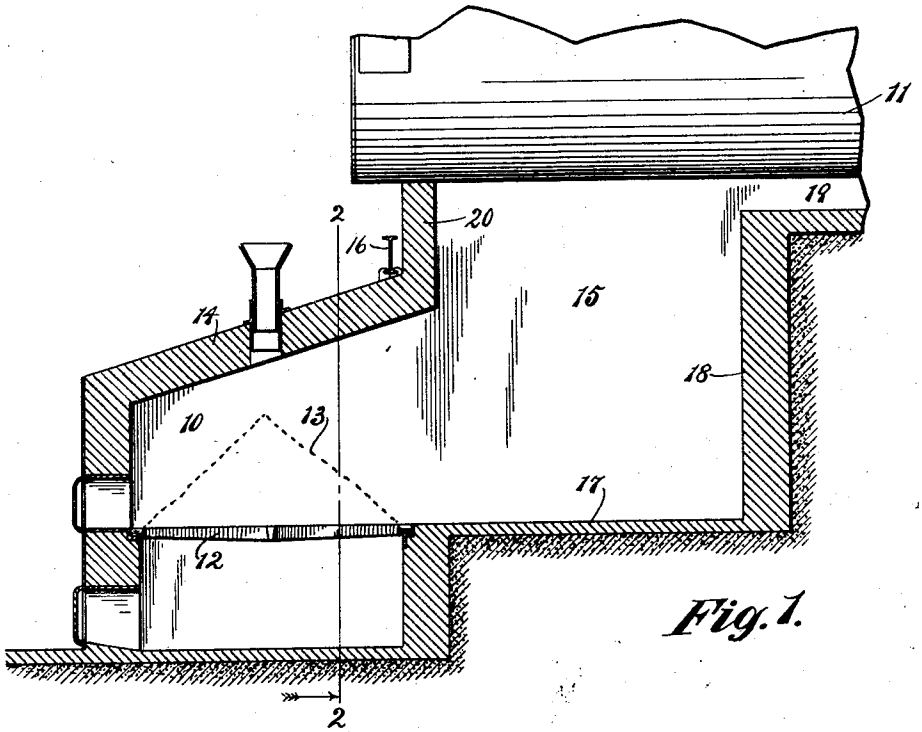

Fig. 1.

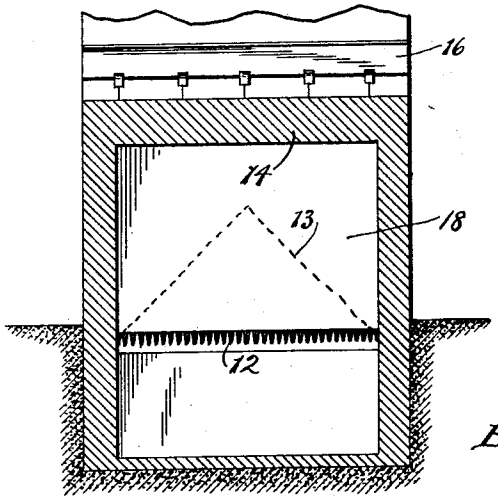

Fig. 2.

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UNITED STATES PATENT OFFICE.

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FURNACE.

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The invention relates to steam boiler furnaces and has for its object the provision of a furnace of improved design having particular reference to securing increased capacity with fuel of low grade while still insuring complete combustion and economical use of the selected fuel.

As the combustion of solid fuel comprises the production of combustible gases by destructive distillation of the fuel in the first instance, and then the burning of the gases so produced, the total capacity of the furnace for economical use of the fuel depends both upon its capacity for destructive distillation of the solid fuel and its capacity for burning combustible gases to good advantage. Furthermore, as low grade fuels usually contain but small amounts of fixed carbon and produce gases of only relatively low heating value, the proportion of the total heat of combustion derived from the burning gases is larger than in the case of better fuels and larger amounts of gas must be produced and burned. And finally, as some of the low grade fuels contain moisture in amounts equal to and even exceeding the weight of dry fuel, this moisture must be evaporated from the fuel bed and the resulting water vapor substantially dilutes the combustible gases.

It follows that, particularly with low grade wet fuels, the relatively small amount of combustion which takes place in the fuel bed cannot be relied upon to provide sufficient heat for the rapid drying and destructive distillation of fresh fuel and not only must ample provision be made for the complete combustion of the combustible gases but these gases must be burned in such relation to the fuel bed that the heat generated by their combustion will be effective to promote drying and destructive distillation of the fuel in addition to heating the steam boiler with which the furnace is associated. The invention accordingly contemplates an improved construction of steam boiler furnace comprising a flat sloping arch which extends entirely over the fire box and a combustion chamber of large capacity having direct open communication with the fire box from the grate level to the higher end of the said arch, one embodiment of the improved construction being illustrated in the accompanying drawings, wherein

Fig. 1 is a central longitudinal sectional view, and

Fig. 2 is a detail transverse sectional view taken on the line 2—2 of Fig. 1.

When the improved furnace is associated with a steam boiler, as 11, the fire box 10 is preferably located in front of the forward end of the boiler as is quite common in so-called extended front or "Dutch oven" furnaces, but with the boiler 11 supported at a much greater elevation above the level of the grate 12 than has heretofore been the customary practice. When sawdust or the like is to be used as fuel it is desirable that the fuel heap, indicated at 13, should be disturbed as little as possible. The grate 12 is accordingly shown as being of the conventional stationary type.

In carrying out the invention, the roof 14 of the fire box is constructed to be heated not only from the burning fuel within the fire box but also from the combustion of gases beyond the end of the fire box and for directing heat upon the fuel heap to assist in the drying and destructive distillation of the fuel. For this purpose, the roof 14 is made in the form of a flat masonry arch which slopes upwardly and rearwardly, preferably throughout its entire length, whereby its under surface faces downwardly and rearwardly at a substantial angle. As the fire box 10 opens directly into a commodious combustion chamber 15, no support is provided under the rear end of the roof 14 but this may be hung from a transverse beam or channel 16 in accordance with the well known practice of supporting flat arches.

The combustion chamber 15 is shown as being located under the forward end of the boiler 11. It has a masonry floor 17, preferably located at the same level and equal in extent with the grate 12, and an upright masonry rear wall 18 the top of which is only sufficiently removed from the underside of the boiler to provide flue space 19 extending to the rear end of the boiler. The combustion chamber 15 also has a masonry front wall 20 extending from the level of the rear end of the fire box roof 14 to the underside of the boiler and it is of course bounded at the sides by the masonry walls of the boiler setting.

The invention contemplates that the height and longitudinal depth of the combustion chamber 15 shall be such as to provide sufficient capacity for complete combustion of the furnace gases before entering the flue

19. Under these circumstances the masonry wall 18 becomes highly heated and, by reason of the elevation of the rear end of the fire box roof 14, is effective throughout substantially its entire height in radiating heat back into the fire box chamber. Drying and destructive distillation of the fuel are thereby materially aided, both by the combustion of the furnace gases in immediate proximity to the fuel without any intervening obstruction and by the radiating and reflection of heat upon the fuel from the masonry walls of both the fire box and combustion chamber. Likewise, there is ample time for complete combustion of the furnace gases before they are chilled by contact with the boiler shell whereby low grade fuels may be used economically and without the production of smoke.

While the sloping arrangement of the fire box roof 14 has the usual advantage in providing increased volume in the rear end portion of the fire box and a free exit for the furnace gases it has, in this instance, the added advantage of providing an unobstructed path for heat radiating from the upper portion of the wall 18 to the fuel bed and facing the said rear wall 18 to be heated therefrom.

The arch 14, the heat reflecting wall 18 and the floor 17 will usually be formed of refractory clay products commonly termed masonry. The word masonry, as employed in the description and claims, is not however, limited with respect to the particular composition of the refractory material employed for these parts.

I claim as my invention:

1. In a furnace, in combination, a flat horizontal grate for supporting the fuel bed, a flat masonry arch sloping upwardly at a substantial angle from its forward end and extending over the grate, the said arch constituting an inclined roof for a fire box chamber which is open at its rear end throughout the width of the grate and arch and from substantially the grate level to the level of the rear end of the arch, an upright transverse masonry heat storage and reflecting wall extending from the grate level substantially to the plane of the arch but located beyond the rear ends of the grate and arch and facing directly into the fire box chamber, and an upwardly facing masonry floor extending substantially at the grate level from the rear end of the grate to the said upright wall and constituting with the latter the floor and end respectively of a combustion chamber adjoining the fire box and opening upwardly between the rear end of the arch and the top of the said upright wall for the delivery of products of combustion and direct radiation of heat to a steam boiler or the like.

2. In a furnace, in combination, a grate, a masonry arch sloping upwardly at a substantial angle from its forward end and extending over the grate, the said arch constituting an inclined roof for a fire box chamber which is open at its rear end throughout the width of the grate and arch and from substantially the level of the rear end of the grate to the level of the rear end of the arch, an upright transverse masonry heat storage and reflecting wall extending from the level of the rear end of the grate substantially to the plane of the arch but located beyond the rear ends of the grate and arch and facing directly into the fire box chamber and an upwardly facing masonry floor extending between the grate and the said upright wall substantially at the level of the rear end of the grate and constituting with the said upright wall the floor and end respectively of a combustion chamber adjoining the fire box and opening upwardly between the rear end of the arch and the said upright wall for the delivery of products of combustion and direct radiation of heat to a steam boiler or the like.

3. In a furnace, the combination of a grate, a refractory arch sloping upwardly at a substantial angle from its forward end and extending over the grate and constituting the roof of a fire-box, a refractory floor extending rearwardly from the grate at approximately the level of the rear end of the grate, and a transverse refractory heat storage and reflecting wall extending upwardly from the floor rearwardly beyond the rear ends of the grate and arch and facing the fire-box, the floor and wall partially forming a combustion chamber in open communication with the fire-box throughout the width of the grate and arch and approximately from the level of the rear end of the grate to the level of the rear end of the arch and having an opening for the transmission of heat to a steam boiler or the like.

4. In a furnace, the combination of a grate, a refractory arch above the grate sloping upwardly at a substantial angle from its forward end and constituting the roof of a fire-box, a refractory floor extending rearwardly from the fire-box at approximately the level of the rear end of the grate, and a transverse refractory heat storage and reflecting wall extending upwardly from the floor rearwardly beyond the fire-box and facing the fire-box, the floor and wall forming part of a combustion chamber in open communication with the fire-box approximately throughout the width and height of the rear end of the fire-box and having an opening for the transmission of heat to a steam boiler or the like.

5. In a furnace, the combination of a grate, a flat refractory arch above the grate sloping upwardly at a substantial angle from its forward end and constituting the roof

of a fire-box, a refractory floor extending rearwardly from the fire-box at approximately the level of the rear end of the grate, and a transverse refractory heat storage and reflecting wall extending upwardly from the floor rearwardly beyond the fire-box and facing the fire-box, the floor and wall forming two sides of a combustion chamber in open communication with the fire-box approximately throughout the width and height of the rear end of the fire-box and having an opening for the transmission of heat to a steam boiler or the like.

6. In a furnace, the combination of a horizontal grate, a flat refractory arch above the grate sloping upwardly at a substantial angle from its forward end and constituting the roof of a fire-box, a refractory floor extending rearwardly from the fire-box at approximately the level of the grate, and a transverse refractory heat storage and reflecting wall extending upwardly from the floor rearwardly beyond the fire-box and facing the fire-box, the floor and wall forming the bottom and back of a combustion chamber in open communication with the fire-box approximately throughout the width and height of the rear end of the fire-box and having an opening for the transmission of heat to a steam boiler or the like.

7. In a furnace, the combination of a horizontal grate, a flat refractory arch above the grate sloping upwardly at a substantial angle from its forward end and constituting the roof of a fire-box, a refractory floor extending rearwardly from the fire-box at approximately the level of the grate, a transverse refractory heat storage and reflecting wall extending upwardly from the floor rearwardly beyond the fire-box and facing the fire-box, the floor and wall forming two walls of a combustion chamber in open communication with the fire-box approximately throughout the width and height of the rear end of the fire-box, and a refractory wall extending upwardly from the rear end of the arch and facing said transverse wall and forming therewith an opening for the transmission of heat to a steam boiler or the like.

8. A furnace comprising a fire box chamber, means for supporting fuel therein, an inclined refractory arch extending over the fuel rearwardly and upwardly to a height substantially higher than the fuel, a combustion chamber in substantially unobstructed communication with the rear end of the fire box chamber and extending rearwardly therefrom for retaining, until their substantially complete combustion, the combustible volatiles issuing from the fuel, said combustion chamber including a floor extending rearwardly from approximately the bottom of the fire box chamber, and a transverse wall extending upwardly from the level of the rear end of said floor to the level of the upper end of said arch and facing said fire box chamber for reflecting and radiating heat forwardly against the fuel in the fire box chamber, and also against said arch, by which heat is reflected and radiated against the fuel, and a flue connected with the combustion chamber for exhausting the heated gases.

9. A furnace comprising a fire box chamber, provided with means for supporting fuel therein, a combustion chamber in substantially unobstructed communication with said fire box chamber from top to bottom thereof and extending rearwardly therefrom for retaining, during their combustion, the combustible volatiles issuing from the fuel, said combustion chamber including a floor extending rearwardly from approximately the bottom of the fire box chamber, and a transverse wall extending from said floor to the full height of the fire box chamber and facing the fire box chamber for reflecting and radiating heat forwardly thereinto, a discharge flue connected with the combustion chamber, and an inclined refractory arch extending over the fuel rearwardly and upwardly to a level above the hottest zone in the combustion chamber, whereby heat received from said combustion chamber and from said wall is reflected and radiated therefrom against the fuel.

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