(No Model.) 2 Sheets—Sheet 1.

J. M. THOMAS.

SMOKE CONSUMING FURNACE.

No. 519,779. Patented May 15, 1894.

FIG. 1.

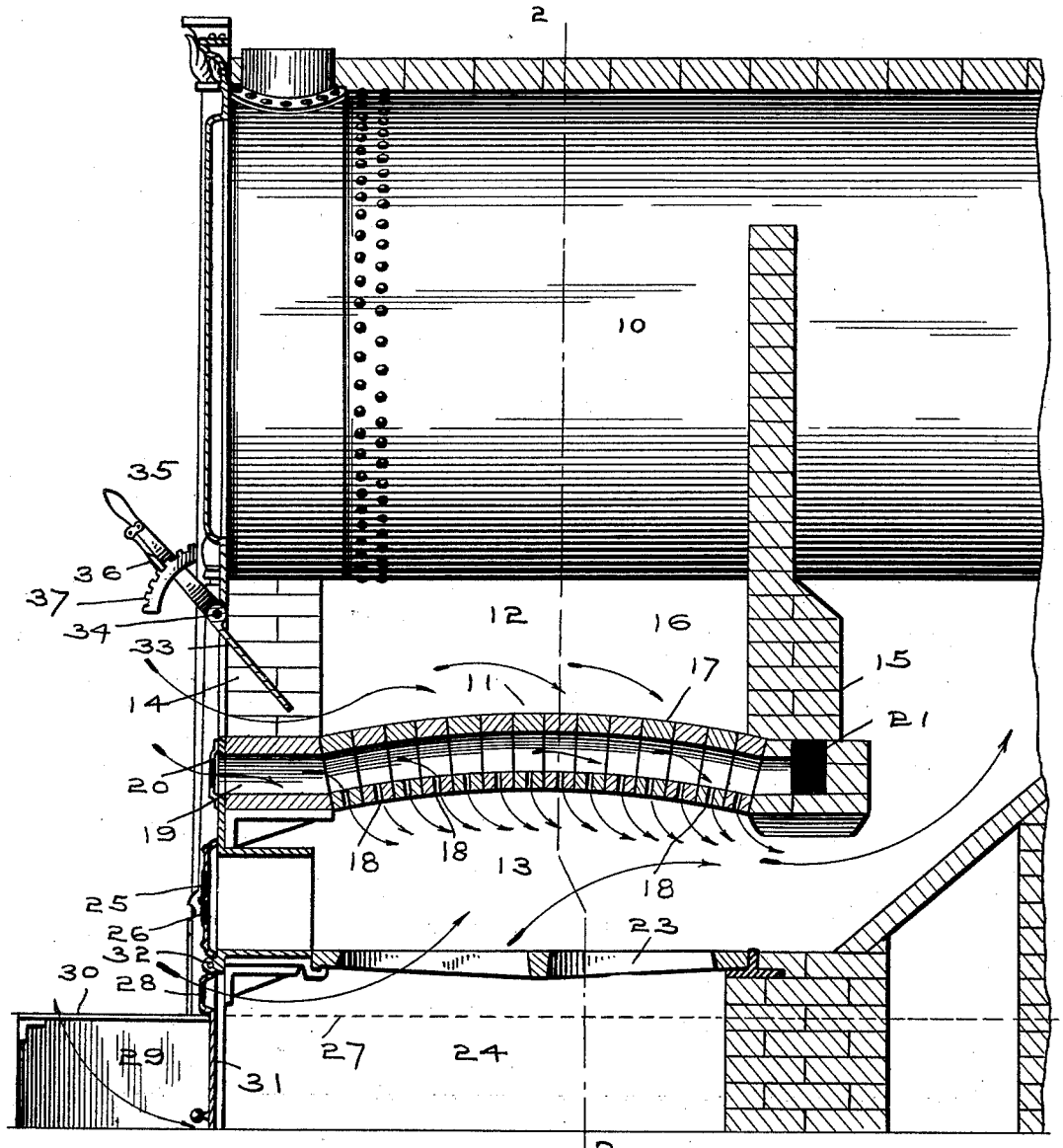
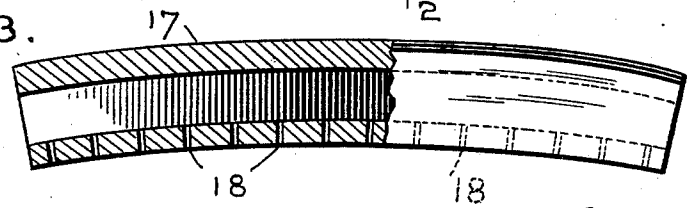


FIG. 3.



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(No Model.) 2 Sheets—Sheet 2.

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FIG. 2.

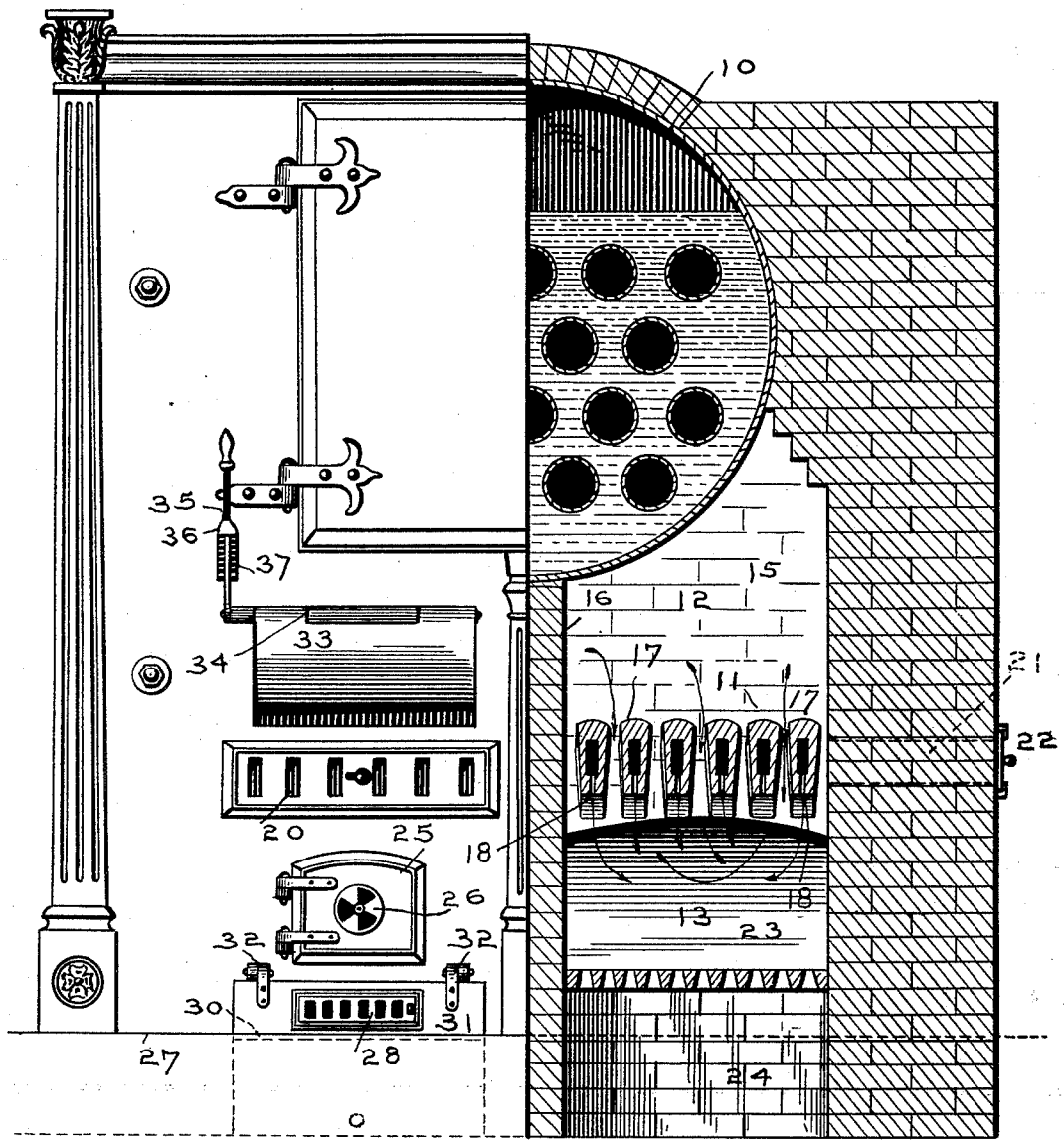


FIG. 5.

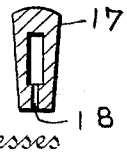
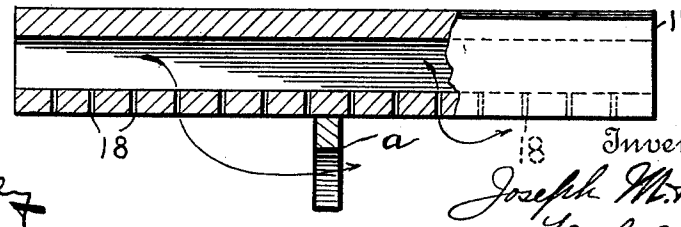


FIG. 4.



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UNITED STATES PATENT OFFICE.

JOSEPH M. THOMAS, OF ST. LOUIS, MISSOURI.

SMOKE-CONSUMING FURNACE.

SPECIFICATION forming part of Letters Patent No. 519,779, dated May 15, 1894.

Application filed February 14, 1894. Serial No. 500,172. (No model.)

To all whom it may concern:

Be it known that I, JOSEPH M. THOMAS, a citizen of the United States, residing at St. Louis, State of Missouri, have invented a certain new and useful Downdraft Smoke-Consuming Furnace, of which the following is such a full, clear, and exact description as will enable any one skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, forming part of this specification.

The object of my invention is to construct a downdraft furnace for steam or other boilers, which shall be cheap and effective in the way of preventing smoke; and by securing perfect combustion add to the efficiency and capacity of the boiler.

The invention has also for its object, to dispense with the water tubes ordinarily used in the construction of such a furnace, and at the same time to produce a practical downdraft furnace which shall answer all commercial requirements.

The invention, briefly and generally stated, consists in a downdraft grate which may be composed of a series of bars of refractory material, which bars may be arched, if desired, to form an arch supported at its edges and which bars if desired may be made hollow to conduct heated air beneath the said grate to effectually secure perfect combustion.

The invention also consists in other features and in combinations which will be described in detail hereinafter, and then pointed out in the claims, making a part of this specification.

Figure 1 is a sectional side view of a downdraft furnace, made in accordance with one form of my invention showing the same applied to an ordinary steam boiler. Fig. 2 is a front view thereof, one-half of said figure being in elevation, and the other half in section on the plane of the line 2, 2 of Fig. 1. Fig. 3 is a detail view, illustrating a modification in which the downdraft hollow arched grate bars are made in one piece. Fig. 4 is a detail view showing a modification of the upper downdraft grate bars, and Fig. 5 is a cross-section of one of the grate bars.

The same marks of reference indicate the same parts in the several figures of the drawings.

The preferred form of my invention is illustrated in Figs. 1 and 2.

10 is an ordinary steam boiler beneath which my downdraft furnace is preferably applied.

11 is an upper or downdraft grate dividing the furnace into a fuel-charging chamber 12, and a combustion chamber 13.

14 is the front wall or arch of the furnace which supports the steam boiler 10 at the front. At some distance therefrom is arranged a second arch or partition wall 15 beneath the boiler shell. Between these two walls or arches 14 and 15 may extend a vertical wall 16 longitudinal of the boiler dividing the fuel-charging as well as the combustion chamber each into two separate chambers if desired.

Between the walls or arches 14 and 15 is arranged the upper or downdraft grate 11 which is composed of a series of arches 17, each of said arches being preferably made up of hollow blocks of fire clay or other refractory material, as shown in Fig. 1. These hollow blocks of refractory material have a perforation 18 at the lower side thereof. If need be, the upper or downdraft grate may be composed of a series of arches 17, constructed of a continuous hollow arched piece having perforations 18 at its lower side as illustrated in Fig. 3. The arching of the grate permits the grate intermediate of its ends rising and falling to compensate for expansion and contraction without disturbing the supporting walls of the grate or straining and injuring the grate itself.

I have shown in Fig. 4 a modification of the upper or downdraft grate in which the grate bars are constructed of a continuous straight piece of refractory material having perforations 18 at the lower side thereof, instead of the said bars being arched as in the previous instance. In this case where the grate bars of considerable length, as required in general commercial use, it may be necessary to provide a supporting arch *a*, sustained by the side walls of the furnace, below and intermediate the ends of the said straight hollow grate bars and transverse of the same.

Through the front wall of the furnace, is one or more orifices or passage-ways 19 communicating with the hollow arches of the

downdraft grate. The admission of air to these openings 19 may be controlled by a suitable damper 20 at the front of the boiler. In the rear wall or arch 15 may be a flue or passage-way 21, running transverse of the hollow arches 17 of the grate 11, which passage-way communicates with the interior of the hollow arches. This passage-way 21 extends through the side walls of the furnace, and the air admitted therethrough may be regulated by a suitable damper 22. By these means the amount of air passing through the hollow arches composing the downdraft grate 11, and into the combustion chamber 13 below the same, may be suitably regulated.

Below the upper grate 11 is arranged an ordinary updraft grate 23, below which is the ash pit 24. The bars of the lower grate 23 are preferably more narrowly spaced than the series of arches 17 composing the upper grate 11. The lower grate is fed by the unconsumed fuel which falls from the upper grate. Between the upper and lower grates is the combustion chamber 13 previously referred to. This chamber is provided with a door 25 at the front of the furnace, whereby it may be properly cleaned. Such door may be furnished with a damper 26, to admit more or less air as may be desired to the combustion chamber between the upper and lower grates. The lower grate 23 is arranged slightly above the floor line 27, and the front of the furnace above the floor line, and below the lower grate, may be furnished with an adjustable damper slide 28 to regulate the amount of air supplied below the lower grate. The ash pit of the furnace is extended out beyond the front of the furnace, forming a chamber 29, covered by a suitable plate 30. The damper slide 28 before referred to is preferably located upon a door 31, hinged at 32 to the lower and front part of the boiler. This door 31 is, after the plate 30 is removed from the top of the chamber 29, swung upwardly to gain access to the ash pit to remove the ashes therefrom. The fuel is fed in the charging chamber 12 on the down draft grate 11, and the draft passes down through the spaces between the grate bars, into the combustion chamber, where it encounters an updraft from the lower grate, and the two drafts commingling pass through the throat of the furnace to the boiler.

I admit the air below the lower grate 23, just beneath the same, so as to have the draft from the lower grate as nearly in the direction of the length of the base of the lower grate as possible, in order to convey the heat from the combustion chamber through the throat of the furnace to the boiler, instead of retaining it too effectually in the combustion chamber. This I can do in my furnace as the draft from my upper grate, as above described, is entirely smokeless, and I do not depend upon the flame from the lower grate consuming any smoke which may be emitted by the down draft from the upper grate. I make use of the lower grate principally to secure economy and add to the efficiency and capacity of the boiler; for the lower grate burns any coal which falls from the upper grate and thus totally consumes the fuel. I have found that when air is admitted to the lower part of the ash pit, so that it can rise vertically up through the grate bars of the lower grate, the heat is retained in the combustion chamber instead of passing to the boiler.

In downdraft furnaces heretofore constructed, the upper or downdraft grate is generally composed of water tubes connected with the boiler, or the upper grate bars are made of solid bars of refractory material. In my furnace air is drawn through the passage-ways in the grate bars and being therein heated to a high temperature, passes through the perforations 18 in the lower side of the grate bars commingling with the down draft as it passes through the spaces between said grate bars. The air so passing through the hollow grate bars supplies oxygen to the fire just beneath the downdraft grate, where it is particularly needed to render the combustion complete. I thus secure an even distribution of hot air to the combustion chamber, and more complete combustion than in previous constructions. It is not desirable that the heated air from the grate bars be discharged into the coals of the fire as it burns, for there it would only partially accomplish the desired result, but by mixing the heated air with the flame and unconsumed products of combustion after they leave the bed of coal, perfect combustion is obtained. It will be further noted that the hot air so supplied to the combustion chamber is injected in the combustion chamber along the lower side of the grate bars intermediate the downdrafts passing through the spaces between the grate bars oxygen is thus furnished to the fire where particularly needed. Such a furnace as I have described with the upper or downdraft grate composed of refractory material is also specially well adapted to prevent the formation of smoke, in that the refractory material of which the bars of such grate are composed becomes incandescent, there being no water passing therethrough to cool same, and thus more effectually consumes any smoke which may be generated. This feature combined with the feature of having oxygen at a high temperature supplied to the combustion chamber just beneath the downdraft grate, renders my furnace in the highest degree smokeless. Making the grate bars hollow and passing air therethrough also limits to a considerable extent the temperature of the hollow grate bars and renders them more durable, they being thereby better able to withstand the intense heat of the downdraft. So also by drawing air through the hollow grate bars, I deliver more hot air to the boiler, and thus better heat the water therein.

To properly direct the draft of air supplied

above the downdraft grate and keep the cold air from striking the bottom of the boiler, when my furnace is applied beneath the boiler, I provide the fuel-charging chamber with a door 33, adapted to swing inwardly therein and admit the air to the fuel-charging chamber at the lower part thereof, so that the cold air will pass at once through the upper grate, and not strike the bottom of the boiler. This door 33 is swung at its upper edge at 34, and may be controlled by a handle 35, furnished with a catch 36 adapted to take into the teeth of an arc-shaped piece 37, whereby the said door may be held in any desired position. The swinging door referred to admits air to the upper grate in the direction of the length of its grate bars, and thus assists in causing the heated air to pass rearward to the boiler instead of being too effectually retained in the combustion chamber.

Such a furnace as I have described, is exceedingly simple; may be applied to any boiler; and secures complete combustion. Its great advantages are:—the cheapness of its construction; its effectiveness as a smoke consumer; its great saving of fuel; and the facility with which it can be applied to a boiler, as there are no water connections and steam tight joints to be made with the boiler. There is also no danger of leaks and explosions, and consequently no chance of the boiler breaking down with such a furnace.

Having fully set forth my invention, what I desire to claim and secure by Letters Patent of the United States is—

1. A steam boiler furnace having an arched downdraft fuel grate of refractory material, supported by the walls of the furnace independently of intermediate support and composed of bars arched longitudinally of the furnace.

2. A steam boiler furnace having a hollow downdraft fuel grate of refractory material, perforations in the same at the lower side thereof, and air passages communicating with the hollow interior of said grate, whereby heated air is thereby supplied to the flame beneath the said grate and is evenly distributed in the combustion chamber to secure complete combustion.

3. A steam boiler furnace having an arched hollow downdraft fuel grate of refractory material, supported by the walls of the furnace independently of intermediate support, perforations in said grate at the lower side thereof, and air passages communicating with the hollow interior of said grate for the purpose described.

4. A steam boiler furnace having a downdraft fuel grate composed of a series of independent arched bars of refractory material supported at their ends by the walls of the furnace independently of intermediate support and of each other.

5. A steam boiler furnace having a downdraft fuel grate composed of a series of hollow grate bars of refractory material, suitably perforated below, and air passages communicating with the hollow interior of the said bars and the exterior air, whereby heated air will be delivered to the flame below the said downdraft grate to secure complete combustion.

6. A downdraft furnace having a downdraft fuel grate, composed of a series of arched bars of refractory material, supported at their ends by the walls of the furnace independently of intermediate support, said bars constructed of separate blocks of refractory material and arched longitudinally of the boiler.

7. A downdraft furnace having a downdraft fuel grate composed of a series of hollow arched bars supported at their ends by the walls of the furnace, said bars constructed of separate hollow blocks of refractory material perforated below, forming a flue through the said bars, and air passages leading from the exterior air to the hollow interior of said bars.

8. A steam boiler furnace having a hollow downdraft fuel grate of refractory material, perforations in the same at the lower side thereof, air passages communicating with the hollow interior of said grate and with the exterior air, and dampers for regulating the amount of air passing through said hollow grate and delivered to the flame below said grate.

9. The combination with a steam boiler, of a hollow downdraft fuel grate of refractory material perforated below and communicating with the exterior air, and an ordinary updraft grate beneath the said downdraft grate for the purpose set forth.

In testimony whereof I have hereunto set my hand and affixed my seal, this 12th day of February, 1894, in the presence of the two subscribing witnesses.

JOSEPH M. THOMAS. [L. S.]

Witnesses:
A. C. FOWLER,
ART. D. GREENE.