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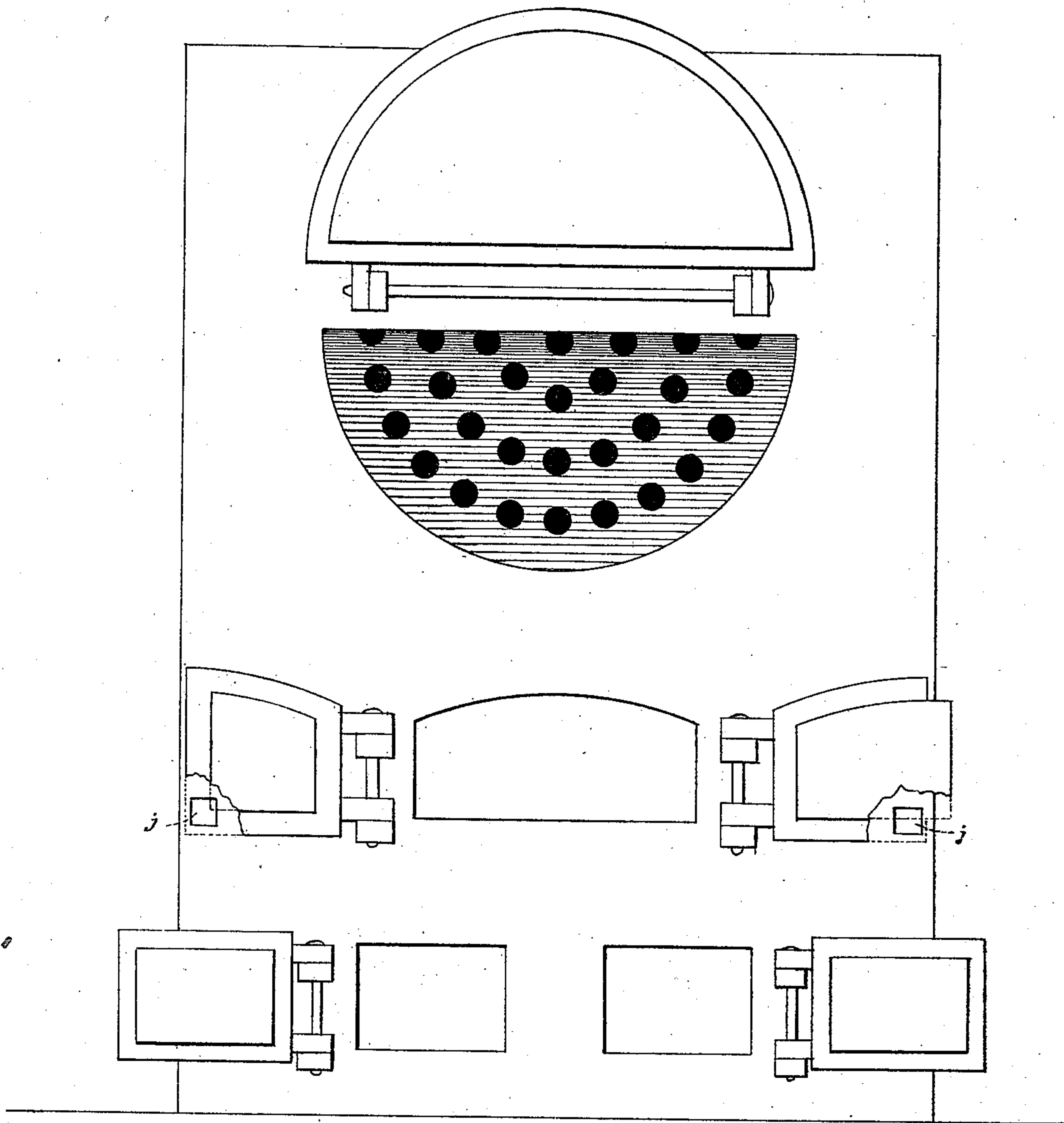
K. M. JARVIS.

SMOKE AND GAS CONSUMING FURNACE.

No. 176,639.

Patented April 25, 1876.

*Fig. 1.*



Witnesses.

*L. H. Latimer.*  
*W. J. Pratt.*

Inventor.

*Kingsbury M. Jarvis*  
*per Crosby Gregory Atty*

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Fig. 2.

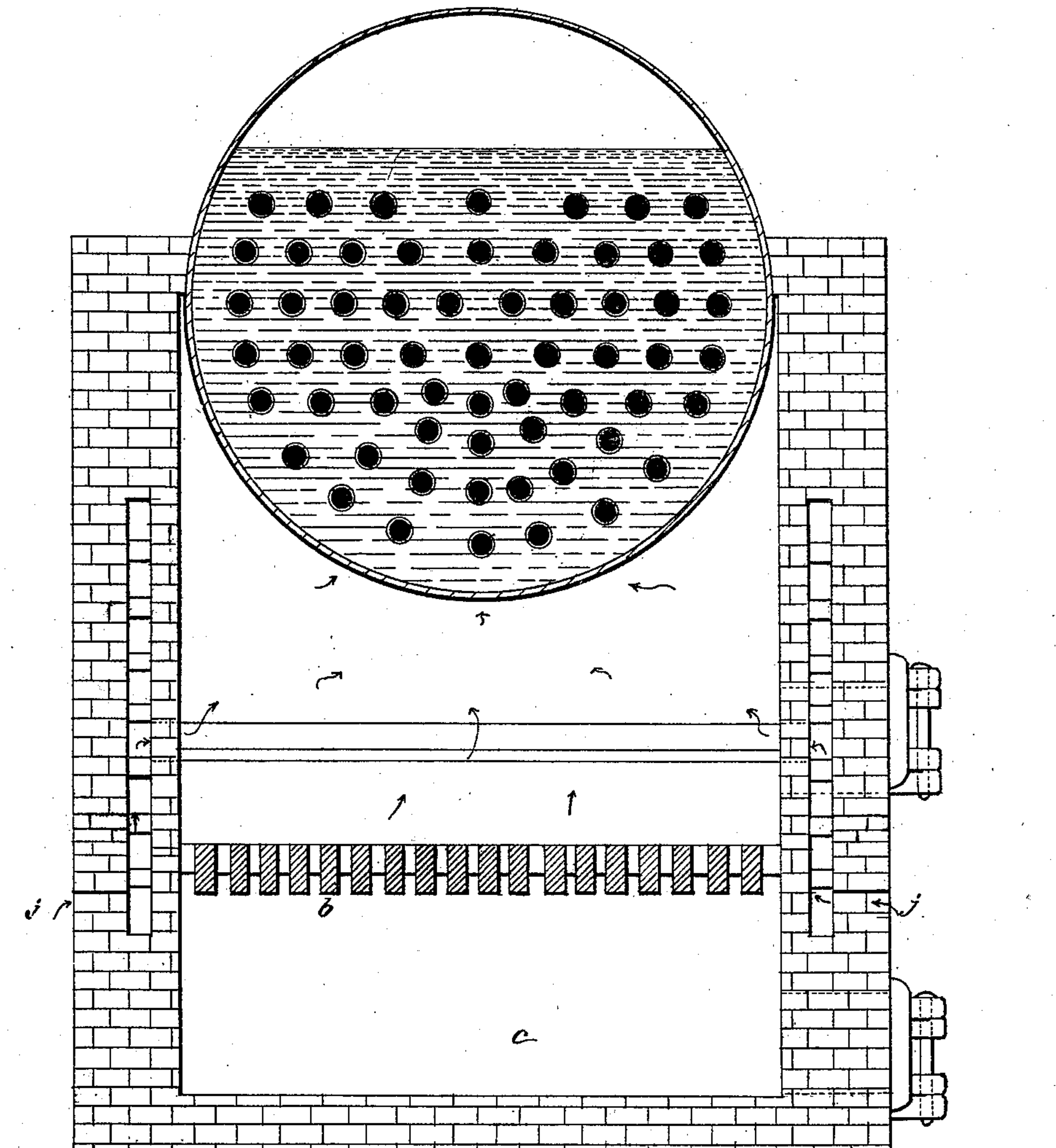
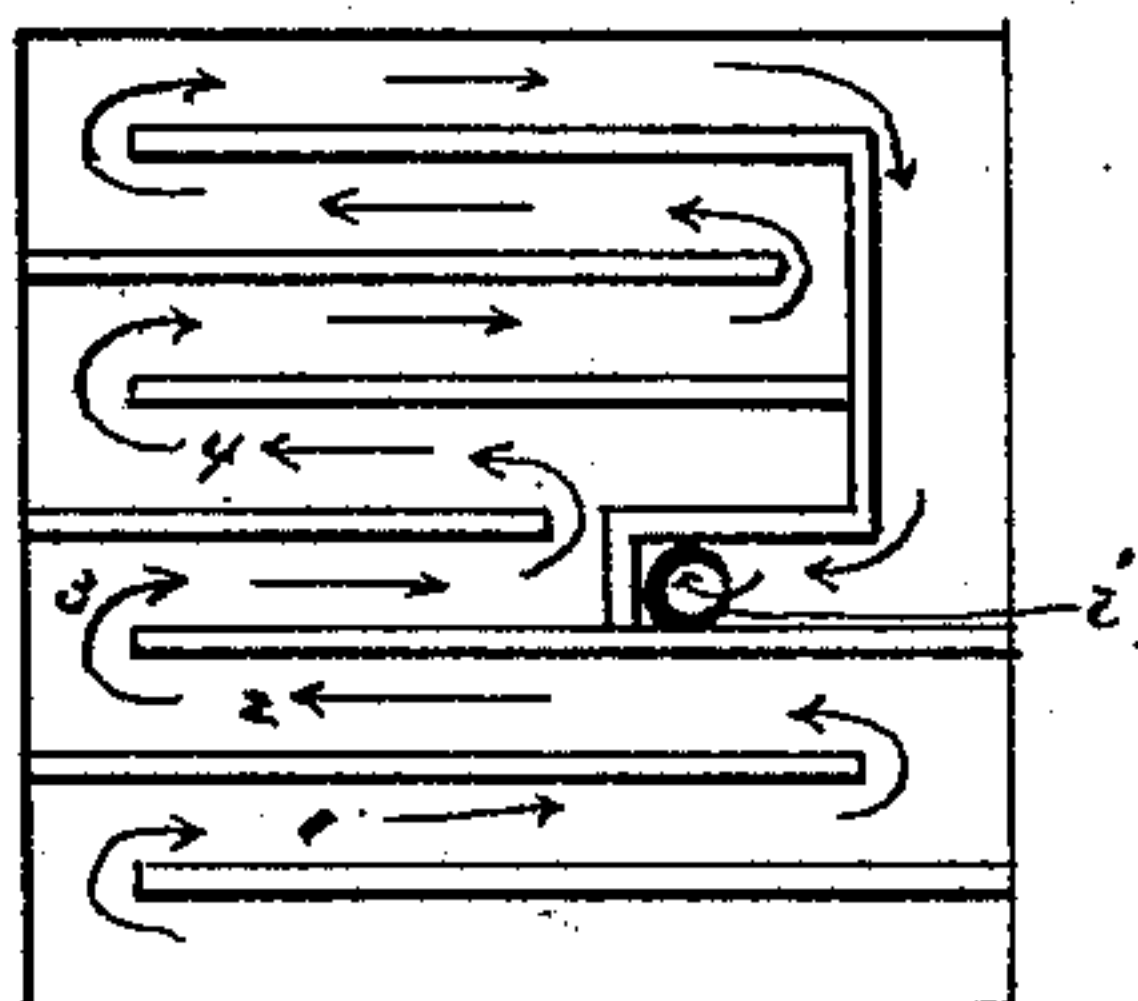


Fig. 4.



Witnesses:

L. H. Latimer.

W. J. Pratt.

Inventor.

Kingsbury M. Jarvis

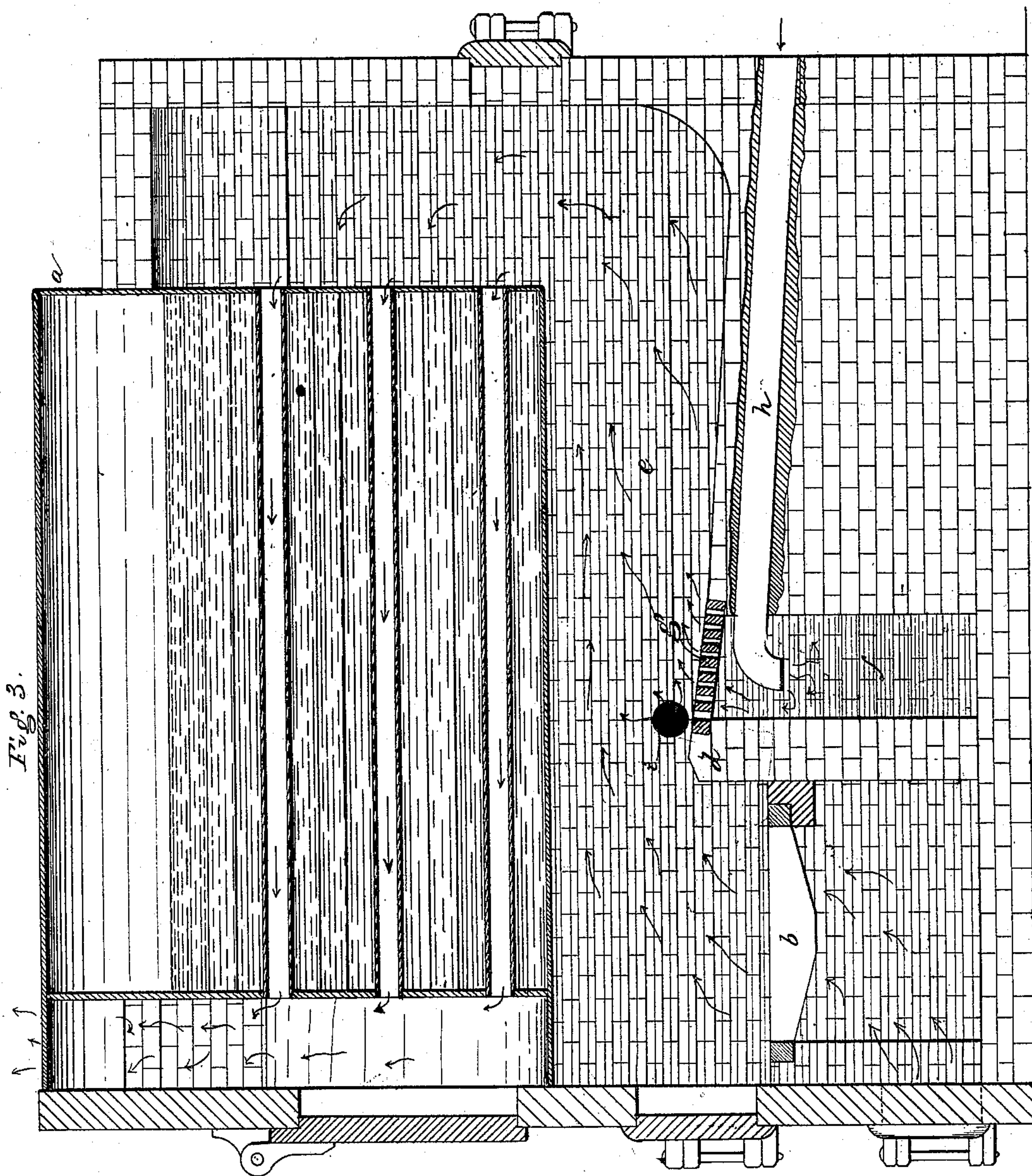
per Leroy & Morgan Atty.

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# UNITED STATES PATENT OFFICE.

KINGSBURY M. JARVIS, OF PEABODY, MASSACHUSETTS.

## IMPROVEMENT IN SMOKE AND GAS CONSUMING FURNACES.

Specification forming part of Letters Patent No. 176,639, dated April 25, 1876; application filed April 3, 1876.

*To all whom it may concern:*

Be it known that I, KINGSBURY M. JARVIS, of Peabody, in the county of Essex, and State of Massachusetts, have invented an Improvement in Smoke and Gas Consuming Furnace, of which the following is a specification:

This invention relates to smoke and gas consuming furnaces of steam-boilers; and consists in the combination, with the furnace, of flues, as hereinafter set forth, whereby heated air is delivered to the column of gas freed by the combustion of the coal through the bottom and sides of the combustion-chamber, the heated air acting to reduce the temperature of the gas much less than cold air, thereby permitting the oxygen of the heated air to mingle with the gas at a temperature nearer the temperature of ignition, making the combustion more thorough while the gas is under the boiler, where the greatest heat is needed, and in connection with the admission of heated air, as described, the boiler is elevated more than usual to afford an enlarged space sufficient for thorough expansion and combustion of the gas and carbon.

Figure 1 is a front view of a furnace of a stationary engine, all the doors being open. Fig. 2, a cross-section taken just back of the end of the boiler and through the grate; Fig. 3, a longitudinal section; and Fig. 4, a plan of the flue in the side wall of the furnace.

The boiler *a* is of usual or any ordinary construction. *b b* are the grate-bars; *c*, the ash-pit; *d*, the bridge-wall; and *e*, the combustion-chamber. Back of this bridge-wall is an open space, *f*, covered from side to side of the furnace with a strong cast-iron plate, *g*, perforated with a great number of small holes, through which passes heated air discharged from flues *h*, formed in this instance from pipes communicating with the atmosphere at the back of the furnace. These pipes are laid close up to or into the bottom of the combustion-chamber, so that the gases therein will heat quite hot the air in the flues, and the air so heated is directed downward into the chamber or space *f*, where it is allowed to expand, and its current is broken, so that in leaving the chamber through the perforations in the plate it is discharged evenly from side to side of the

combustion-chamber, and is mixed with and supplied uniformly to the gases passing over the bridge-wall, and this even and uniform mixing of the heated air and gases makes the combustion much more perfect than would be the case if the air was admitted in but few places, and not thoroughly incorporated into and among the column of gas. In addition to this supply of heated air at the under side of the gas passing over the bridge-wall, I also throw into the flame or gas a column of heated air from each side of the combustion-chamber, above the perforated plate. The air to be heated and supplied from openings *i* at each side of the combustion-chamber enters the openings *j* either at the side of the furnace-wall, as in Fig. 2, or at the front, as in Fig. 1, and traverses the flues 1 2 3, &c., (see Fig. 4,) such flues being made in the side wall of the furnace fire-chamber, and from these flues the heated air issues at *i* in a strong current. This heated air is discharged laterally into the flame or gas just as it passes over the bridge-wall, and coming from opposite sides, and into the flame or gas, at substantially a right angle, it breaks up the regularity of the current of flame or gas, as will be fully evident to practical persons, and the heated air imparts its supply of oxygen to the flame or gas, and at this time, the gas or flame being disturbed and checked by counter-currents, receives at its under side the body of heated air rising through the perforated plate in numerous small jets that penetrate the whole mass of flame or gas from side wall to side wall, and the gas or flame, with its commingled heated air in the process of combustion, rolls and moves about in the combustion-chamber, and laps up about the under portion of the boiler in a manner not possible where the flame or gas is permitted to move over the bridge-wall in a regular defined current, and without great disturbing currents.

The mixing of heated air in this way with the flame or gas, as described, makes most perfect combustion, and enables me to burn coal or pressed tan or screenings.

A boiler—say, of one hundred horse-power—when set according to my improvements, will have the grate placed twenty-six inches below it, the top of the bridge-wall will be fourteen



inches below the bottom of the boiler, and the under side of the boiler at its back end will be twenty-four inches above the floor of the combustion-chamber. This, it will be noticed, affords more space than usual for complete combustion of the gas. The flues in the side wall, as shown in Fig. 4, instead of being arranged horizontally, might be arranged vertically, or at any other angle in the side walls, so long as the flues are made as long as possible, so as to retain the air between the side walls long enough to thoroughly heat it. By conducting the air through tortuous flues formed in the hollow side walls, I am enabled to heat it much better than would be possible were the flues direct.

Any desired number and diameter of pipes may be employed for the flues *h*, according to the quantity of air to be admitted, and in some instances I propose to make them tortuous, and, if desired, I may form two or more metallic plates with projections arranged substantially as shown in Fig. 4, and such plates may be embedded in the brick-work of the furnace forming the under side of the combustion-chamber, so as to form tortuous flues leading from the atmosphere outside the furnace into the chamber *f*, and the flat sides of the plates would, in this modification, form the bottom of the combustion-chamber.

I am aware that it is not new to lead air into the combustion-chamber and fire-box, (both cold and hot air,) and through direct flues in the furnace-walls.

I am also aware that cold and warm air have been discharged into the fire-chamber

both above and below the incandescent fuel, and also through a bridge-wall; but I am not aware that heated air has ever been admitted or discharged into the flame or gas in opposing directions, as herein described and shown, whereby the heated air is thoroughly and minutely commingled with the flame or gas to insure complete combustion, and to check the current of gas or flame. The enlarged combustion-chamber permits the practically complete combustion of the gas therein before passing to the chimney.

In practice, a furnace set and supplied with heated air, as shown and described, need not be supplied with air from a blower, even when hard coal, screenings, or pressed tan is used.

The openings *i* are about four inches in diameter.

I claim—

In a smoke-consuming furnace, the flues in the side walls and openings *i* at the sides over the bridge-wall, in combination with the flues *h* and the perforated plate and chamber *f*, all arranged with reference to each other and the boiler, as described, whereby the heated air is introduced and commingled with the gas or flame in the combustion-chamber, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

KINGSBURY M. JARVIS.

Witnesses:

GEO. HOLMAN,  
BENJ. K. DAVIS.