2 Sheets--Sheet 1.

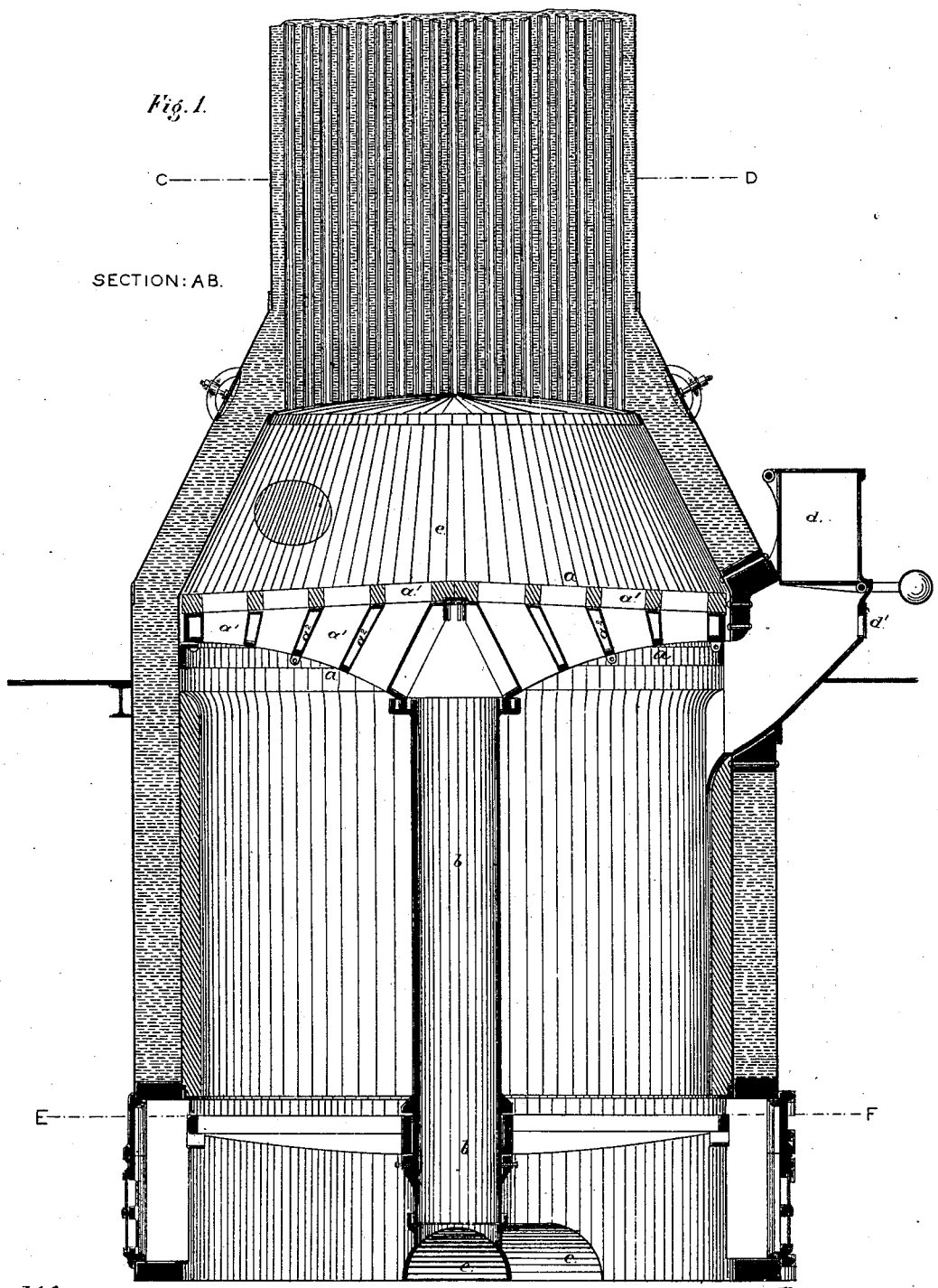
Z. S. DURFEE.

Vertical Gas Burning Boiler.

No. 167,080. Patented Aug. 24, 1875.

Fig. 1.

SECTION: AB.



Witnesses:
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2 Sheets--Sheet 2.

Z. S. DURFEE.

Vertical Gas Burning Boiler.

No. 167,080. Patented Aug. 24, 1875.

Fig. 2

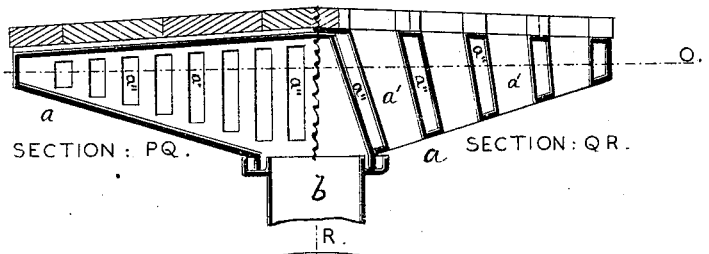


Fig. 3

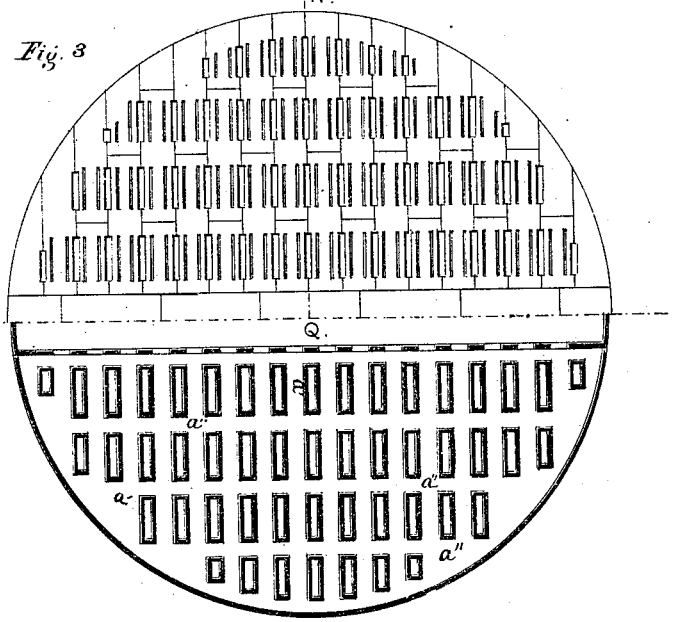


Fig. 4

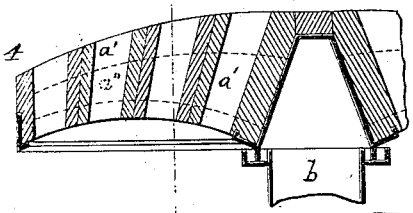


Fig. 5

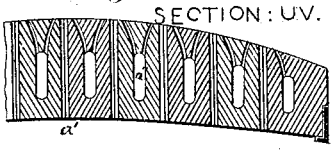
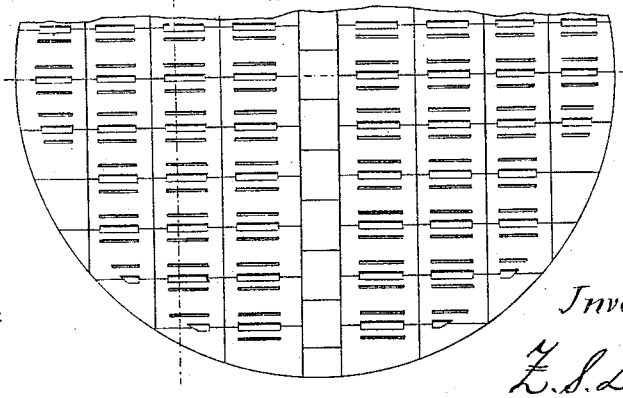


Fig. 6



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UNITED STATES PATENT OFFICE.

ZOHETH S. DURFEE, OF NEW YORK, N. Y.

IMPROVEMENT IN VERTICAL GAS-BURNING BOILERS.

Specification forming part of Letters Patent No. **167,080**, dated August 24, 1875; application filed March 9, 1875.

To all whom it may concern:

Be it known that I, ZOHETH S. DURFEE, of the city and State of New York, have invented an Improvement in Vertical Gas-Burning Boilers, of which the following is a specification:

My invention consists in an improved mode of combining with vertical steam-boilers gas-burning diaphragms and pipes for leading air to said diaphragms.

Figure 1, Sheet 1, is a vertical section of my boiler. Figs. 2, 3, 4, 5, 6, Sheet 2, are sections and plans of the combustion-diaphragms I propose to employ.

The general features of the boiler will be understood from the drawings and need not be described. *a a* represent the combustion-diaphragm; *b*, the vertical pipe supplying air to the diaphragm; *c*, a horizontal pipe leading from without the boiler to the vertical pipe *b*, and supplying the air to it. In the several plans and sections of the diaphragm, a^1 represents the gas-passages; a^2, the air-passages and spaces between the walls of the iron shell of the diaphragm, and a^3 the holes for the passage of the air up through the bricks protecting the top of the diaphragm. These surface bricks may be superseded by giving the top plate of the iron shell greater thickness and putting the air-flues now shown in the bricks in this plate. The feeding-hoppers *d d* have sight-holes *d'* in their lower parts, communicating with the fuel-chamber, through which the condition of the fuel under combustion may be watched and the fuel stirred when necessary. A platform is constructed around the boiler to give convenient access to the feeding-hoppers.

In working the boiler a fire is kindled on the grate and air let in through the doors of the ash-pit in the usual way, until the fire is well kindled, when charging of coal through the feeding-hoppers is carried on from time to time till a combustible gas begins to be developed. Before the gases have much combustible character, sufficient air should be let, through the pipes *c* and *b*, into the diaphragm *a* to combine with the gases produced in the fuel-chamber, and as both air and the gases pass up through small openings which are close together, the ignition of the mixture will take place at the proper time without any serious explosion or puff, especially as it will be seen, on examination of the drawings, that the several streams of air and gas converge together to a focus quite close to the surface of the diaphragm. If desired, the man-hole of the combustion-chamber may be opened and a light fire kindled on the surface of the diaphragm, and be kept burning till a satisfactory combination of air and gases is assured.

It will be seen that by varying the pressure and volume of air under the grates and in the pipes and diaphragms, the character and intensity of the heat developed in the combustion-chamber can be varied at will. The depth of fuel on the grates will be determined by the character of the fuel and the strength of the blast or draft. The management of the fires will be understood by all familiar with the now quite common practice of burning fuel as a gas, and need not be explained here. The inlet to the pipe *c* may be controlled in any convenient way, depending, of course, upon whether blast or draft is used.

In working the feeding-hoppers, care must be taken to keep the stoppers of the sight-holes and the drop-bottoms tightly closed when not required to be opened, and it is preferable to follow up each discharge of fuel with an immediate recharge of the hopper, to prevent more fully any leakage of gas.

The diaphragm *a* may be constructed as a whole or in sections; but it will be best to make it in sections, the joints running in the line of the gas-openings, as shown in Fig. 1. The joint between the diaphragm and the vertical pipe *b*, and the joint between the pipe *b* and the pipe *c*, I show as simple socket-joints, to be made tight by cement or sand, or any other convenient way. The joints between the periphery of the diaphragm and the inner shell of the boiler I close in the same way.

The diaphragms, as shown in Fig. 1, are constructed in sectors communicating at their apexes with the vertical air-tube. Those shown in Figs. 2 and 3 are composed of half-circular diaphragms (which may be whole or be divided in parallel strips) resting against an iron air-distributing box running across the boiler, and which is shown in cross-section

in Fig. 4, and in one-half longitudinal section in Fig. 2, on the left hand.

In Figs. 4, 5, and 6, I show, instead of the cast-iron diaphragms faced with brick, a diaphragm composed of arched bricks resting against the air-distributing box, the bricks being such as I have described and claimed in a previous patent.

If desired, a water-diaphragm provided with valves for shutting off the gases from the combustion-diaphragm may be constructed in the boiler below the combustion-diaphragm, substantially as is done in my horizontal boilers, described in an application for a patent for locomotive and horizontal boilers, filed February 20, 1875. In some cases I line the surface of the boiler, inside of the fire-box, with fire-brick, as shown in Fig. 1. This is done partly because it will facilitate holding the fire in the boiler without a rapid generation of steam, when steam is not required, and partly because, at the slow rate at which it is desirable to burn the fuel, it will be difficult to maintain any combustion near the inside walls of the boiler if they are not lined; and it may be doubtful if the loss of gas by the stoppage of combustion on the outside of the fuel will not be more important than the loss of effective heating-surface from a moderately thick brick lining.

Reserving all right of priority of invention in the details shown and described in my drawings and specification not now claimed,

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

The combination with vertical steam-boilers with internal fire-boxes, the gas-burning diaphragms *a*, air-pipes *b*, &c., and feeding-hoppers *d d*, substantially as described and shown.

ZOHETH S. DURFEE.

Witnesses:

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