

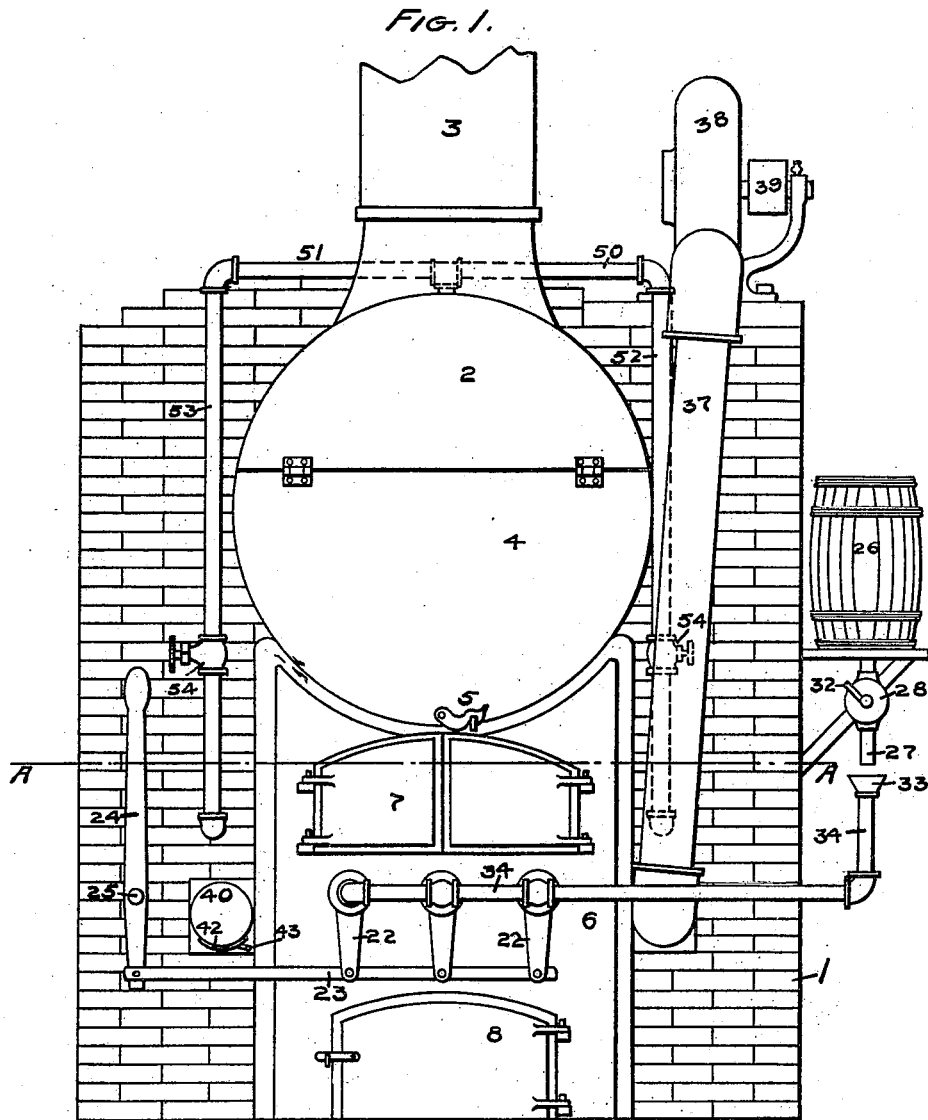
No. 649,211.

Patented May 8, 1900.

F. M. REED.
SMOKELESS FURNACE.
(Application filed July 11, 1899.)

(No Model.)

4 Sheets—Sheet 1.



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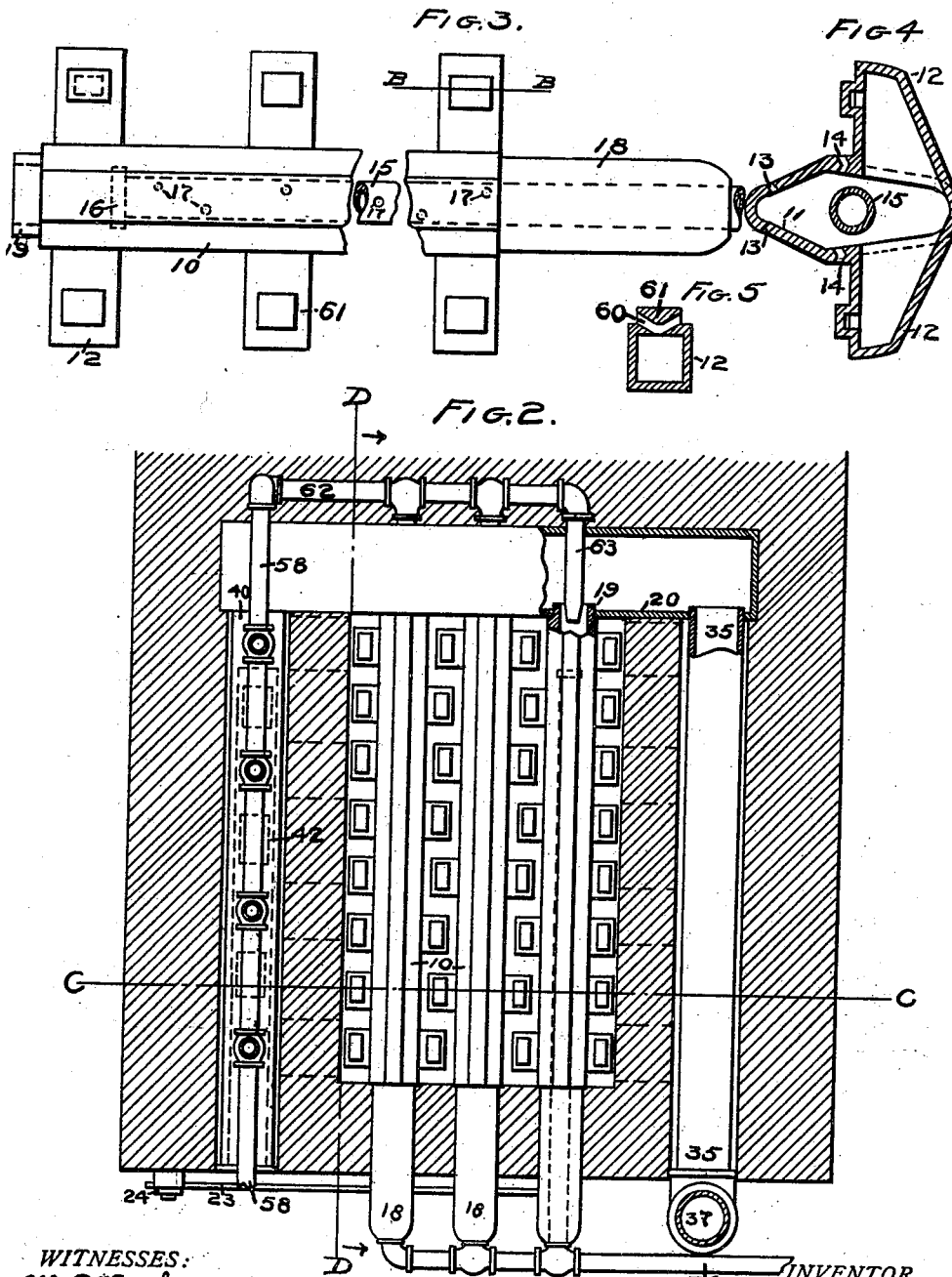
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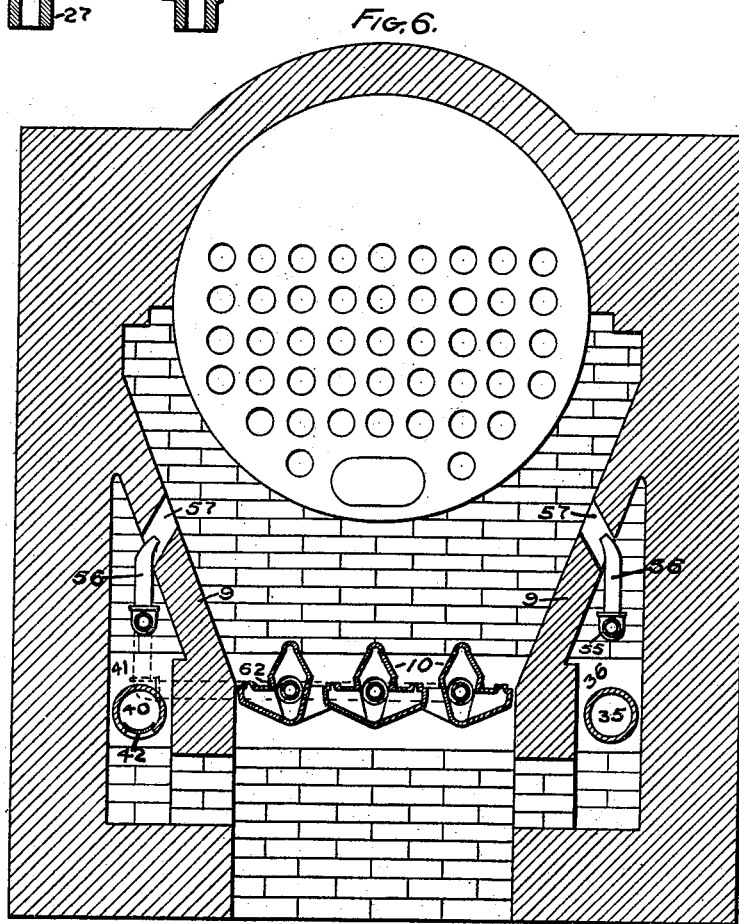
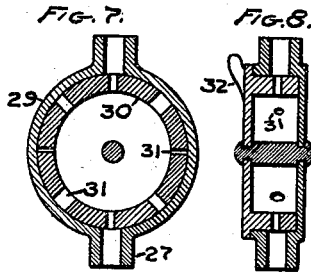
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4 Sheets—Sheet 3.



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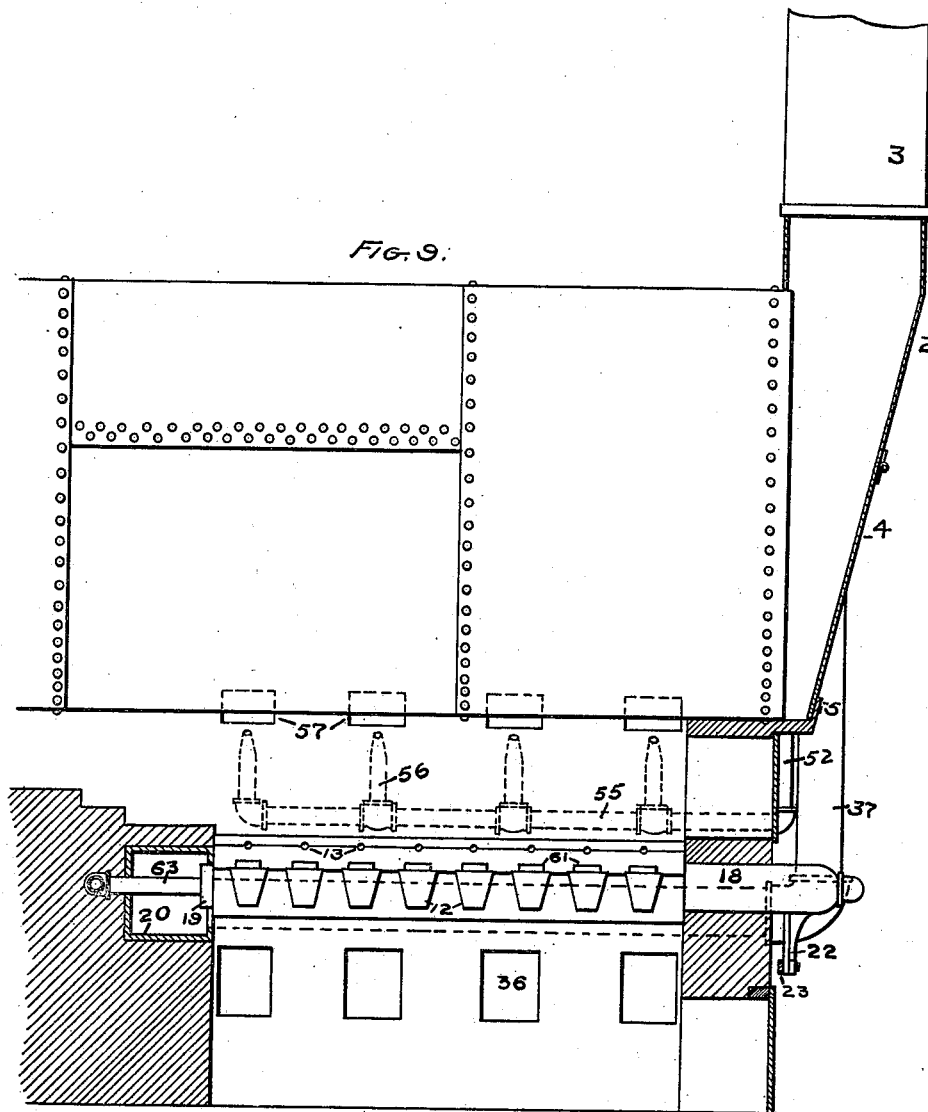
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(Application filed July 11, 1899.)

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4 Sheets—Sheet 4.



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SMOKELESS FURNACE.

SPECIFICATION forming part of Letters Patent No. 649,211, dated May 8, 1900.

Application filed July 11, 1899. Serial No. 723,508. (No model.)

To all whom it may concern:

Be it known that I, FRANKLIN M. REED, of Indianapolis, county of Marion, and State of Indiana, have invented a certain new and useful Smokeless Furnace; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, in which like figures refer to like parts.

My invention relates to a furnace consisting of such parts and so arranged as to discharge no smoke while in operation. One feature of the construction tending to this result is grate-bars, upon which the coal or other fuel is deposited and burned. These grate-bars are of a peculiar construction and arrangement and have extending longitudinally through them a perforated water-pipe from which water and steam emanate. Steam and water are also introduced into the hollow grate-bars, which are perforated. By these means a water-gas is formed that materially contributes to the rapid and ready consumption of the coal above and of the unconsumed particles in the smoke. Another feature is the combination, with the foregoing feature of construction, of means for introducing air and steam in the upper part of the chamber above the grate to draw the air and unconsumed smoke from beneath the grate-bars through the side chambers and drive it into the chamber above the furnace and at the same time mingle steam with it. There are other novel features, which with these will more fully appear from the accompanying drawings and the description and claims following.

In the drawings, Figure 1 is a front elevation of said furnace. Fig. 2 is a horizontal section thereof on the line A A of Fig. 1. Fig. 3 is a detail in plan of a grate-bar centrally broken away. Fig. 4 is a cross-section of a grate-bar. Fig. 5 is a section of one of the extensions from the grate-bar on the line B B of Fig. 3. Fig. 6 is a vertical section on the line C C of Fig. 2. Figs. 7 and 8 are sections of the valve for adjusting the drip from the water-tank, to be seen in Fig. 1 on the right side thereof. Fig. 9 is a vertical longitudinal section of the furnace on the line D D of Fig. 2.

Referring now to the details of the draw-

ings, 1 represents the brickwork frame of a furnace; 2, the head of a boiler mounted therein; 3, the chimney; 4, a door in the head of the boiler, and 5 the latch for closing the same. A metallic front plate 6 is secured to the brickwork of the furnace, provided with doors 7 leading to the furnace and a door 8 to the ash-pit.

As appears in Fig. 6, the furnace-chamber is contracted in width at its lower end by the auxiliary walls 9, and in the lower and narrow part thereof hollow grate-bars 10 are mounted, as appears in Fig. 9. Said grate-bars are formed in cross-section, as shown in Fig. 4. As there shown, it is hollow, with an upward extension or ridge 11 and lateral extensions 12 on each side. These lateral extensions are in pairs opposite to each other on the same grate-bar; but the various grate-bars are so arranged that said extensions 12 on adjacent grate-bars alternate with each other, as appears in Fig. 2. In the upper side of each extension 12 there is an outlet 60 formed, as shown in Fig. 5. It is rather a double outlet inclined in opposite directions at an angle of about forty-five degrees and passing through a cap 61 on the extension 12. The purpose of the inclination of said outlets 60 is to direct the flame coming therefrom above the adjacent extension 12 on either side, so that the flame will not contact with the adjacent extensions.

In the upper portion or rib 11 of the grate-bar there is along the upper edge thereof and on both sides a series of outlets 13, inclined also upward at an angle of about forty-five degrees. Along the lower portion of said rib 11 and on both sides there is another series of outlets 14 therefrom. This outlet is V-shaped to prevent ashes entering the hollow grate-bar. The ashes will collect in the lower portion of the slot or outlet and will be blown out when the blast is turned on. The cap 61 above referred to is also for the purpose of preventing the ashes from getting into the grate-bar.

A water-pipe 15 extends centrally into and almost through each grate-bar. It is closed at its inner end at 16 and receives water from the front end of the pipe. It is provided with a series of holes 17, located near the front

end, preferably in the upper portion, and being located more and more on the sides of the pipe as it extends inward. Since water enters this pipe, the arrangement of holes just mentioned tend to prevent the water from flowing out immediately near the front end of the pipe, as there are no holes or outlets 17 in the side of the pipe near the front end; but toward the inner end of the pipe the volume of water therein would at all times be less than at the front end, and therefore holes or outlets on the sides are preferable. However, when in full operation the heat of the furnace converts the water into steam almost as soon as it enters the pipe and the steam passes out through said openings 17 into the hollow grate-bars. At the front end of said grate-bars necks 18 are secured, through which the water-pipes extend. The neck 18 is loosely mounted in the brickwork, so as to be rotatable, as appears in Figs. 2 and 9. It is also rotatable on the water-pipe 15. The inner end of the grate-bar is contracted into the form of a collar 19, that is rotatably mounted in one side of the box 20.

As appears in Fig. 1, arms 22 are secured to the outer ends of the necks 18 and depend therefrom. To the lower end of the series of arms 22, there is pivoted a horizontal rod 23, to one end of which a hand-lever 24 is pivoted, said hand-lever being mounted at 25 to the furnace. By operating said hand-lever the grate-bars are oscillated, and thereby the grate is shaken.

The water-pipes 15 are supplied with water from the tank or barrel 26. (To be seen in Fig. 1.) A pipe 27 leads from the lower end and has in it an adjustable valve 28 for adjusting the drip of water from the barrel or tank. This valve is shown more fully in Figs. 7 and 8. As there shown, a cylindrical casing 29 is provided in the pipe 27, in which a rotatable valve 30 is mounted. This valve is provided with a series of oppositely-located ports 31, adapted to register with the upper and lower ends of the pipe 27 when turned in position. The series of ports 31 vary in dimensions, as shown in Fig. 7. The valve is actuated by the small lever 32. (Seen in Fig. 1.) For the passage of a relatively-large amount of water said valve is so rotated as to place the larger pair of ports 31 in line with the pipe 27. To reduce the amount of water passing through, said valve is rotated to bring the small ports in line with said pipe 27. Immediately below the end of the pipe 27 a funnel 33 is mounted upon the pipe 34, that extends first vertically and then horizontally to the outer ends of the water-pipes 15 in the grate-bars.

Air is supplied to the grate-bars through an air-box 20, located transversely at the rear of the grate, as appears in Figs. 2 and 9. It is supplied with air from the pipe 35, that extends horizontally through the chamber 36 on the right-hand side of the furnace from the vertical air-pipe 37, that leads from a fan 38,

driven by the pulley 39 from any suitable source of power. Through the pipes mentioned air is blown into the box 20 and escapes therefrom through the collar 19 into the grate-bars. The air-pipe 40 extends from the left end of said air-box through the left-hand chamber 41 to the front of the boiler. This air-pipe 40 is provided along its lower side with a series of dampers or slide-valves 42, operated by the little lever 43. (To be seen in Fig. 1.) The valve 42 is shown closed in Fig. 6. When opened, air escapes from said pipe 40 into the chamber beneath the grate-bars. The purpose of this is to prevent a back draft of the gas and smoke through the grate-bars and also to mingle air with said gas and smoke to render them in a completely-combustible condition.

The supply of steam to the furnace leaves the top of the boiler, as shown in dotted lines in Fig. 1, and passes through the pipes 50 and 51, that are connected with the vertical pipes 52 and 53, each of which is provided with a valve 54. The vertical pipe 52 is at its lower end connected with the horizontal pipe 55, that extends through the chamber 36, as appears in Fig. 6 and in dotted lines in Fig. 9. A series of steam-injectors 56 extend upwardly and partially into the openings 57 through the walls 9, as appears in Fig. 6. The function of these injectors is to send a jet of steam through said opening 57 to assist in the proper combustion of the gas and smoke in the chamber above the grate and also to draw the air and gas from the chamber below the grate through the side chamber 36 and opening 57 into the chamber above the grate. This causes the combustion of the unconsumed gas or smoke in the chamber above the grate in close proximity to the boiler. The other steam-pipe 53 on the left is connected at its lower end to the pipe 58, similar to the pipe 55 and having on it similar injectors 56, that send a jet of steam through the openings 57 in the wall 9 at the left-hand side. This pipe 58 is continued to the rear, where it turns downward somewhat behind the box 20 and connects with the transverse pipe 62, which is embedded in the bridge-wall and from which three forwardly-extending pipes 63 extend through the walls of the box 20 into the opening at the inner end of the grate-bars. These pipes inject steam into said opening and grate-bars, and since said opening is larger than the diameter of the pipe 63 a jet of steam draws air from the box 20 and drives it into the hollow grate-bars in combination with the steam. From this description it is seen that a gas is formed in the hollow grate-bars from the water and steam issuing from the pipe 15 and the steam entering through the pipes 63 and the air coming in from the box 20 and that this vapor passes out through the outlets 13, 14, and 60 to and through the fuel above the grate-bars. The amount of steam coming into the hollow grate-bars blows the vapor out of said

grate-bars with considerable force. To get this blast, the double provision of the water-pipe and the steam-pipe 63 is made. Under certain circumstances probably either one of these would suffice to furnish sufficient steam to mix with the air-blast and have sufficient pressure to blow the resulting mixture out of the grate-bars; but with the arrangement shown and described such result can be accomplished beyond any doubt.

The arrangement and construction referred to in the preceding paragraph very greatly tend toward effecting the complete combustion of the fuel in close proximity to the grate-bars. However, to complete the combustion and prevent smoke and unconsumed matter from escaping through the chimney or smoke-stack I have provided the means above described for introducing into the chamber, above the grate and immediately below the boiler, where said smoke initially accumulates, steam and air through the openings 57. It is also observed that by means of the valve 42 in the air-pipe 40 I introduce air into the chamber below the furnace and into the side chambers 36 and 41, which accomplishes two results—namely, the prevention of a back draft through the grate-bars and the supply of air immediately beneath the boiler. Attention is also called to the fact that the furnace is contracted at its lower end and expands upward to suit the boiler above, whereby with the other features the amount of fuel necessary for a boiler is greatly reduced as compared with furnaces as heretofore made. It reduces the blast necessary to burn the fuel.

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

1. In a furnace, hollow perforated grate-bars, a perforated water-pipe in said grate-bars, and means for supplying said water-pipe with water.

2. In a furnace, hollow perforated grate-bars, a water-pipe in such bars, and means connected with one end of said water-pipe for supplying it with water, said water-pipe being provided with perforations in the top near the end to which water is first supplied and

farther down along the sides of said water-pipe as the distance from the supply end of said pipe increases.

3. In a furnace, perforated grate-bars, water-pipes extending therein, a supply-pipe leading to said water-pipes, a tank to supply water to said supply-pipe, and a valve for regulating the drip of the water from the tank to said supply-pipe consisting of a casing with an upper inlet and a corresponding lower outlet, a hollow cylinder in said casing with a series of oppositely-located ports of varying dimensions adapted to register with the inlet and outlet, and means for rotating and adjusting said cylinder.

4. In a furnace, hollow grate-bars provided with an upwardly-extending ridge having suitable outlets and oppositely-located horizontal extensions from the grate-bar which have on their upper surface a suitable outlet.

5. In a furnace, hollow grate-bars with outlets therefrom V-shaped or extended downward between the inlet and outlet ends thereof.

6. In a furnace, hollow perforated grate-bars, an air-box at the rear into which the grate-bars extend, steam-injectors entering the inner end of said grate-bars, and means for introducing water into the front end of said grate-bars.

7. In a furnace, hollow grate-bars, an air-box into which one end of said grate-bars extends, means for supplying air to said box, a steam-supply pipe embedded in the bridge-wall behind said air-box, and steam-injectors leading from said steam-supply pipe and extending through said air-box and entering the open ends of the hollow grate-bars for introducing steam therein and also drawing in the air from the air-box.

In witness whereof I have hereunto affixed my signature in the presence of the witnesses herein named.

FRANKLIN M. REED.

Witnesses:

V. H. LOCKWOOD,
M. C. BUCK.