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FURNACE FOR BURNING HYDROCARBONS.

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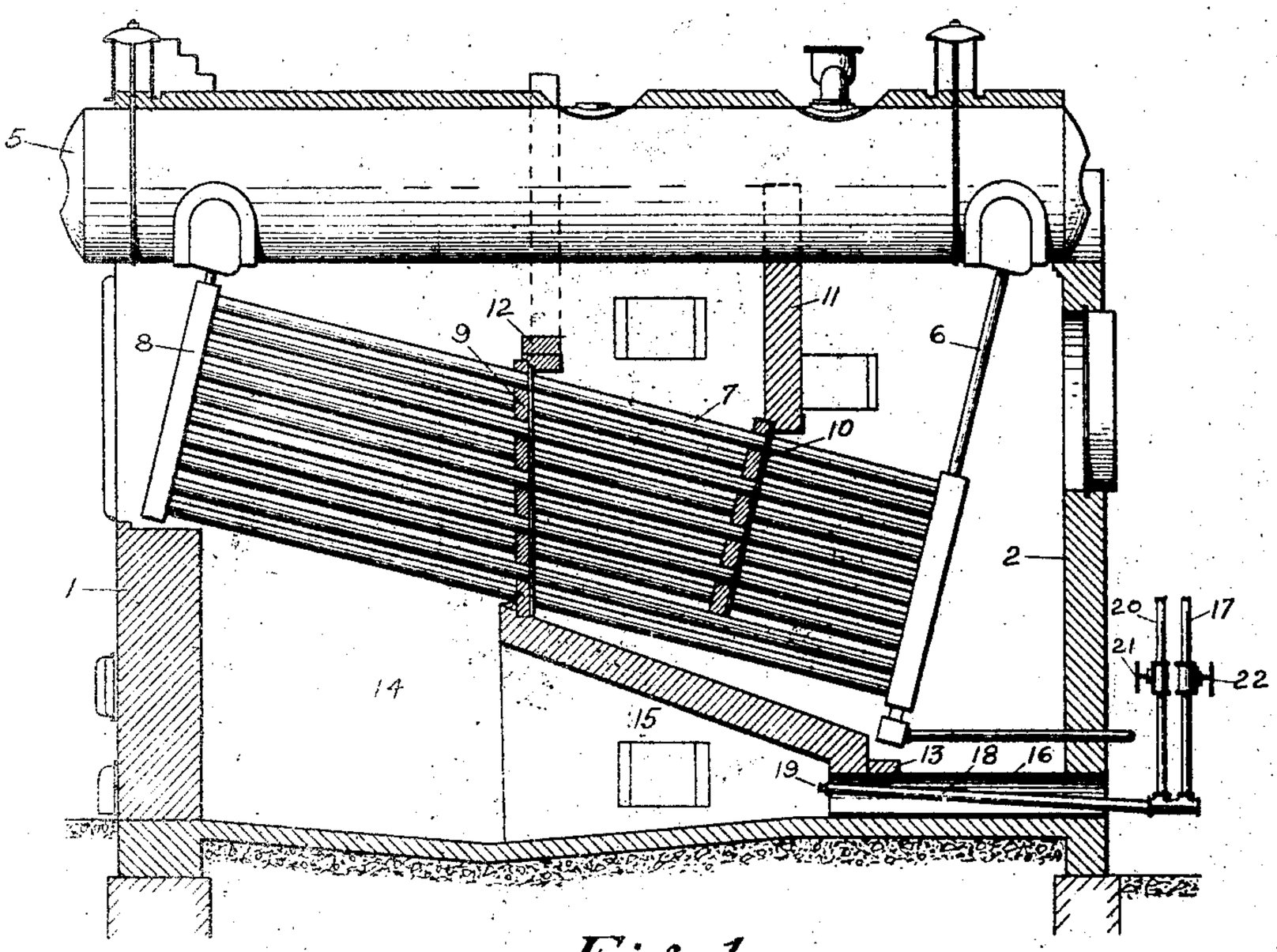

Fig. 1.

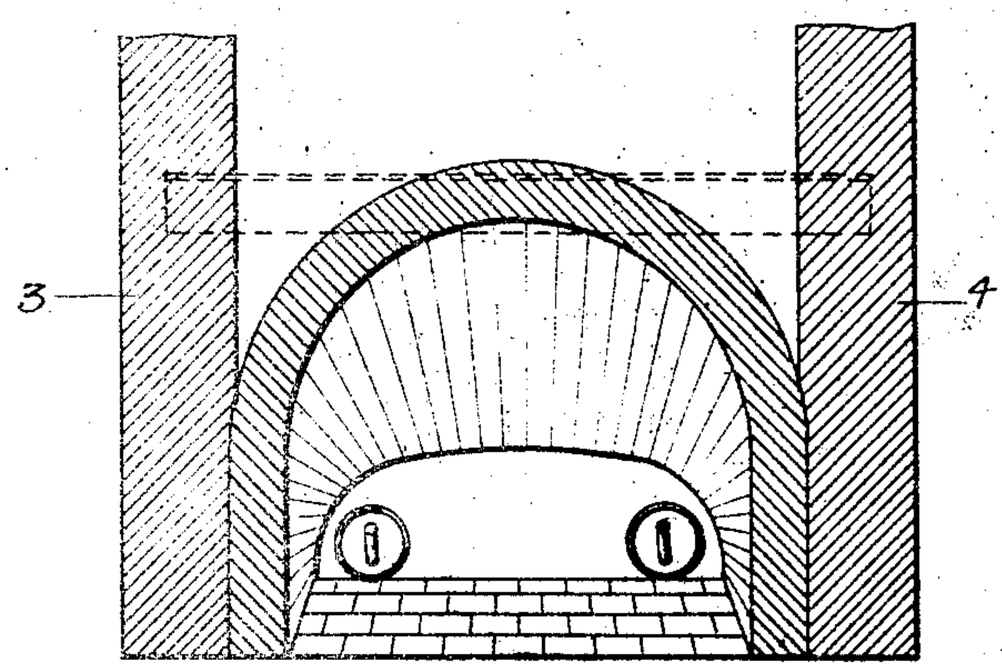

Fig. 2.

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UNITED STATES PATENT OFFICE.

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FURNACE FOR BURNING HYDROCARBONS.

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Application filed November 29, 1907. Serial No. 404,319.

To all whom it may concern:

Be it known that I, PIERRE O. KEILHOLTZ, citizen of the United States of America, residing at the city of Baltimore, State of Maryland, have invented certain new and useful Improvements in Furnaces for Burning Hydrocarbons, of which the following is a specification.

The present invention relates to furnaces for burning liquid hydro-carbons, or pulverized coal, particularly adapted to the production of steam, and contemplates the provision of such a furnace in which the fuel is so presented as to give the highest temperature, complete combustion; and as a result of these and other features greatly increased economy as compared to other furnaces now in use.

In furnaces of this general type, the fuel and air while in the process of combustion are brought into contact with the heating surface or other conducting members and thereby cooled, so that combustion is arrested and rendered incomplete. By this means much fuel is lost and a carbonaceous deposit formed by which the tubes are made less capable of transmitting heat. A feature of my invention designed to overcome these difficulties is a combustion chamber of non-conducting material at the rear of the furnace into which the fuel is sprayed and allowed to expand and burn completely. The products of combustion pass forward toward the front wall, then rise and come in contact with the front ends of the tubes. From this point they are guided back in contact with the heating surface to the rear of the furnace and finally to the stack. Thus we have the products of combustion at their highest temperature in contact with the portion of the tubes from which steam is taken, and from that point conducted back as their temperature falls to the rear ends of the tubes into which the water to be heated is first admitted.

My invention has for its object to provide a furnace for burning liquid fuel so constructed that a particle of fuel will, when projected into the furnace, have a straight path long enough to insure complete combustion, and of such a shape as to permit uniform expansion of the gases without obstruction, check or retardation from the time they leave the injector nozzle until they reach the extreme end of the chamber.

To this end, the furnace is constructed in the form of a long cone with sides which are constantly diverging from the small inlet to the large outlet end. This chamber is of uniform shape on all sides and may be made parabolic for convenience of structure. The bottom of the chamber is made flat, but, theoretically, it would be better if shaped exactly corresponding with the rest of the interior surface.

Referring to the drawings,—Figure 1 is a longitudinal vertical cross-section of a water tube boiler in connection with the furnace which constitutes the subject-matter of this invention. Fig. 2 is a transverse cross-section of the furnace taken on the line 2—2 looking toward the rear.

The boiler setting consists of the usual front wall (1), rear wall (2), and side walls (3 and 4). The drum (5) of a water tube boiler rests on the walls and is secured thereto by means well known in the art. Tubes (6), known as rear multiples, extend downwardly from the rear end of the drum and are inclined slightly forward. From each multiple a number of water tubes (7) lead forward and upward at an angle of about 15° and join the front multiples (8) which enter the bottom of the drum at the front parallel to the rear multiples. The usual baffle plates (9 and 10) and baffle walls (11 and 12 and 13) are provided.

The furnace proper consists of a main chamber (14) which occupies the same position under the forward portion of the tubes as is usually occupied by the fire-box in a coal burner, and the combustion chamber (15) having thick imperforate walls of non-conducting material as fire brick, extending forward from a point near the rear ends of the tubes and opening into the main chamber. The combustion chamber (15), the transverse cross-section of which increases toward the front has at the rear large pipes (16), in this instance about 12 inches in diameter, open at their extremities, extending from the combustion chamber through the wall (2). A pipe (17) conducting tar or any other fuel to be burned leads from a suitable reservoir, not shown, to the pipe (18). This pipe extends forward through the horizontal pipe (16) and is shown as tending slightly upward and terminates in a suitable nozzle (19). A steam pipe (20) from any suitable source joins the pipe (18).

The supply of steam and tar is controlled by the valves (21 and 22) respectively.

In the operation of the furnace steam and tar under pressure are injected through the nozzle (19) into the combustion chamber (15) the tar being atomized by the action of the steam. The relative quantities of the two substances are controlled by the valves 21 and 22 and the necessary amount of air is drawn into the furnace through the pipes (16) by the action of the jet of steam and tar. The nozzle is so disposed as to direct the incoming fuel and steam forward longitudinally of the combustion chamber.

The pressure under which the fuel and steam are supplied is relaxed as they issue from the nozzle, and combustion and expansion take place as the gases and vapors advance. When the furnace has been in operation for a short time, the walls of the combustion chamber reach a maximum temperature, which approaches the temperature of combustion of the fuel. By this means the fuel and air are raised to a high temperature when admitted; their temperature increases as they advance and they are completely burned in the combustion chamber. The burned gases when they emerge from the combustion chamber increase slightly in volume in the main chamber and are carried by their momentum and the pressure from behind toward the front wall, where they are deflected, and move upward by convection into the tube space, and contact with the forward ends of the boiler tubes. The steam is taken or rises from this end of the tubes into the steam drum and it is important that the gases at their highest temperature should be brought in contact with the tubes at this point. The draft, due to the stack or any other suitable device, draws the gases backward, and the baffle plates and baffle walls serve to direct them into contact with the tubes. As the temperature of the gases is reduced by contact with the tubes, they approach the rear portion of the boiler where the water enters and the gases or products of combustion, when they reach their lowest temperature are brought into contact with the tubes holding the water last introduced.

Having thus described my invention, what I claim and desire to secure by Letters Patent is:

1. In a furnace for burning finely divided fuel, a long, conical chamber having thick, imperforate walls acting as heat reservoirs, the small end of the cone having an opening to admit air, means at the small end for injecting fuel, the large end of the cone being open and unobstructed to allow free passage of the fuel in a straight line and permit its complete combustion before such passage is arrested.

2. In a furnace for burning finely divided fuel, a long, conical chamber having imperforate walls open at both ends, at the small end to the air and at the large end to the main chamber of the furnace, means at the small end for injecting fuel and directing it toward the large end, the large end of the cone being unobstructed, so as to permit the particles of fuel when projected into the chamber to travel in substantially straight lines from the point of admission to the point of complete combustion; whereby, substantially all the fuel is burned in the chamber.

3. In combination with the steam boiler, a furnace having a main chamber and a long conical chamber with imperforate walls, the latter chamber having its large end forward and opening into the main chamber and entirely unobstructed, its small end apertured to admit air and means for injecting fuel at the small end and directing it longitudinally of the cone.

4. In combination with a water tube boiler, a furnace having a main chamber under the higher portion of the tubes and the long conical chamber with imperforate walls, the latter chamber having its large end opening into the main chamber and entirely unobstructed, its small end apertured to admit air and means in the small end for injecting fuel and directing it longitudinally of the cone toward the large end.

5. In a furnace for burning finely divided fuel, a long, conical chamber made of refractory material having imperforate walls acting as heat reservoirs, the chamber being open at both ends, at the small end to the air and at the large end to the main chamber of the furnace, means at the small end for injecting the fuel and directing it toward the large end, the large end being unobstructed so as to permit the particles of fuel when projected into the chamber to travel in substantially straight lines from the point of admission to the point of complete combustion, whereby substantially all the fuel is burned in the chamber in contact with heat-radiating surfaces, so that the fuel reaches its highest possible temperature before it comes in contact with heat-absorbing surfaces.

Signed by me at Baltimore, Maryland, this 26th day of November, 1907.

PIERRE O. KEILHOLTZ.

Witnesses:

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