

Jan. 8, 1929.

1,698,552

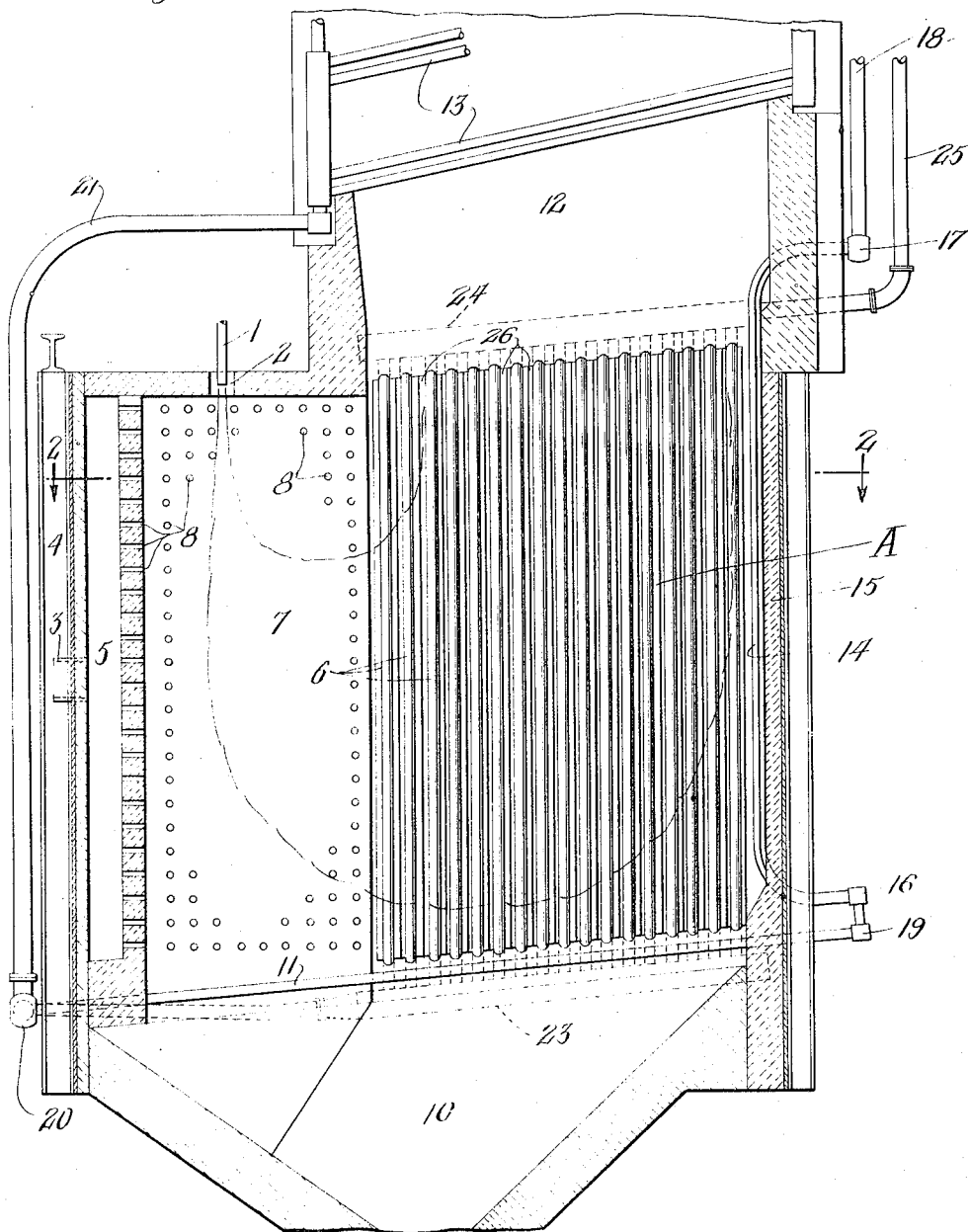
E LUNDGREN

FINELY DIVIDED FUEL BURNING BOILER FURNACE

Filed Oct. 11, 1924

2 Sheets-Sheet 1

Fig. 1.



INVENTOR
Edwin Lundgren
BY
Synnestvedt & Lechner
ATTORNEYS

Jan. 8, 1929.

1,698,552

E. LUNDGREN

FINELY DIVIDED FUEL BURNING BOILER FURNACE

Filed Oct. 11, 1924

2 Sheets-Sheet 2

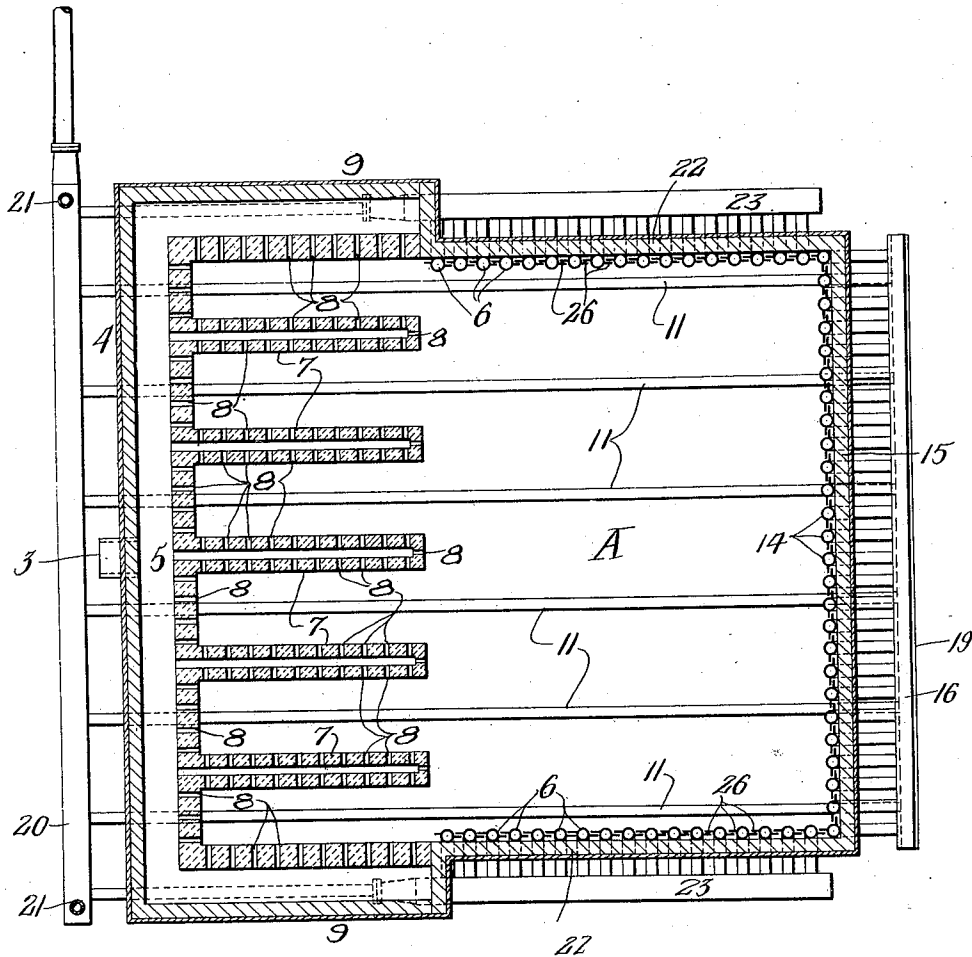


Fig. 2.

INVENTOR
Edwin Lundgren
BY
Symmes & Lechner
ATTORNEYS

UNITED STATES PATENT OFFICE.

EDWIN LUNDGREN, OF FREDERICK, MARYLAND, ASSIGNOR TO INTERNATIONAL COMBUSTION ENGINEERING CORPORATION, A CORPORATION OF DELAWARE.

FINELY-DIVIDED-FUEL-BURNING BOILER FURNACE.

Application filed October 11, 1924. Serial No. 742,990.

This invention is directed to the burning of powdered coal in furnaces equipped with water walls defining a large part of the combustion space, subject to radiant heat and connected into the circulation of the boiler. It is particularly useful in stationary boiler settings.

Such arrangements present comparatively but little difficulty in the burning of lump coal with stokers, but serious difficulty would be encountered in burning finely divided fuel in suspension in such an arrangement for the reason that the incoming fuel must be ignited while in suspension primarily by radiant heat, and the water walls absorb so much heat that the furnace temperature is lowered to the point where the combustion of powdered coal in suspension cannot be favorably carried on, with smokiness and inefficiency as a consequence. It is a primary object of my invention to make it possible to burn pulverized coal successfully and effectively in such an arrangement.

More specific objects and advantages of my invention will become apparent from the following description, and from reference to the accompanying drawings, wherein I have illustrated a preferred embodiment of my invention.

Figure 1 is a sectional elevation through a furnace of the type described but equipped for carrying out my invention.

Figure 2 is a plan section on the line 2-2 of Figure 1.

The reference letter A indicates the combustion chamber of an installation suitable for carrying out my invention. The combustion chamber has an outlet or offtake 12 in an upper part thereof so that the fuel and flame stream takes an U-shaped course through the chamber, as will further appear. Over the outlet is a bank of tubes of the boiler, diagrammatically indicated at 13, these tubes being preferably comparatively few in number for the reason that the water walls, to be described, define a large portion of the combustion space and perform the major portion of the evaporation. The rear or bridge wall 15 is covered by a set of vertically-extending tubes 14, closely spaced, the lower ends of which are curved to pass outwardly through the bridge wall 15 to the header 16 outside of the chamber, the upper ends being similarly curved for connection to the header 17, this latter header being

connected to the drum of the boiler, not shown, by the upcomers 18. The rear water wall 14 is connected in series with the screen 11, located in the lower part of the chamber, by means of the connections 19. The forward ends of the tubes of screen 11 are connected into the header 20, which in turn is connected to the boiler by the downcomers 21. Approximately the rear half of the side walls 22 is covered by similar water walls of closely spaced tubes, the lower ends of which extend outside the chamber for connection with the headers 23, which are in turn connected with the header 20. The upper ends of the tubes of the side walls pass outwardly and connect with the headers 24 which in turn connect with the boiler by the upcomers 25. The tubes are provided with longitudinal fins 26 arranged to overlap in the assembled structure so as to provide a substantially continuous wall.

It will be seen from the foregoing, therefore, that a very large part of the combustion chamber is defined by evaporating surfaces, such combustion space being, however, sufficient for the completion of combustion before the tubes 13 are reached. In order to overcome the difficulties incident to maintaining proper combustion because of the chilling effect of the tubes, I propose the following:

The fuel, together with a certain amount of carrying air, is admitted downwardly in an upper portion of the furnace at a point removed from the boiler tubes, through the nozzles 1. There is a battery of these nozzles extending across the front of the furnace and suitably spaced. A certain amount of air may be induced around these burners through the openings 2. I subject the entering fuel streams to radiant heat from relatively extensive refractories, to which end I divide the combustion space in front of that portion defined by the side and rear water walls into compartments by the refractory division walls 7 extending rearwardly from the front wall and vertically from the roof of the arch. The individual fuel streams pass downwardly into these compartments, being subject to radiant heat from the refractories, as a result of which, ignition takes place promptly and combustion is expeditiously carried on. By subjecting the incoming fuel to radiant heat in this manner, no

difficulty is encountered in completing combustion in a satisfactory and efficient manner.

If all of the air for combustion were admitted with the fuel, the refractories would in all probability be very rapidly destroyed, making maintenance charges excessive. To overcome this, I supply a large portion,—preferably a major portion,—of the air for combustion to the fuel delivered into the combustion space, in such manner as to protect the refractories without, however, unduly lowering furnace temperatures. I accomplish this by making the front wall 4, the side walls 9 and the division walls 7 hollow, supplying air through any suitable opening, such as is indicated at 3 to the space 5 under pressure. The air flows from the space 5 into the combustion chamber through a plurality of very small and closely spaced delivery openings 8 in the side walls, front wall and division walls in the manner indicated in somewhat exaggerated form in the drawings. By reason of this the descending fuel and flame streams successively meet with transversely directed small jets of air which, while holding the flame away from the brick work, produce a multiplicity of small eddies, securing a most intimate and prompt admixture of the combustibles with air. Such air, in passing through the refractories serves to absorb some heat therefrom and enters the combustion space in somewhat preheated form, so that, while the refractories are protected, there is no appreciable chilling effect. In fact the zone of high temperature in the flame will be located in the compartments, and the ascending portions of the fuel and flame stream traversing the space defined by the water walls will be subject to radiant heat from the descending hot leg of the fuel and flame stream and from the refractories, so that combustion will be completed before the tubes 13 are reached.

Refuse particles gravitating out of the fuel and flame stream will pass through the screen 11 which serves to cool them below slag forming temperature, thus making the ash readily removable from the pit 10.

From the foregoing it will be seen that the furnace and boiler setting comprises in general a combustion chamber defined, in part, by water tubes subjected to radiant heat and connected into the circulation of

the boiler, and, in part, by a plurality of chambers opening into that portion of the chamber which is defined by the water tubes, the plurality of chambers being formed by refractory structure, and the fuel being introduced into said chambers and subjected to radiant heat.

I claim:

1. In a furnace and boiler setting for burning finely divided fuel in suspension, a combustion chamber having an outlet in an upper part thereof; evaporating surfaces defining a substantial part of the combustion space thereof; refractories defining the combustion space adjacent to that defined by the evaporating surfaces, including spaced refractory walls dividing such space into a plurality of vertical compartments communicating with the adjacent space; means for admitting the fuel downwardly into said compartments whereby the fuel and flame streams pass downwardly through and laterally out of the compartments into the space defined by the evaporating surfaces and thence upwardly to the outlet.

2. In a combustion chamber the rear part of which is defined by heat absorbent elements and the fore part by refractory walls, the combination of a plurality of spaced hollow vertical foraminous walls providing a plurality of compartments in the fore part opening into the rear part of the combustion chamber; means for forcing air into the hollow portion of the spaced walls and thence out in a lateral direction through the perforations in the walls; and a burner for each compartment, said burners being adapted to discharge into the respective compartments.

3. In a pulverized fuel combustion chamber the rear part of which is defined by heat absorbent elements, and the fore part by refractory brick; a plurality of hollow refractory walls spaced transversely of the chamber and dividing the fore part of the chamber into compartments opening into the rear part of the chamber, said refractory walls being provided with a multiplicity of small air delivery openings establishing communication between the hollow portion of the walls and said compartments; and means for admitting the fuel downward into said compartment.

In testimony whereof, I have hereunto signed my name.

EDWIN LUNDGREN.