Z. S. DURFEE. 4 Sheets--Sheet 1

Improvement in Base Burning Steam Boilers.

No. 124,672. Patented March 19, 1872.

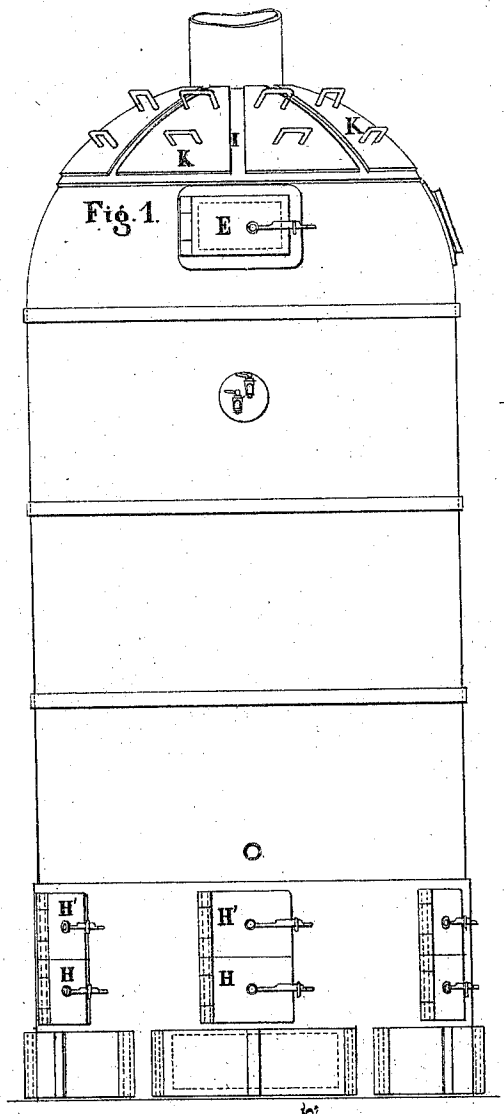


Fig. 1.

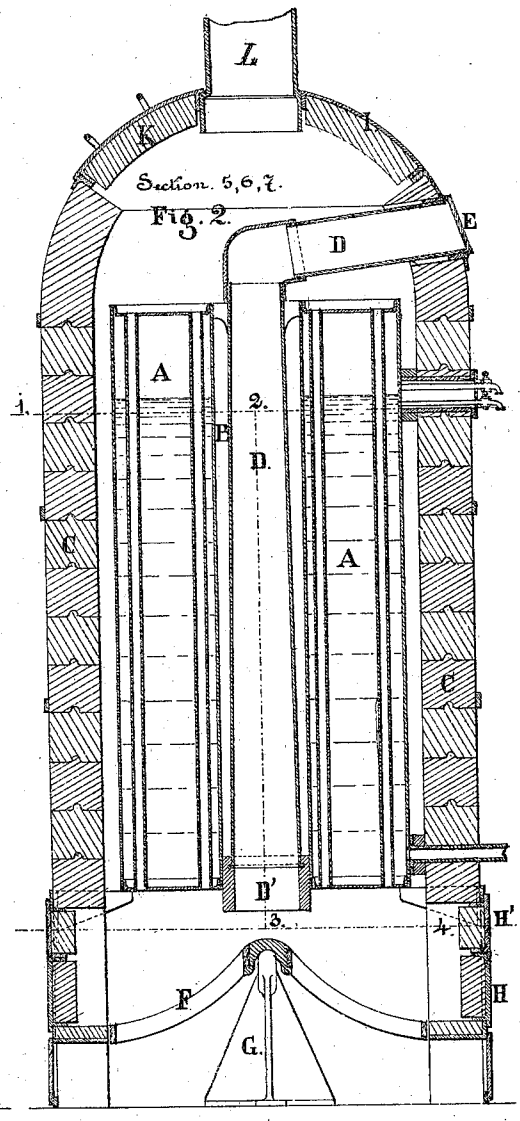


Fig. 2.

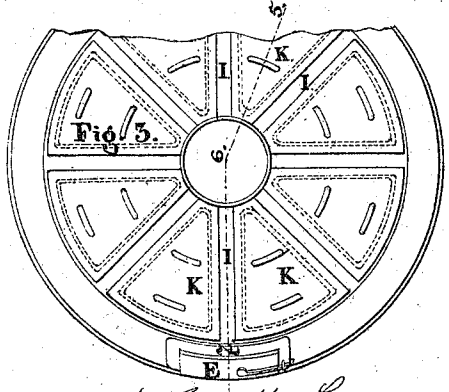


Fig. 3.

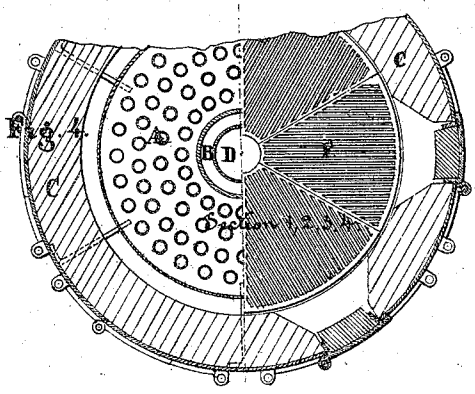


Fig. 4.

Witnesses: Chas. A. Ladd
Emil Heusner

Inventor: Z. S. Durfee

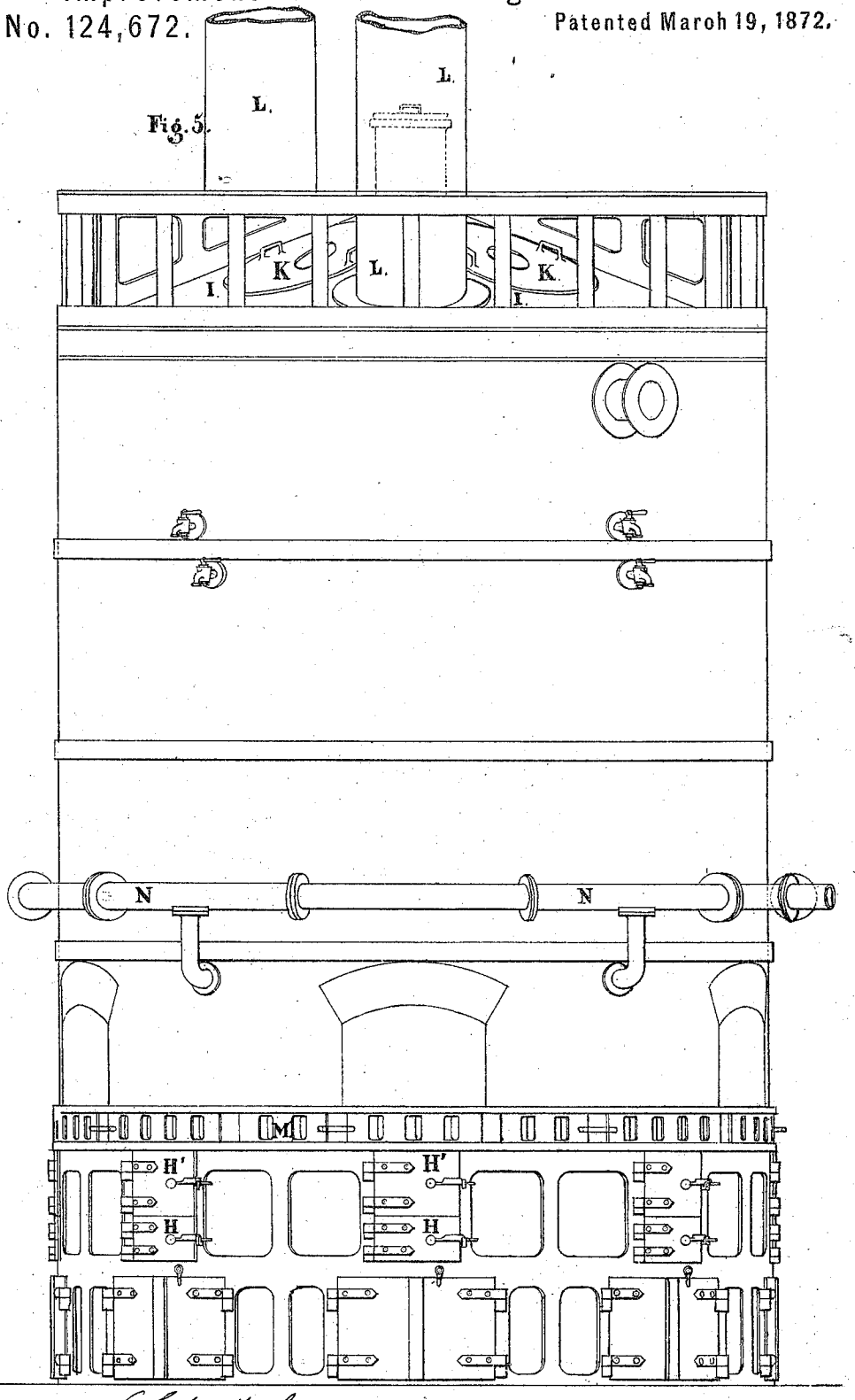
4 Sheets--Sheet 2.

Z. S. DURFEE.

Improvement in Base Burning Steam Boilers.

No. 124,672. Patented Maroh 19, 1872.

Fig. 5.



Witnesses: Chas. H. Ladd, Emil Heusner

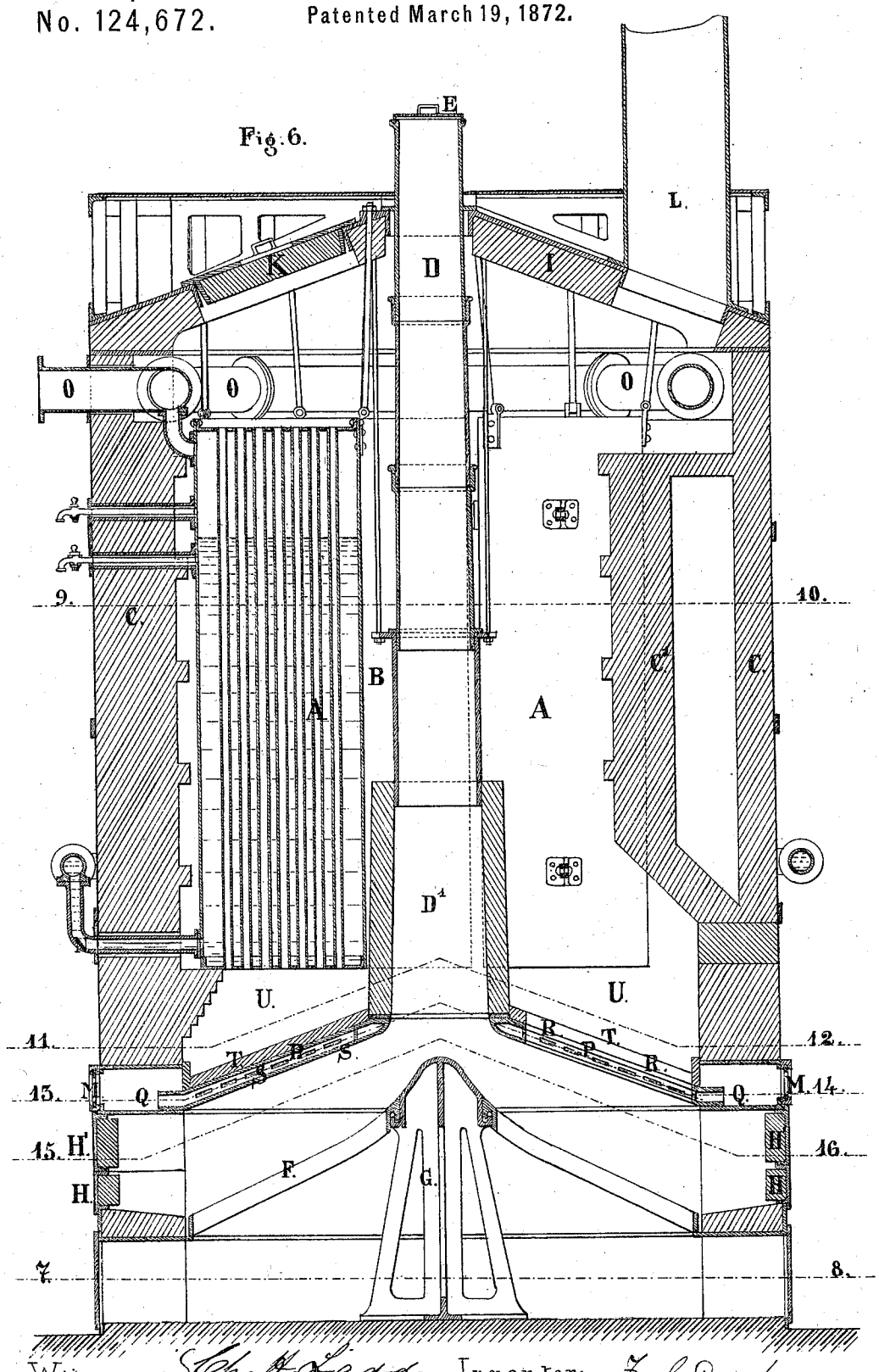
Inventor: Z. S. Durfee

Z. S. DURFEE. 4 Sheets--Sheet 3.

Improvement in Base Burning Steam Boilers.

No. 124,672. Patented March 19, 1872.

Fig. 6.



Witnesses: Chas. H. Ladd
Emil Heusner

Inventor: Z. S. Durfee

Z. S. DURFEE. 4 Sheets--Sheet 4.

Improvement in Base Burning Steam Boilers.

No. 124,672. Patented March 19, 1872.

Fig. 7.

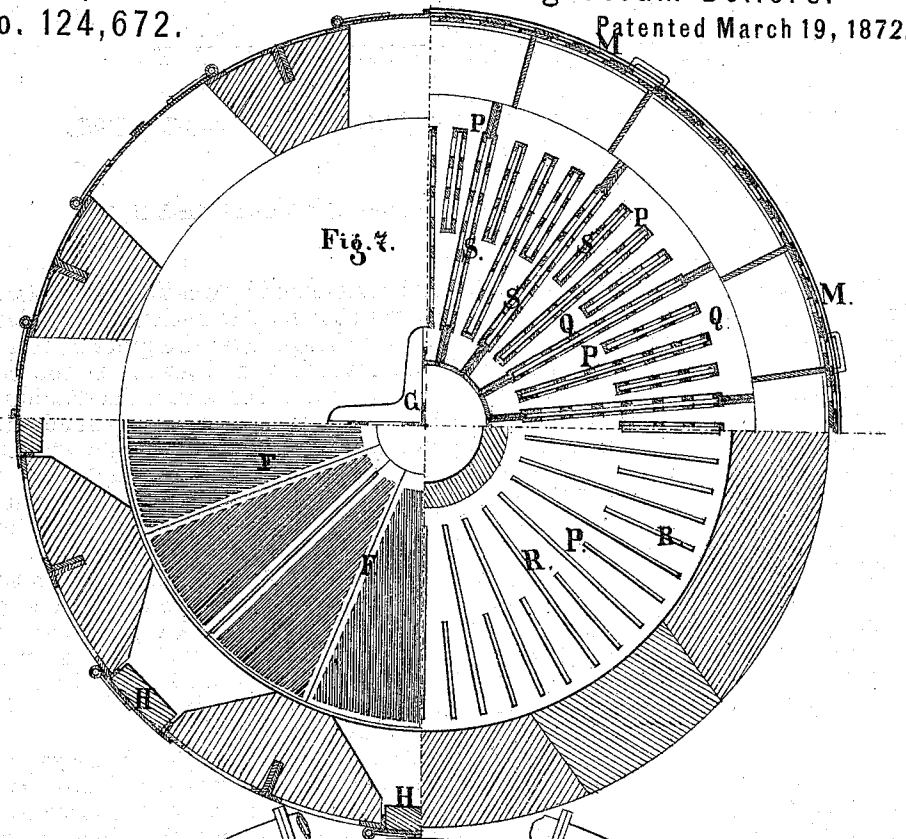
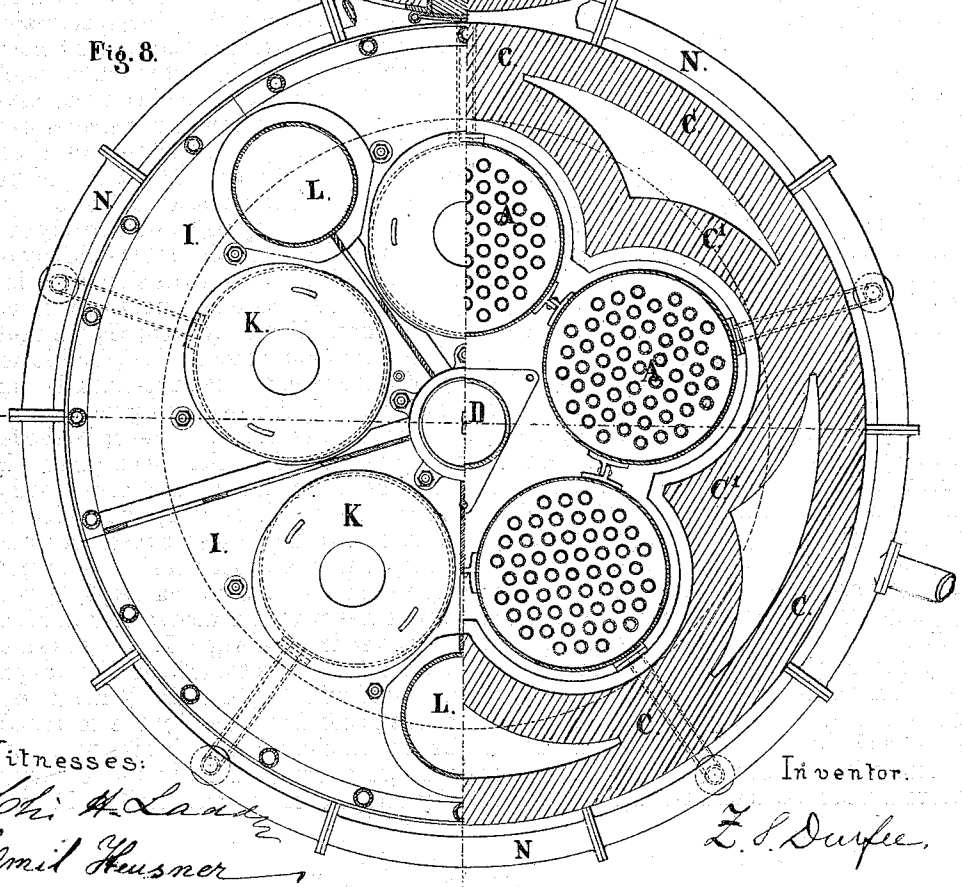


Fig. 8.



Witnesses:

Chi. H. Laaton

Emil Heusner

Inventor.

Z. S. Durfee.

UNITED STATES PATENT OFFICE.

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

IMPROVEMENT IN BASE-BURNING STEAM-BOILERS.

Specification forming part of Letters Patent No. 124,672, dated March 19, 1872.

I, ZOHETH S. DURFEE, of the city, county, and State of New York, have invented certain Improvements in Steam-Boilers, which are described in the subjoined specification and the accompanying drawing.

Figure 1 is an elevation; Fig. 2, a vertical section; Fig. 3, a plan of the top; and Fig. 4, a double cross-section of my boiler and its setting.

The boiler A has an internal flue, B, and is supported by the lower part of the fire-brick casing C, in which it is loosely inclosed. Through the flue B there passes a feeding-chamber, D, made either of iron or brick, but having always a fire-brick bottom piece, D′, where the fuel passes out upon the grate F. E is the door to the feeding-chamber, which is made to close tightly. The grate G is made somewhat conical, so as to insure the coal being of an even thickness all over it; and I have here shown it as resting, in the main, on a pivot, G, on which it may be reciprocated in a horizontal plane, such motion at the same time removing the ashes and causing the fuel from the feeding-chamber to roll down upon it. I do not, however, confine myself to this form of grate. H and H′ show the double vertical doors arranged around the fuel or combustion chamber, and there are also suitable doors for gaining access to the ash-pit. The feeding-chamber is mainly supported by the boiler, and its iron portion is, by preference, made in two or more sections, so as to allow for any unequal expansion due to the varying heat of the fuel in it. There is an annular space between the metallic or upper part of the feeding-chamber and the boiler, and also between the boiler and its casing, so that nearly the whole of the external surface of the boiler, as well as its tubes, is exposed to the heat evolved from the fuel. The upper part of the casing consists of an iron frame, I, whose several openings are closed by fire-brick doors K, which are provided with handles so that they may readily be removed. These doors are for giving opportunity to clean the tubes of the boilers. The chimney L rests upon the iron frame I, but may be partially suspended, if desired. When boilers are needed for furnishing a large amount of power, I use, instead of one boiler, as above shown, several boilers of moderate diameter, without the flue B, arranged in a circle around a central feeding-chamber, D, and surrounded by a casing, C, substantially as shown above. I sometimes, also, place a hollow diaphragm over the grate F, at a suitable distance from it and also from the bottom of the boiler, and I construct the diaphragm with flues so arranged that air may be admitted from outside the casing and mingle with the gases passing up through the diaphragm, the two combining and burning and giving their heat to the boiler, instead of the direct heat from the coal or other fuel on the grates.

On Sheets II, III, IV I have shown my modes of carrying out the last-named plans, Fig. 5 being an elevation; Fig. 6, a vertical section; Fig. 7, four partial horizontal sections, on the lines 7 8, 11 12, 13 14, and 15 16 of Fig. 6; and Fig. 8, a half-plan of the top, cutting the railing, and a half-section on the lines 9 10.

A A are the boilers, which are supported on brackets from the walls, and also by suspension-rods from the crown of the walls. B is the interior space between the boilers, corresponding to the internal flue of the single boiler before described; C C, the outer walls, which in this case are carried in between the several boilers, so as to restrict the outer spaces around them, the entrant portion of the walls being shown at C′, Figs. 6 and 8. D D′ show the feed-chamber, which is made partly of iron and partly of fire-brick, or may be made entirely of one or other of these materials, but should, by preference, be made in sections, as shown. E is the cover to the fuel-chamber, arranged so as to close air-tight. F F are grates; G, the central standard supporting them; H H′, double doors to the fire-chamber; I, the fire-brick lining of the top; and K, the doors to give access for cleaning the tubes; L L, chimneys; N, the feed-water pipes; and O O, the steam-pipes. P P is a diaphragm, made, in this case, partly of iron and partly of fire-brick, but which may be made of either of these substances alone. This diaphragm is constructed and operated as follows: It contains a chamber, Q Q, which communicates with the air-register M M, and also with vertical passages R R by means of small slits S S. The top of the diaphragm is here covered with fire-brick T. When in operation, the gases developed by the combustion of the fuel on the grates F F rise up through the vertical openings R R, in which they are met by streams of air admitted at M, which

pass through the chamber Q and the slits S S, and are highly heated during their passage. The combined air and gases then pass into the combustion-chamber U under the boilers, where they are burned. The object of this diaphragm is twofold: First, it insures a complete combustion of the fuel; and second, it enables the operation of the boiler to be suspended with more ease than it could be if the heat of the incandescent coal on the grates F F was allowed to operate directly on the boilers. By this construction the gas rising into the combustion-chamber need be scarcely more than enough than will, when burned, keep the steam up; and so the development of steam in the boiler can be suspended nearly at will, while, if the boiler was subjected to the direct action of the fire, it would be almost impossible to prevent the rapid development of steam, whether it was needed or not. The diaphragm P P supports the fire-brick portion D′ of the fuel-chamber.

When this plan of boilers is used on shipboard the walls or casing C C may be replaced by a water-casing; but in such case I would prefer to line the water-casing with fire-brick and use it as a heater of water only.

Having thus described the various details of my invention, I wish it to be understood that I do not claim, broadly, the use of a base-burning fuel-chamber with a vertical boiler; neither do I claim, separately, all the details herein described; but

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

1. Constructing and operating vertical steam-boilers with internal base-burning fuel-chambers and brick or water casings in such wise that the boiler and fuel-chambers may be nearly or quite surrounded by the heat developed on the grates and in the combustion-chamber, substantially as herein described and shown.

2. The combination of several boilers around one fuel-chamber, with or without the diaphragm P P, substantially as described herein, and shown on Plates II, III, and IV herewith.

3. I claim the diaphragm P, constructed substantially as and for the purpose described.

Z. S. DURFEE.

Witnesses:
CHI. H. LADD,
EMIL HEUSNER.