T. Main,

Steam-Boiler Fire-Tube.

No. 47,968. Patented May 30, 1865.

Fig. 3.

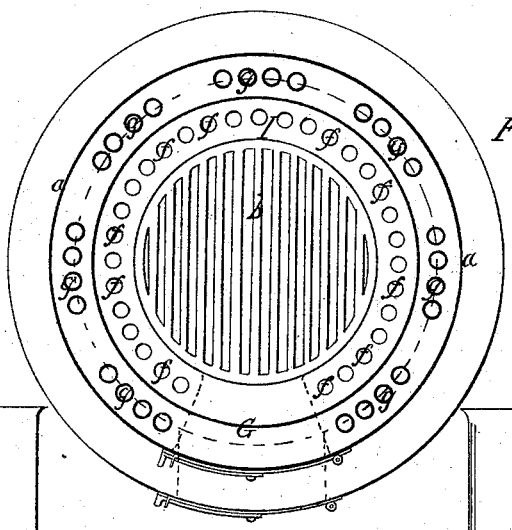


Fig. 1

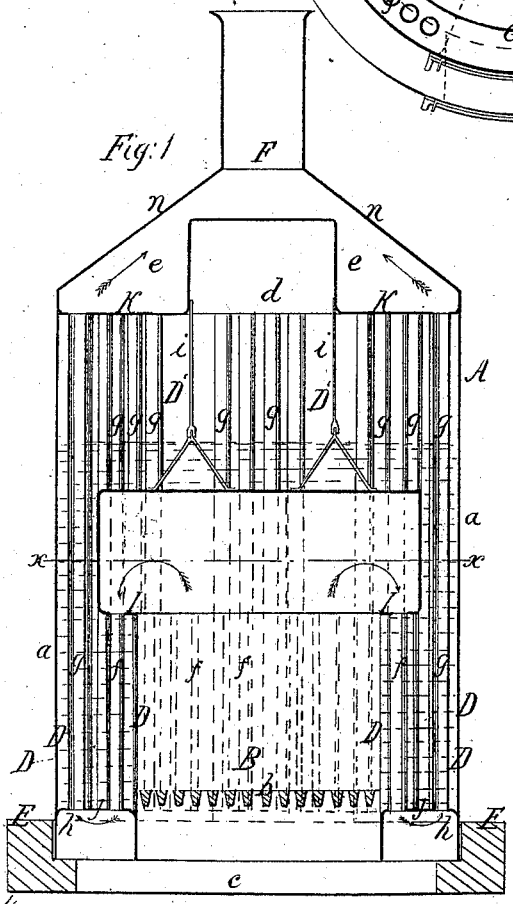
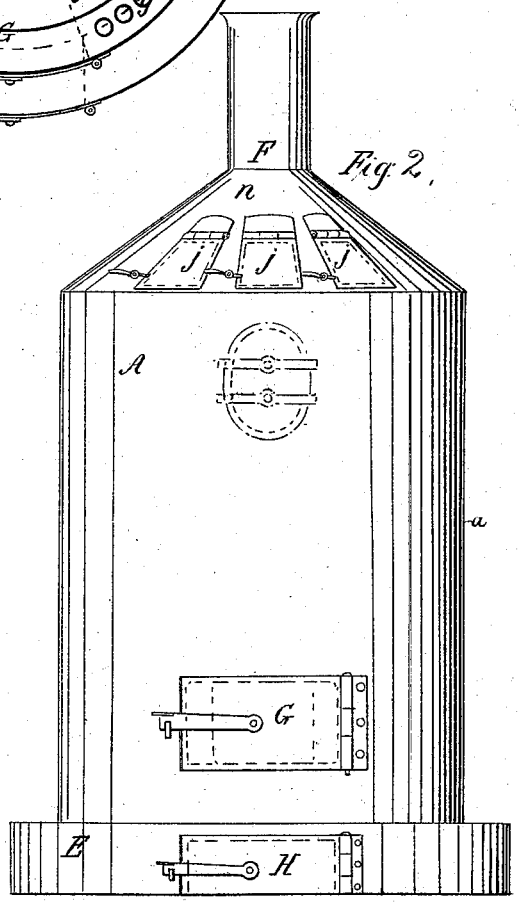


Fig. 2.



Witnesses;
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THOMAS MAIN, OF GREEN POINT, NEW YORK.

IMPROVEMENT IN STEAM-BOILERS.

Specification forming part of Letters Patent No. **47,968**, dated May 30, 1865.

To all whom it may concern:

Be it known that I, THOMAS MAIN, of Green Point, in the county of Kings and State of New York, have invented a new and useful Improvement in Steam-Boilers; and I do hereby declare that the following is a full, clear, and exact description thereof, which will enable those skilled in the art to make and use the same, reference being had to the accompanying drawings, forming part of this specification, in which—

Figure 1 is an elevation of a vertical section of a steam-boiler made according to my invention. Fig. 2 is an elevation of the boiler as seen from the outside. Fig. 3 is a transverse section on the line *x* of Fig. 1.

Similar letters of reference indicate like parts.

This invention consists of certain improvements in the construction of vertical steam-boilers wherein a combustion-chamber is employed and the flues both downward and upward are made to pass through the water-space, and wherein the upper parts of the apparatus are so arranged that the products of combustion and heated gases are made to superheat the steam in the steam-space of the boiler.

A represents a vertical boiler supported upon a suitable base, E, which, in this example of my invention, incloses the ash-pit *c* of the furnace. The boiler here shown is cylindrical; but it may be of any suitable and convenient form.

B is the furnace, and *b* its grate. The walls of the furnace are increased in diameter at a line sufficiently high to be above the highest point at which the fuel will lie into a combustion-chamber, C, of any suitable form, and which is here made circular, like the furnace. The sides and top of this chamber are closed or solid, and its lower edge is separated from the upper edge of the wall of the fire-chamber by an annular plate, I, which also helps to secure them in their places. The plate I is perforated to receive flue-tubes *f*, arranged vertically outside of the fire-chamber, their lower ends opening into an annular flue-space, *h*, through an annular plate, J, which extends from the outside of the fire-chamber to the shell *a* of the boiler. The bottom of the flue-space *h* is also the bottom of the boiler.

K is the upper plate proper of the boiler, or what answers for its crown. It is secured in any proper manner to the shell *a*, near its upper edge, and has a steam-dome or steam-space, *d*, rising from its center. The plate K is perforated near its circumference to receive the upper ends of flue-tubes *g*, which are placed in several sets—four tubes in a set—about the entire circumference of the plate. Their lower ends pass through and are secured in the annular plate J, before mentioned, being situated between the flue-tubes *f* and the shell *a* of the boiler. An upper flue-space, *e*, is made above the upper plate, K, by means of a hood or roof, *n*, with inclined sides, as in this example, or it may be arched or of any other form, from the center of which rises a discharge flue or chimney, F. The hood *n* fits over or is connected in any other suitable manner to the upper edge of the shell *a* of the boiler. The plate K is stayed by rods *i*, which descend from the lower sides of the dome *d* to the top of the combustion-chamber C, to which they are properly secured.

In order to obtain access to the flue-tubes *g*, I construct doors *j* in the hood *n* of the upper flue-space—one above each set of tubes—through which doors easy access can be had to the tubes in order to clean them of soot and other obstructions. I have shown only three such doors in this example of my invention; but they are to be made around the whole hood *n* over each set of the flue-tubes *g*.

A man-hole may be made in the shell *a* of the boiler at any suitable point above the level of the combustion-chamber C. I have not thought it necessary to show one in this example, since its office and manner of construction are familiar to those persons who are skilled in the art to which this invention belongs; but I have indicated a proper position for such a man-hole by red outline in Fig. 2. It should be located in such a position as to open between two adjacent series of flue-tubes *g*.

The water-space in my boiler is indicated by the letter D, the steam-space lying above the water-line, as indicated by the letter D′. The water is free to circulate around and between the flue-tubes *f* and *g*, between the shell *a* of the boiler and the walls of the fire-chamber B and combustion-chamber C, and also over the

top surface of the latter chamber. The radiating-surfaces of the furnace and its flues are thus surrounded by the water-space, the bottom plate, J, of that space being on a line below the level of the grate of the furnace. The flues *g* pass through the steam-space also, which, as before explained, is enlarged by the addition of the dome *d*, which extends upward into the upper flue-space, *e*. The products of combustion and gases from the furnace will have parted with the greater part of their heat when they have reached the chimney F, and the steam in the upper part, D′ *d*, of the boiler will be more or less superheated in the ordinary working of the furnace by means of the radiation of heat from the flues *g* and the flue-space *e*, the upper parts of said flues *g* being surrounded by steam, while the steam in the dome *d* is surrounded by the upper flue-space, *e*.

By constructing a boiler in the way here explained I am able to dispense almost entirely with braces, which are in ordinary constructions considered indispensable. The doorway G′ of the furnace passes through the side and walls of the boiler and fire-chamber, and is surrounded above and below and on its two sides by the water-space, the flues *f* being of course omitted at the place of the doorway.

G is the furnace-door, and H is the ash-pit door, both made in any proper manner, so as to control the draft of the furnace. The course of the products of combustion is through the mixing and combustion chamber C; thence down through the flues *f* into the flue-space *h;* thence up through the flues *g* into the upper flue-space, *e*, and thence into the chimney. The position of the flues *f*, as well as their direction and the restricted passage-way furnished by their narrow throats, cause the gases from the fire to be retained a short time in the chamber C, and thus gives time for the air to mix with them while they are at a high temperature, so that they will be thoroughly consumed before they escape down through the flues *f*.

I claim as new and desire to secure by Letters Patent—

The combination, in a vertical steam-boiler, of the fire-chamber B, the enlarged combustion-chamber C, surmounting the said fire-chamber and surrounded by the water-space, the descending flues *f*, and ascending flues *g*, passing through the said water-space, and the upper flue-space, *e*, surrounding the steam-dome *d*, all as herein described.

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