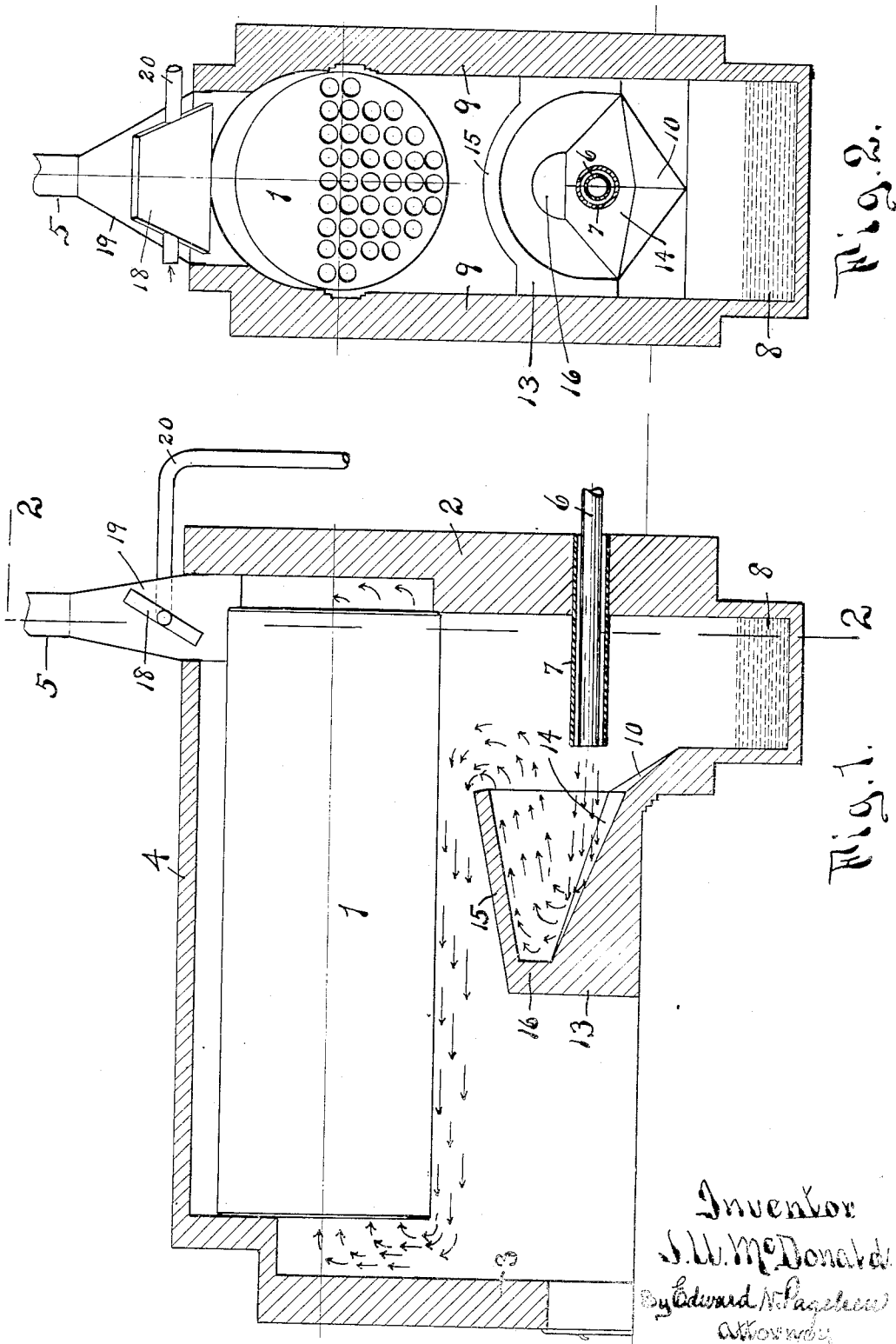


1,349,971.

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UNITED STATES PATENT OFFICE.

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FURNACE.

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Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, JOHN URBAN McDONALD, a citizen of the United States, and residing at Decatur, in the county of Macon and State of Illinois, have invented a new and Improved Furnace, of which the following is a specification.

Perfect combustion of coal is obtained by reducing it to a fine powder and injecting it into a zone of intense heat in the presence of sufficient but not too much air which is so thoroughly mixed with the powdered fuel that complete and extremely rapid combustion occurs. This results in a clear blue white flame which can be accurately controlled and varied as desired. The furnace in which the combustion is completed may vary widely in shape and dimensions, but the form and construction of the chamber in which the fuel is ignited and in which the combustion begins is of importance and forms the subject matter of this present invention.

As all powdered coal embodies a greater or less amount of ash which liquefies in the intense heat of properly burnt coal, the ignition chamber should be so constructed that the liquid slag will not be prevented from freely flowing therefrom. I have therefore so constructed and proportioned the ignition chamber that the injected fuel will be directed toward the highly heated inclined bottom which soon becomes coated with liquid slag and is protected thereby. The fuel becomes highly heated as it leaves the injector and bursts into flame at about the instant it enters the ignition chamber, and the flame is thrown back upon itself by the walls of this chamber and travels above the fresh incoming fuel giving off some of its heat thereto.

In the accompanying drawing, Figure 1 is a central vertical longitudinal section of a furnace embodying my improved ignition chamber. Fig. 2 is a section on the line 2-2 of Fig. 1.

Similar reference characters refer to like parts throughout the several views.

The drawing shows conventionally a well known fire-tube boiler 1 and the front furnace wall 2, rear wall 3, covering 4, side walls 9 and smoke pipe 5 therefor. The coal is conducted into the furnace in the form of a powder by means of a current of air through an injector consisting of the pipe 6 in the usual manner, this pipe being central

with a second pipe 7, preferably of refractory material, the space between the two pipes serving to admit air to the furnace. Just back of the front wall 2 I prefer to construct a tank or receptacle 8 to receive the slag and cinders.

The ignition chamber 13 is positioned from four to eight feet from the wall 2 and is so constructed that its bottom 14 slopes down forwardly and the chamber is of such a height that the fuel from the injector strikes the bottom just back of its front edge as indicated by the arrows in Fig. 1. I prefer this floor to be in the form of a trough so that the slag formed by melting the ash of the fuel may flow down to the tank 8. Above the floor is an arch 15 tapering rearwardly to the end wall 16. The crown of this arch is preferably thin enough to transmit heat from its lower to its upper surface and thus avoids being melted as in the case with heavy arches. An apron 10 slopes down from the front of the bottom 14 toward the tank 8.

The end of the injector is spaced sufficiently from the front face of the ignition chamber to avoid being melted by the intense heat just within the ignition chamber, but the fuel as it leaves the injector is exposed to this heat so that it begins to burn as it enters this chamber. All of the coal, excepting the ash, becomes a gas and ignites under this intense heat and the flame thereof turns upward and outward, passing over the incoming fuel without mixing or interfering therewith and then passes to the atmosphere, preferably back over the arch 15 and if desired, through the tubes of the boiler.

A portion of the heat of the waste gases passing to the stack 5 may be saved by placing a pre-heater 18 in the breeching 19 of this stack, the pipe 20 being connected to the fan (not shown) which supplies the air for the fuel injector. The greatest heat is within and just in front of the ignition chamber and the practically incandescent gases pass rearwardly between the boiler and the top of the ignition chamber.

I claim:—

1. An apparatus for burning powdered fuel comprising a front wall; a rearwardly tapering ignition chamber spaced from said wall and a combustion chamber between them, and an injector for powdered fuel and air mounted in said wall and extending

partially across the combustion chamber toward the ignition chamber and having its discharge end substantially level with the bottom of the ignition chamber so that the
5 air and fuel will impinge thereon and the flame from the fuel may be deflected upwardly and forwardly and pass out over and pre-heat the incoming mixture before passing upwardly and rearwardly over the
10 top of the ignition chamber.

2. An apparatus for burning powdered fuel comprising a front wall, a rearwardly tapering ignition chamber spaced from said wall and a combustion chamber between
15 them, and an injector for powdered fuel and air mounted in said wall and extending partially across the combustion chamber toward the ignition chamber and having its discharge end substantially level with the
20 bottom of the ignition chamber so that the air and fuel will impinge thereon and the flame from the fuel may be deflected upwardly and forwardly and pass out over and pre-heat the incoming mixture before
25 passing upwardly and rearwardly over the top of the ignition chamber, the top of the ignition chamber being thin so as to transmit heat therethrough to the space above it and prevent excessive heating of said top.

30 3. A boiler furnace for burning powdered fuel comprising a front wall extending up

to the boiler, a rearwardly tapering ignition chamber spaced from the front wall and facing it and a combustion chamber between
35 them, an injector for fuel and air extending through said wall and partially across the combustion chamber, the bottom of the ignition chamber being inclined downwardly toward the front wall and so positioned relative to the injector that the blast of incoming fuel will strike it at an acute angle.
40

4. An ignition chamber for furnaces adapted to receive a blast of fuel and air comprising a rear wall, a bottom sloping up to a rear wall and an arch resting on said
45 bottom and sloping down to the rear wall, the upper surface of the bottom being in two parts sloping down toward each other and toward the central vertical plane of the structure.
50

5. An ignition chamber for furnaces adapted to receive a blast of fuel and air comprising a rear wall, a bottom sloping up to a rear wall and an arch resting on said
55 bottom and sloping down to the rear wall, the upper surface of the bottom being in two parts sloping down toward each other and toward the central vertical plane of the structure, and an injector for powdered fuel and air directed toward said bottom so that
60 the fuel will impinge thereon.

JOHN URBAN McDONALD.