

June 19, 1934.

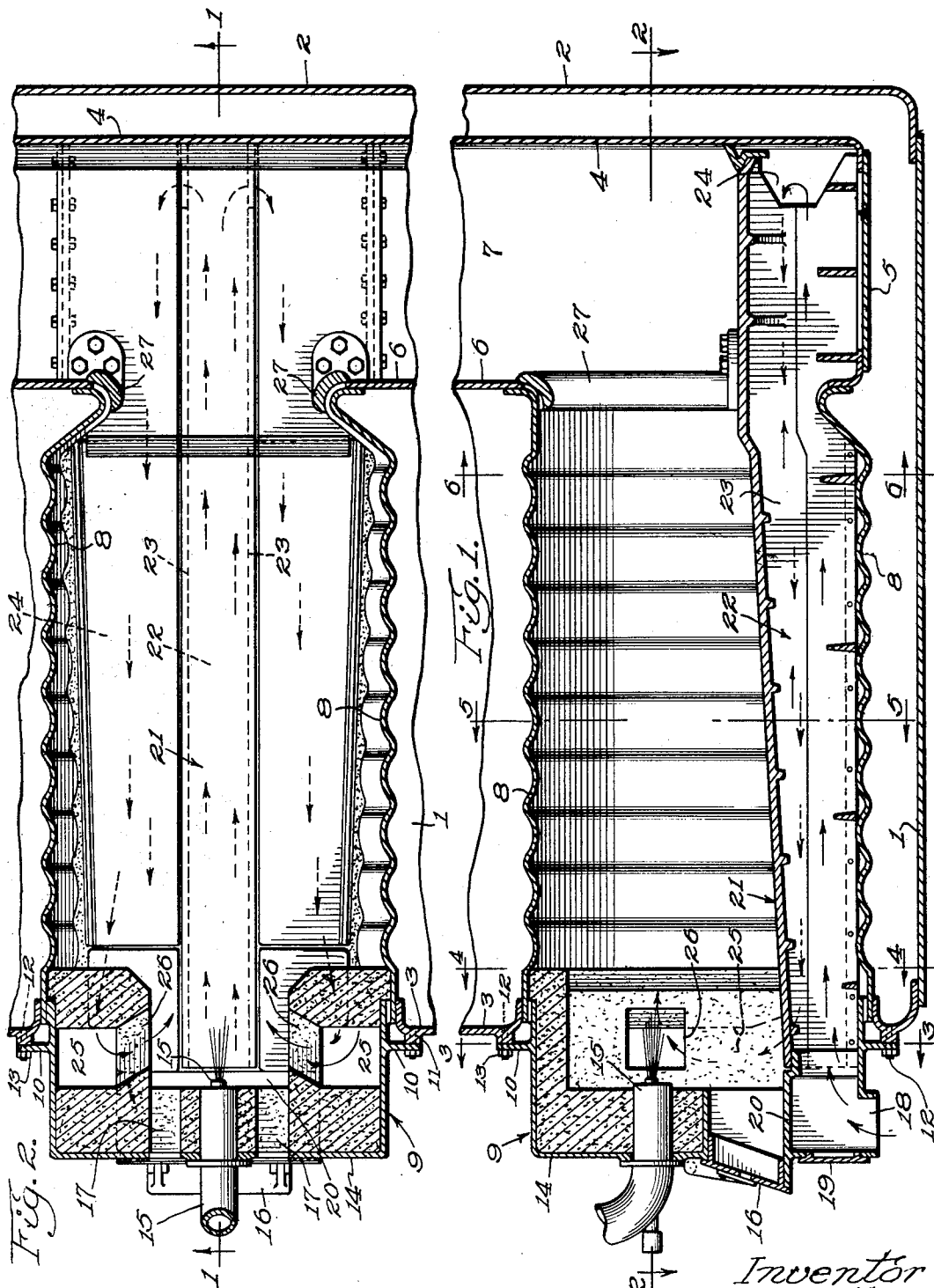
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1,963,358

COMBUSTION FURNACE

Filed March 7, 1932

2 Sheets-Sheet 1



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Fig. 3.

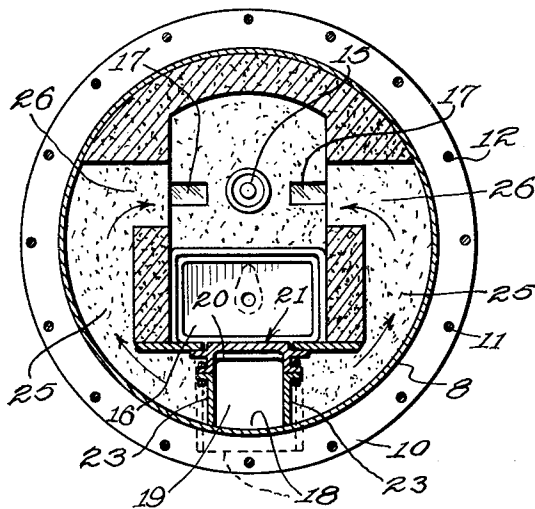


Fig. 4.

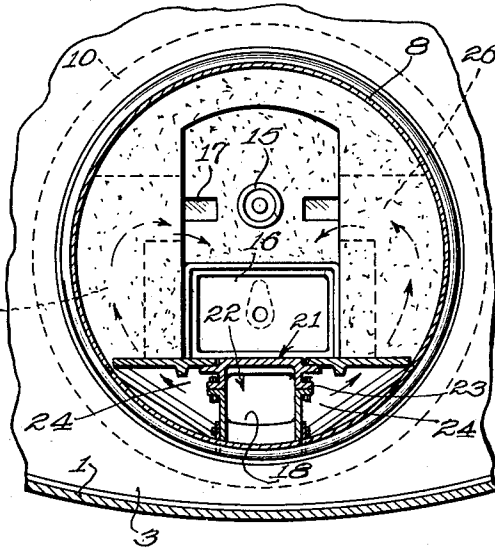


Fig. 5.

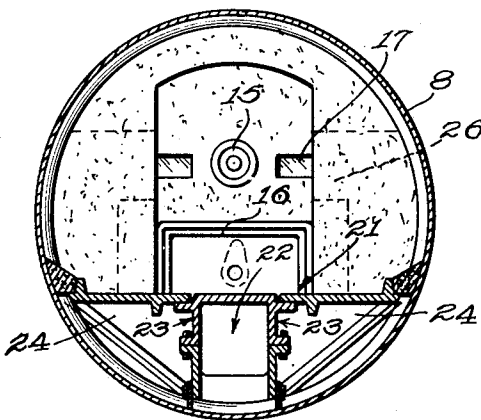
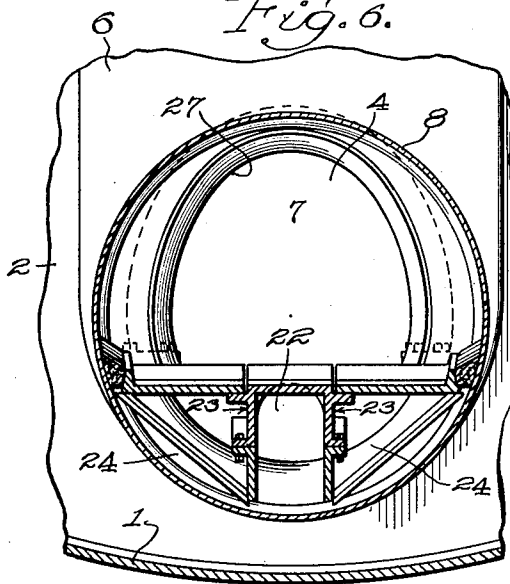


Fig. 6.



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UNITED STATES PATENT OFFICE

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COMBUSTION FURNACE

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Application March 7, 1932, Serial No. 597,264

4 Claims. (Cl. 110—28)

This invention relates to methods of burning powdered coal and the like, and particularly to confining the combustion thereof to the combustion chamber of a boiler. Experience has proved that attempts to efficiently burn powdered fuel by placing the nozzle in the combustion chamber in a fire tube boiler has proved a failure since the zone surrounding the nozzle remains at a comparatively low temperature and at the same time the rear end of the furnace section rises to such a temperature that fittings are melted down and unburned or partially burned fuel is continuously thrown out of the boiler stack.

The main object of my invention is to confine the combustion range of sprayed fuels to the normal furnace section of a boiler. This and other objects are obtained by providing for the furnace tube an extended front forming a compartment outward from the fire tube. Further objects are to provide a fuel nozzle mounted in the compartment with the tip of the nozzle outside of the normal combustion chamber area; to provide a preheated air supply for the combustion chamber; to provide in the fire tube circulating channels for the preheated air; and to provide, in a fire tube combustion chamber, delivery outlets for the preheated air from which the air flow is directed laterally into the flow of the fuel at a point adjacent the fuel nozzle.

An illustrative embodiment of my invention is shown in the accompanying drawings, in which Figure 1 is a vertical section on line 1—1 of Fig. 2 of a fire tube in a marine boiler with the upper part of the boiler broken away.

Fig. 2 is a horizontal section on the line 2—2 of Fig. 1.

Fig. 3 is a section of the projecting furnace front with the fuel nozzle mounted near its center, taken on the line 3—3 of Fig. 1.

Fig. 4 is a sectional view on the line 4—4 of Fig. 1.

Fig. 5 is a sectional view on the line 5—5 of Fig. 1.

Fig. 6 is a sectional view on the line 6—6 of Fig. 1.

All of the drawings illustrating my invention are confined to the fire tube section of a marine boiler which is enclosed in a circular shell 1, to which is fastened the back plate 2 and the front head 3. The inside back plate 4, the inside shell 5, and the back-head 6 form the walls of the smoke box 7. Between the front head 3 and the back head 6 is fastened the corrugated fire tube 8.

In my improved arrangement, in place of the usual boiler front, I provide a circular boiler front

or compartment 9 which extends outwardly from the fire tube 8. The extended boiler front 9 has a flange 10 with boltholes 11, arranged to coact with threaded stud bolts 12, having nuts 13, and mounted on the front head 3. On the front plate 14 of the compartment 9 is mounted a fuel nozzle 15, an ash door 16, and at each side of the nozzle 15 is a window 17. Below the ash door 16 is the main air inlet 18 with a vertical removable clean out front 19.

Extending from the horizontal partition 20, between the ash door 16 and the air inlet 18, is a floor 21. The floor 21 divides the fire tube 8 and the smoke box 7 into two separate passages. A part of the passage above the floor becomes the combustion chamber, and the passage below the floor the air preheater. The air inlet 18 delivers air to a central channel 22 formed by two vertical walls 23 which are seated on the fire tube 8 and which also support the floor 21. The vertical walls 23 extend from the air inlet 18 to near the inside back wall 4. Around the ends of the walls 23 the air passes into two side channels 24—24, shown in Fig. 2, thence to vertical bricked-in passages 25—25, thence through the side openings 26—26 into the same zone with the fuel nozzle 15 near the plane of the front head 3. The exit throat of the fire tube 3 is protected by a casting 27. The inside of the compartment 9 is lined with refractory material forming the air channels 25 and 26.

In operation fuel is delivered to the combustion chamber with just enough driving force to deliver the required amount of fuel to the zone where the preheated air commingles with the fuel. In my improved construction the commingling takes place in the compartment which forms the boiler front and which is located outside of the normal combustion chamber.

The conduits are arranged so that the preheated air current is delivered almost perpendicularly to the fuel flow. The location of the nozzle in the compartment and the delivery of the preheated air laterally and directly into the flame both serve to prevent driving the flame through the rear end of the furnace.

The placement of the nozzle tip at or near the plane of the front head permits the formation of an intense flame in the furnace, beginning near the front head, and it is possible to secure satisfactory combustion from a flame which does not extend beyond the back head. The preheated air assists in the rapid combustion required in fuel spraying devices.

By my improved method I am able to secure a stable flame capable of uniformly distributing

heat over the crown sheet area. Further, by this arrangement I use the minimum amount of air to obtain complete combustion, as is demonstrated by the high CO₂ content in the products of combustion.

Although but one specific embodiment of this invention has been herein shown and described, it will be understood that certain details of the construction shown may be altered or omitted without departing from the spirit of this invention as defined by the following claims.

I claim:

1. A Scotch marine boiler for burning sprayed fuel, comprising a furnace tube, a closure forming a longitudinally extending compartment at the front end of said furnace tube, a fuel nozzle mounted in said compartment and directed toward the rear of said furnace tube, an impervious partition dividing said furnace tube longitudinally to form an air preheating channel and a combustion chamber, refractory lining in said compartment, an air conduit in said refractory lining communicating with said air preheating channel, and an outlet from said air conduit for delivering air into said compartment adjacent said fuel nozzle and at an angle to the flow of fuel from said nozzle.

2. In a fire tube boiler having a front head and a furnace tube, a refractory lined and enclosed compartment forming an extension to said furnace tube beyond the plane of said front head, a fuel nozzle mounted in said compartment outside the plane of said front head and directed toward the rear of said furnace tube, impervious longitudinal partitions forming air preheating channels within said furnace tube, and conduits within the refractory lining of said compartment communicating with said channels and said compartment for conducting air from said channels into said compartment and delivering such air adjacent said nozzle.

3. In a fire tube boiler comprising a cylindrical furnace tube having its forward end mounted in

a front head, a horizontal impervious partition disposed within said furnace tube and extending longitudinally thereof to provide an air preheating space therein, vertical partitions dividing said air preheating space into separate channels, said channels communicating adjacent the rear of said furnace tube, an opening in said front head communicating with one of said channels, a refractory lined and enclosed burner compartment mounted in said front head and extending forwardly therefrom, said burner compartment being arranged to provide a closure for the front end of said furnace tube, a fuel nozzle mounted in said burner compartment and directed toward the rear of said furnace tube, and conduits within the refractory lining of said burner compartment interconnecting the others of said channels with said burner compartment for delivering preheated air into said burner compartment adjacent said nozzle.

4. A Scotch marine boiler for burning sprayed fuel comprising a furnace tube, a closure forming a forwardly extending burner compartment at the front end of said furnace tube, a fuel nozzle mounted in said compartment and directed toward the rear of said furnace tube, an impervious horizontal partition dividing said furnace tube to form an air preheating space below said partition and a combustion chamber above said partition, a pair of spaced vertical partitions dividing said air preheating space longitudinally to form air preheating channels, said channels communicating adjacent the rear of said furnace tube, an opening at the front of said boiler communicating with one of said channels, a refractory lining in said burner compartment, air conduits in said refractory lining communicating respectively with the others of said air preheating channels, and outlets from said air conduits for delivering air into said burner compartment adjacent said fuel nozzle.

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