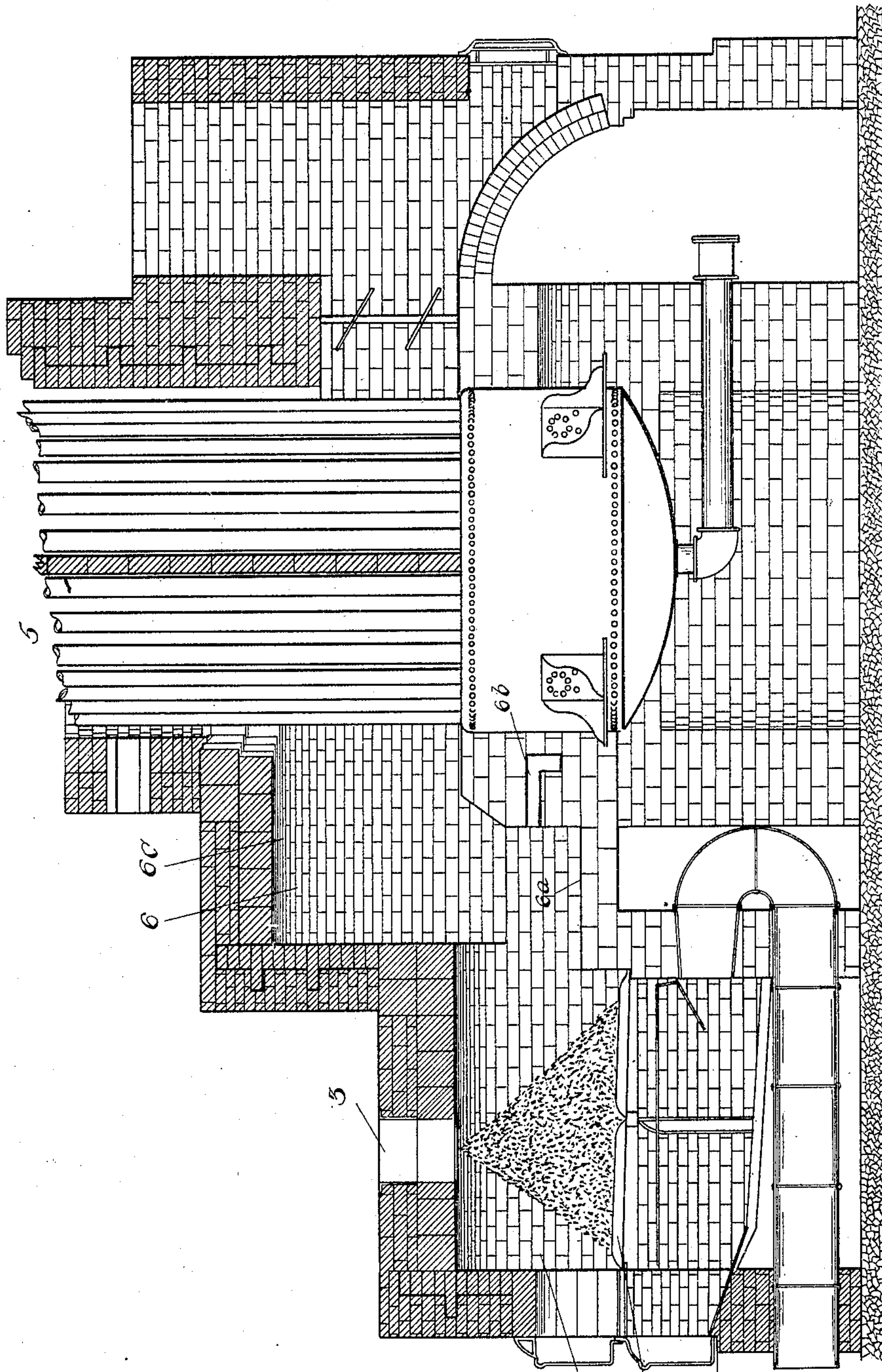


No. 789,722.

PATENTED MAY 16, 1905.

E. C. FISHER.
BOILER FURNACE.
APPLICATION FILED DEC. 23, 1904.



WITNESSES:

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BOILER-FURNACE.

SPECIFICATION forming part of Letters Patent No. 789,722, dated May 16, 1905.

Application filed December 23, 1904. Serial No. 238,108.

To all whom it may concern:

Be it known that I, ELBERT C. FISHER, a citizen of the United States, residing at Saginaw, in the county of Saginaw and State of Michigan, have invented certain new and useful Improvements in Boiler-Furnaces; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention is an improvement in furnaces for steam-boilers, and pertains more particularly to furnaces for vertical water-tube boilers in which refuse fuels—such as saw-dust, wood refuse, bagasse or megasse, and other carbon fuels—carrying a large amount of hygroscopic water are used.

The objects of the invention are to produce perfect combustion of fuels of the class above mentioned, to prevent accumulation of explosive gases in the boiler, to prevent carrying over into the boiler ashes or unburned fuel, and also to attain other advantages which will be set forth later in this specification.

The improvements consist in certain constructions and arrangements of the furnace parts and the equivalents thereof whereby the objects of the invention are attained.

The furnace as applied to a vertical water-tube boiler is illustrated in the accompanying drawing, in which the figure is an enlarged sectional view of the furnace, showing the fuel pile.

As is clearly shown in the drawing, the furnace consists in a fuel-chamber 1, having grates 2 and a fuel-inlet 3 above the grate. The fuel-chamber is formed of refractory material, and its top is preferably arched. Above the fuel-chamber and between it and the boiler 5 is a combustion-chamber 6, through which the gases from the fuel-chamber pass on their way to the boiler and in which they are mixed with air and converted into flame.

The construction of the fuel-chamber is as follows: The fuel-inlet 3 is arranged approximately over the center of the grate 2, and the height of the arch above the grate is made such that the angle of repose of the fuel to be

used in the furnace will cause the fuel to form a cone on the grate of such size that the base of the cone shall not quite cover the grate area, but will leave a space between the periphery of the fuel-base and furnace-wall, such space being either entirely free from fuel or so lightly covered with it that there is little or no resistance to the entrance of air around the periphery of the fuel-base.

For each fuel there is a fixed relation between the height and base of the fuel pile. The area of the base depends upon the angle of repose of the material and the height of the arch.

It is one of the objects of this invention to avoid drawing the air required for combustion up through the fuel-body, and the object of the arrangement just described is to compel air to enter around the periphery of the fuel-base and to flow up along the sides of the pile, reducing the outer surface of the pile to incandescence and storing up intense heat in the walls and the arched top of the fuel-chamber. The hot walls and top reflect the heat back upon the pile, and as the temperature of the pile rises the volatile gases in the material beneath the surface of the pile are liberated and upon coming in contact with the air admitted around the periphery of the fuel-base are partially consumed.

The apex of the fuel-cone is kept close up to the inlet-opening, and the smaller particles of fuel drop down on the sloping sides of the pile and lodge there. They are not agitated as they would be if the air for combustion were forced up through the pile, and consequently are not liable to be carried over into the combustion-chamber and into the boiler.

To insure complete combustion of the gases before they are admitted to the boiler, I provide the combustion-chamber 6. This chamber is formed with a bottom 6^a, which is somewhat higher than the level of the grates for the purpose of preventing the accumulation of soot on the bottom of the combustion-chamber. Slightly above the bottom 6^a and directly in the path of the incoming gases from the fuel-chamber is a series of air-inlets

or twyers 6^b, through which enters the air required for complete combustion of the gases in the combustion-chamber.

The top of the chamber 6 is preferably 5 arched, as at 6^c, and is considerably higher than the top of the fuel-chamber. By making the combustion-chamber higher than the furnace I attain several advantages. One of these advantages is that increased space is 10 provided for the mixture of the air and unburned gases, and another advantage is that this form of combustion-chamber aids in the thorough mixing of air and gas by assisting the natural tendency of the hot gases to rise. 15 In this arrangement of combustion-chamber no pocket can be formed to fill with cooler air, as is the case when the combustion-chamber is on a level with or lower than the grate. A further advantage of this construction is that 20 the capacity of the combustion-chamber is such that the velocity of the gases passing from the fuel-chamber is reduced when they enter the combustion-chamber. The effect of this arrangement is to prevent particles of 25 partly-burned fuel being carried over into the boiler. Since the volume of the combustion-chamber is large in proportion to the area of the opening between the furnace and the combustion-chamber, the velocity of the 30 current of gas when it enters the combustion-chamber is checked, thereby dropping out suspended particles of ash or unburned fuel which might otherwise be carried over and lodged in the boiler.

35 The carrying over of particles of unburned fuel or the accumulation in the boiler of unburned gases is frequently a source of danger, especially in a vertical boiler. If imperfectly-burned gases pass into the space around the 40 boiler-tubes and air leaks in, explosion of gas in the boiler usually results.

It will be noticed that the combustion-chamber in this furnace permits the gas from the fuel-chamber to expand and thoroughly mix 45 with air coming in through the twyers 6^b before entering the boiler.

Since air entering the fuel-chamber does not come through the pile, but around it, natural draft is usually sufficient; but a light 50 forced draft may be used, if desired, produced either by a suitable blower or induced by

steam. A furnace arranged for light forced draft is illustrated.

It will be noticed that this style of furnace is adapted to hold heat for drying the mois- 55 ture of the fuel and that the furnace-walls get their heat by partial combustion in the furnace on the surface of the fuel pile, the furnace acting in this case as a sort of gas-producer, and combustion is completed in the 60 elevated combustion-chamber, to which air is admitted.

What I claim as my invention, and desire to secure by Letters Patent, is as follows:

1. The combination with the fuel-chamber 65 having a grate and an arched top provided with a fuel-inlet above said grate; of a combustion-chamber of larger volume than the fuel-chamber and located in the rear of said fuel-chamber, the bottom of said combustion- 70 chamber being above the level of said grate, and the top of said combustion-chamber being higher than the top of said fuel-chamber; the rear wall of the combustion-chamber having air-inlet openings adapted to deliver air 75 to the gases while traveling under highly-heated brickwork and before they reach the boiler-surfaces, substantially as described.

2. The combination with a vertical water- 80 tube boiler, of a furnace comprising a fuel-chamber and a combustion-chamber, said fuel-chamber having a grate and an arched top provided with a fuel-inlet, the height of said inlet above the grate being so proportioned 85 relatively to the angle of repose of the fuel that the fuel pile shall cover the middle portion of the grate, but leave a portion of the grate area uncovered around the periphery of the fuel- 90 base; said combustion-chamber being of larger volume than the fuel-chamber and located between the fuel-chamber and the boiler and having its bottom above the grate-level and its top above the top of the fuel-chamber, the rear wall of said combustion-chamber being provided with air-inlets arranged opposite the 95 fuel-chamber, substantially as described.

In testimony whereof I affix my signature in presence of two witnesses.

ELBERT C. FISHER.

Witnesses:

W. A. BROWN,
GEO. B. WILLCOX.