No. 652,924. Patented July 3, 1900.

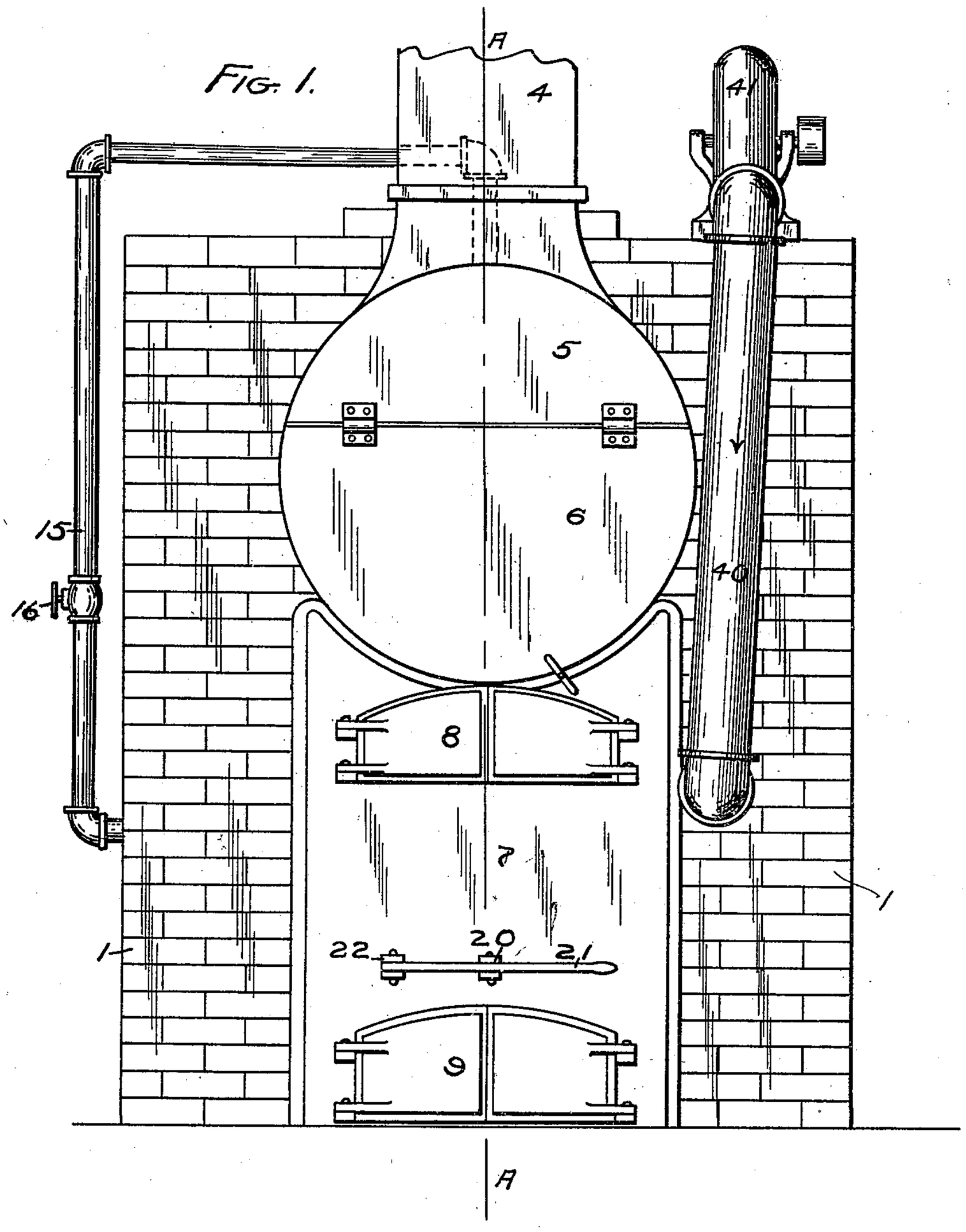
# F. M. REED & R. R. SPAIN.

## SMOKELESS FURNACE.

(Application filed Oct. 2, 1899.)

(No Model.) 4 Sheets—Sheet 1.

FIG. 1.




WITNESSES:
M. C. Buck.
G. H. Blaker.

INVENTORS
Franklin M. Reed and
Richard R. Spain
BY
V. H. Lockwood
Their ATTORNEY.

No. 652,924. Patented July 3, 1900.

# F. M. REED & R. R. SPAIN.

## SMOKELESS FURNACE.

(Application filed Oct. 2, 1899.)

(No Model.) 4 Sheets—Sheet 2.

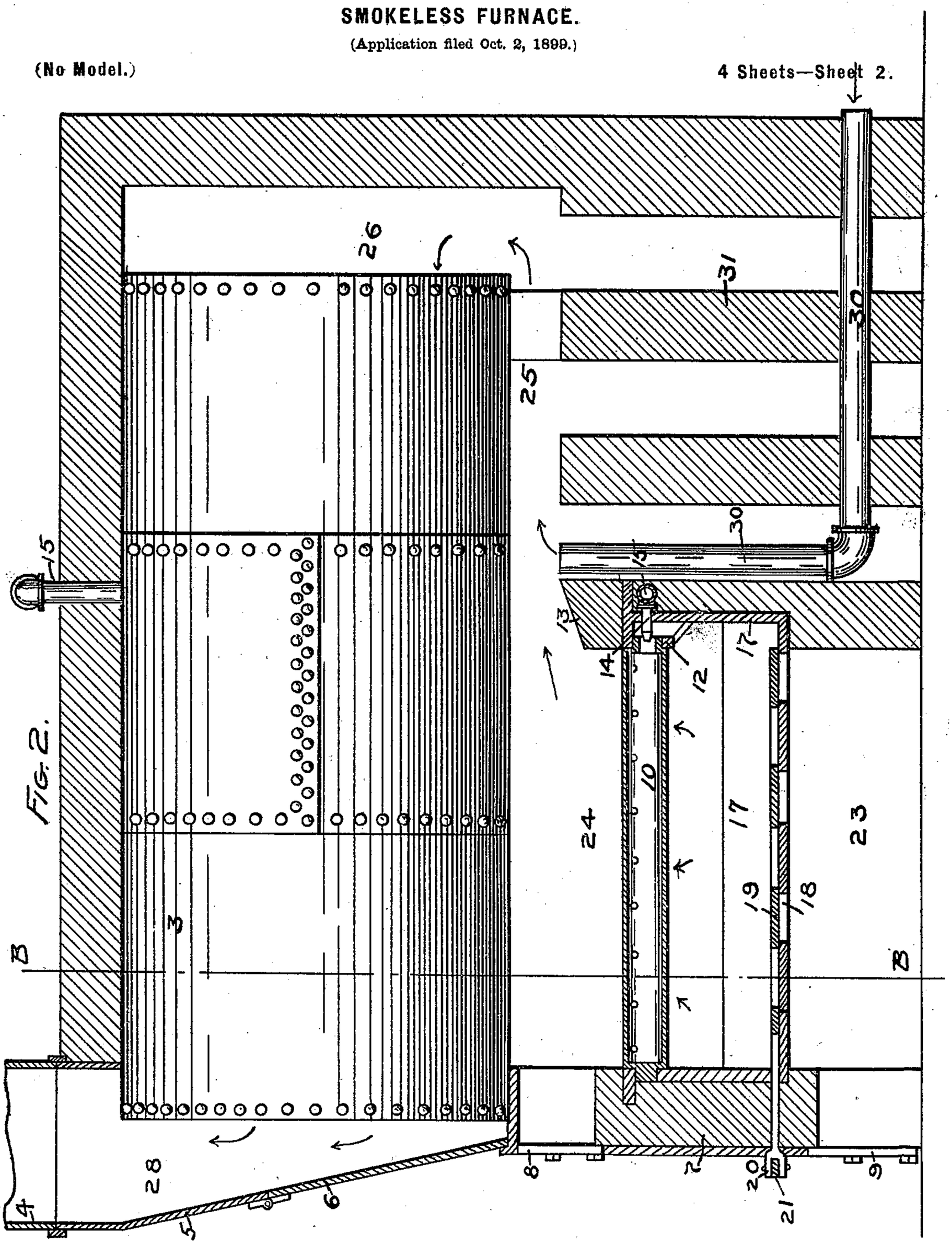



FIG. 2.

WITNESSES:
M. C. Buck.
G. H. Blaker.

Franklin M. Reed and
Richard R. Spain.
INVENTORS.
BY V. H. Lockwood
THEIR ATTORNEY.

No. 652,924. Patented July 3, 1900.

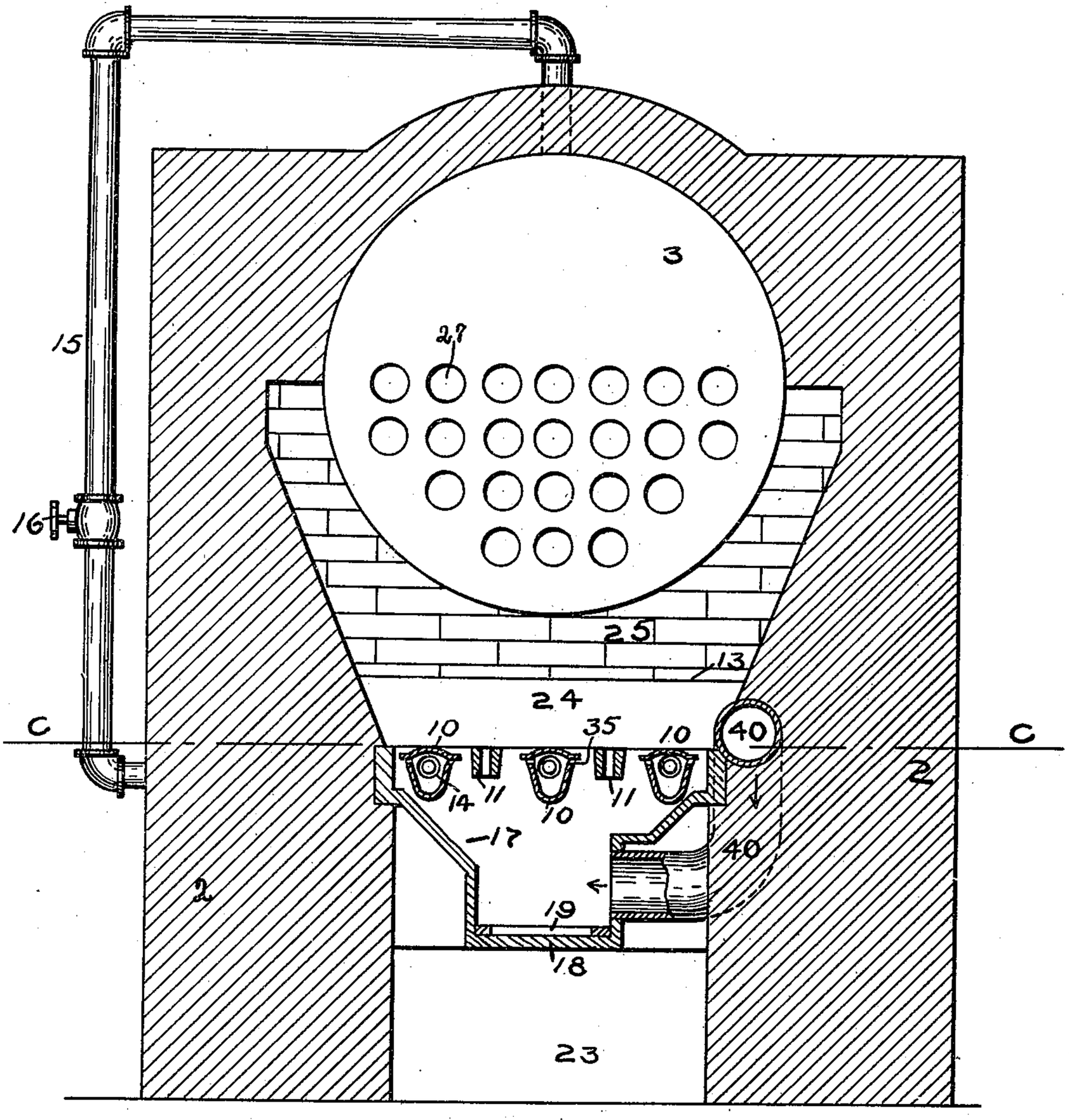
# F. M. REED & R. R. SPAIN.

## SMOKELESS FURNACE.

(Application filed Oct. 2, 1899.)

(No Model.) 4 Sheets—Sheet 3.

FIG. 3.




WITNESSES:
M. C. Buck.
G. H. Blake.

Franklin M. Reed and Richard R. Spain. INVENTORS
BY
V. H. Lockwood
Their ATTORNEY.

No. 652,924. Patented July 3, 1900.

# F. M. REED & R. R. SPAIN.

## SMOKELESS FURNACE.

(Application filed Oct. 2, 1899.)

(No Model.) 4 Sheets—Sheet 4.

FIG. 5.

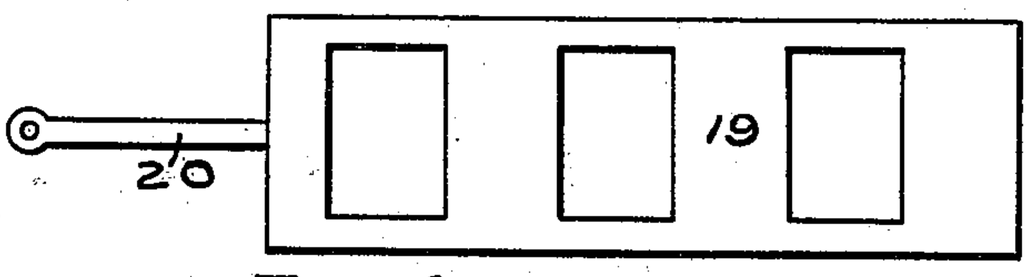



FIG. 6.

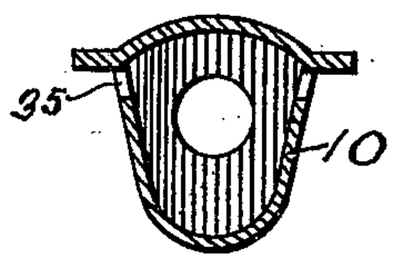
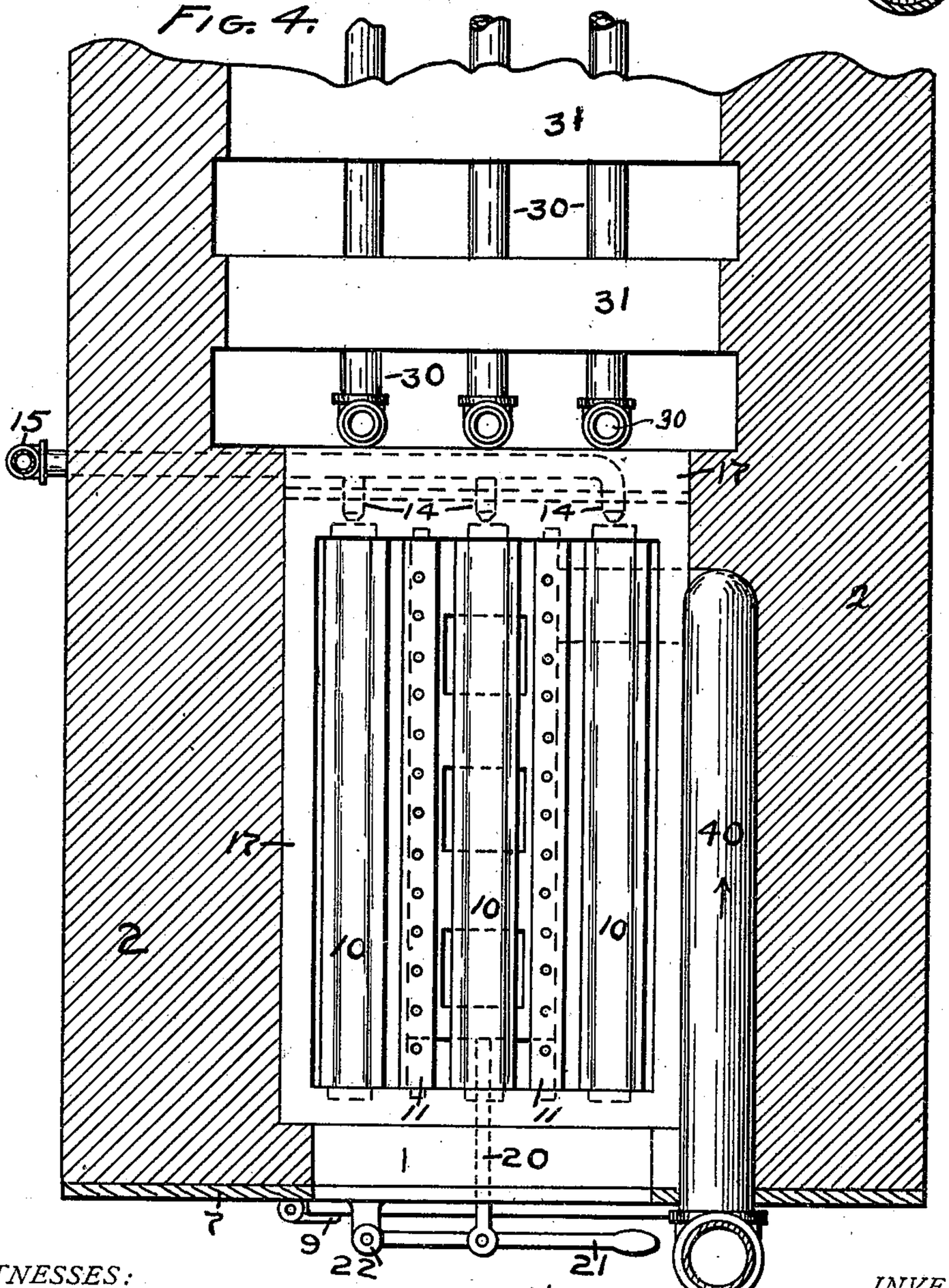



FIG. 4.




WITNESSES:
M. C. Buck.
G. H. Baker.

INVENTORS
Franklin M. Reed and
Richard R. Spain.
BY
V. H. Lockwood.
Their ATTORNEY.

# UNITED STATES PATENT OFFICE.

FRANKLIN M. REED AND RICHARD R. SPAIN, OF INDIANAPOLIS, INDIANA, ASSIGNORS, BY DIRECT AND MESNE ASSIGNMENTS, TO THE REED SMOKELESS FURNACE COMPANY, OF SAME PLACE.

## SMOKELESS FURNACE.

SPECIFICATION forming part of Letters Patent No. 652,924, dated July 3, 1900.

Application filed October 2, 1899. Serial No. 732,358. (No model.)

*To all whom it may concern:*

Be it known that we, FRANKLIN M. REED and RICHARD R. SPAIN, of Indianapolis, county of Marion, and State of Indiana, have invented a certain new and useful Smokeless Furnace; and we 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.

Our invention relates to certain improvements in a smokeless furnace whose object is to assist in the complete combustion of the fuel and the smoke and gases arising therefrom, whereby all the heat units are obtained from the fuel that is possible and no smoke issues from the smoke-stack.

The full nature of our invention will appear from the accompanying drawings and the description following of one form of device embodying our said invention, and the scope of the invention will be understood from the claims following said description.

In the drawings, Figure 1 is a front elevation of a furnace with the smoke-stack broken away. Fig. 2 is a vertical section on the line A A of Fig. 1. Fig. 3 is a vertical section on the line B B of Fig. 2. Fig. 4 is a horizontal section on the line C C of Fig. 4, the rear portion being broken away. Fig. 5 is a plan of the shaker. Fig. 6 is a cross-section of the grate-bar.

Referring now to the details of construction of the furnace shown in the drawings herein, 1 is the brick front wall, and 2 the brick side walls, of a furnace, in which the boiler 3 is mounted. A smoke-stack 4 leads from the front end of the boiler and furnace and has a stack-head 5 at the lower end of it with a hinged door 6. Below this is a front plate 7, with the doors 8 into the furnace-chamber and the doors 9 into the ash-pit.

The grate is formed of two kinds of grate-bars 10 and 11, as shown in cross-section in Fig. 3. The grate-bar 10 is hollow and perforated, closed at the front end, and open at the rear end. The rear end is mounted on a cross-bar 12 adjacent to the bridge-wall 13. Into the rear end the siphoning steam-injector pipe 14 extends, that leads from the steam-supply pipe 15 coming from the boiler, as seen in Figs. 1 and 2. The valve 16 is provided for shutting it off and regulating it.

Beneath the grate-bars we provide a pan or closed box 17, with the rear wall thereof extending upward behind the rear end of the grate-bars, as appears in Fig. 2. This permits the air or gas in said pan or box 17 to be drawn or driven into the hollow grate-bars by the injector-pipes. This grate-box 17 has sloping sides, as appears in Fig. 3, to contract the bottom thereof. The bottom has large openings 18, closed by a damper or shaker 19, which also has openings through it to correspond with the openings 18. Said shaker is shown in Fig. 5 and has a stem 20 extending through the front wall 7, and to the outer end of it the shaking-lever 21 is centrally pivoted, said lever 21 being fulcrumed at 22. This is for the purpose of actuating the shaker. Below the grate-box 17 lies the ash-pit 23, and above the grate-bars is the furnace-chamber 24. The grate-box 17 has an open top, but elsewhere is so constructed that it is air-tight when the shaker 19 closes the openings in the bottom, and air is forced into said box through the pipe 40, that leads from the fan 41. The bridge-wall 13 is sloped or beveled, as shown in Fig. 2, so that there is a chamber 25 under the rear end of the boiler and a chamber 26 behind the rear end of the boiler. The draft or flame passes through the chambers 25 and 26 and through the tubes 27 of the boiler to the chamber 28 at the front end of the boiler, from which it escapes through the smoke-stack. Immediately behind the bridge-wall we provide a series of air-inlet tubes 30, leading from the rear. The air is drawn through said tubes by the draft passing over the upper ends of them. Said tube should extend exactly to the upper edge of the bridge-wall. In order to warm or heat the air passing through the tubes 30, we extend them through a chamber under the rear end of the boiler. We here provide cross-walls 31, with space between them, the end wall, and bridge-wall of the furnace, and let the pipes 30 pass through them

some distance from the bottom. The hot air in this chamber between the wall 31, the end wall, and bridge-wall will heat the air passing through the pipes 30, and the hot air will pass out of said pipes from immediately behind the bridge-wall, where it mixes with the unconsumed gas and smoke and renders them readily combustible, so that their complete consumption immediately ensues and they do not pass out through the smoke-stack.

The hollow grate-bars 10 have side outlet-openings 35, sheltered by the overhanging top from the ashes. The mixed air and steam issuing through said openings cannot turn downward away from the fuel, because the pressure in the air-tight grate-bar drives it upward into the fuel.

The operation of the furnace will be understood from the following description: The blast of air driven into the grate-box 17 supplies more air to the fuel above the grate-bars than if there were no blast. Air from said grate-box is also introduced, along with the steam, through the injector-pipe 14 into the hollow grate-bar, where the same becomes superheated and issues through the perforations of the grate-bars to the fuel above. The means just described tend to promote the complete combustion of the fuel; but whatever unconsumed gases and smoke leave the fuel the same is consumed after the air from the pipes 30 mingles therewith. With this construction, therefore, no smoke escapes from the smoke-stack, the fuel, gas, and smoke are completely consumed, and a vigorous draft is maintained all the time in order to furnish an intense heat. The suction of the smoke-stack draws the air from the outside through the pipes 30.

What we claim as our invention, and desire to secure by Letters Patent, is—

A furnace including a grate-box air-tight excepting at the top, hollow perforated grate-bars across the top thereof with one end opening into said box, a steam-supply pipe, injector-pipes leading therefrom through the wall of said box into the open ends of the grate-bars for injecting steam therein and drawing air from the box into the grate-bars, and means for forcing air into the grate-box.

In witness whereof we have hereunto affixed our signatures in the presence of the witnesses herein named.

FRANKLIN M. REED.
RICHARD R. SPAIN.

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