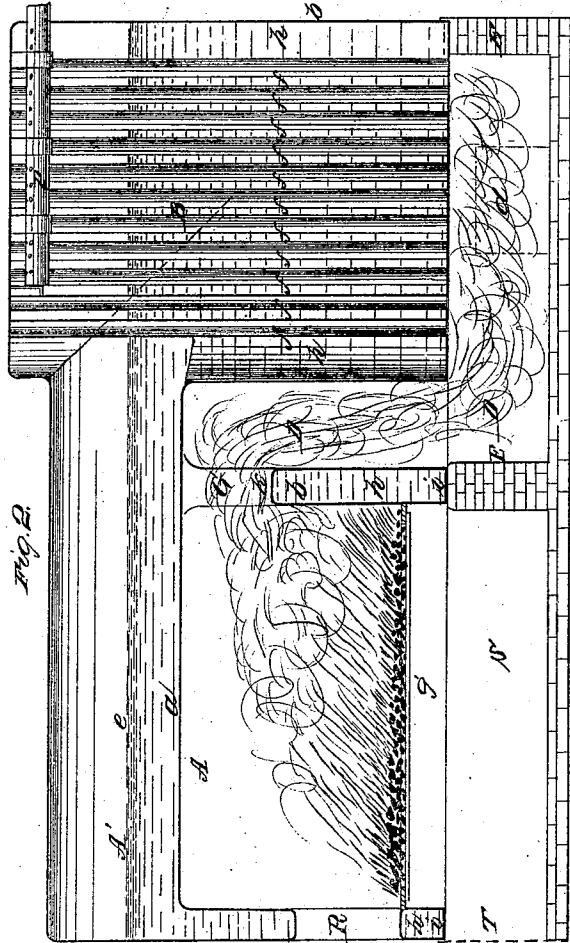
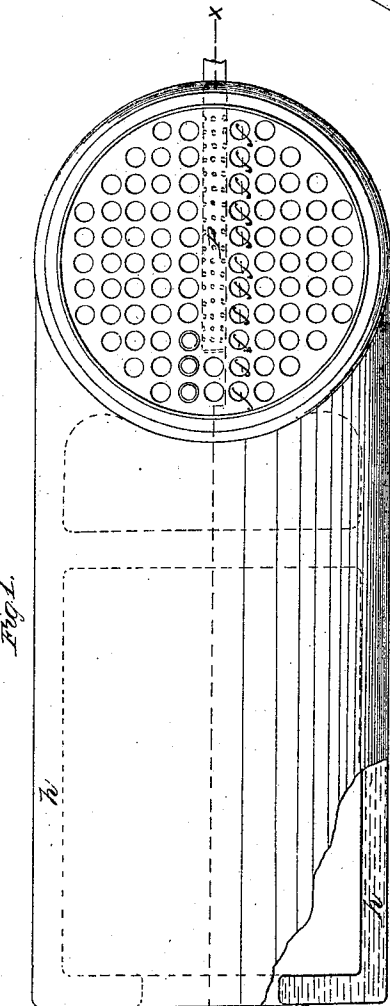
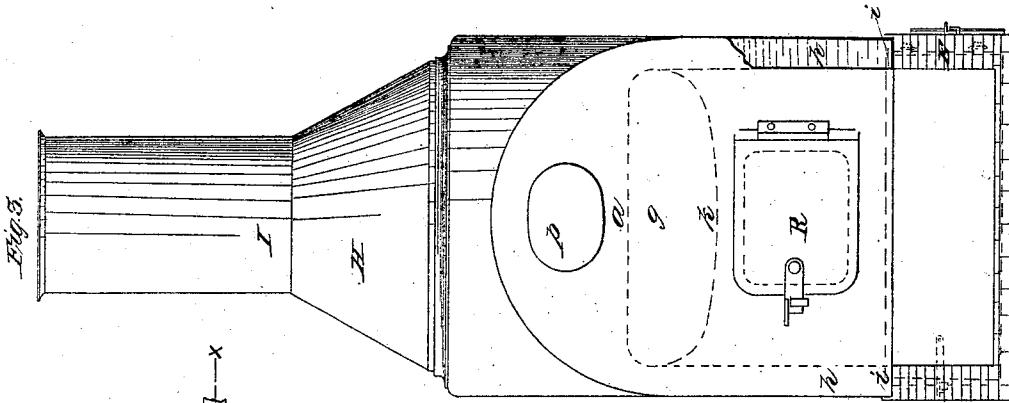


T. Main,

Steam-Boiler Fire-Tube.

N<sup>o</sup> 59,424.

Patented Nov. 6, 1866.



Witnesses:  
Amos Coe  
Jas. Morison

Inventor:  
Thomas Main  
Munn & Co  
attys

# UNITED STATES PATENT OFFICE.

THOMAS MAIN, OF GREEN POINT, NEW YORK.

## IMPROVEMENT IN STEAM-GENERATORS.

Specification forming part of Letters Patent No. 59,424, dated November 6, 1866.

### *To all whom it may concern:*

Be it known that I, THOMAS MAIN, of Green Point, in the county of Kings, 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.

This invention consists in combining the advantages of a horizontal boiler (which shall have a water-space or bridge-wall in the furnace and a combination chamber) with an upright tubular boiler, and also in providing a perforated pipe, and locating it so that it shall receive and discharge the steam in a superheated state.

To enable others skilled in the art to make and use my invention, I will proceed to describe it, reference being had to the accompanying drawings, forming part of this specification, and to the letters of reference marked therein.

Figure 1 represents a top view, partly sectional, as at *h*, with the hood and chimney removed. Fig. 2 is a longitudinal sectional elevation through the line *x x*, Fig. 1; and Fig. 3 is a front elevation of the boiler.

Similar letters of reference indicate like parts.

A represents the furnace of a horizontal locomotive-boiler, and A' the water and steam space above it. B represents the upright tubular portion of the boiler. *b* represents the shell. *e* is the water-line. *a* is the crown-sheet or tip of the furnace. C is a water-space or bridge-wall, forming the back part of the furnace. D is the combustion-chamber, and *f* represents the tubes of the upright part. P is the dry pipe, from which the steam is discharged, and *h* the water-spaces of the boiler, surrounding the furnace or fire-box and tubes of the upright portion.

The fuel rests upon the grate-bars *g*, and the products of combustion, in their passage to the flue-tubes of the upright part, pass over the water-space C into the combustion-chamber D. This chamber is formed by the space between the bridge-wall or water-space C and the shell or water-space of the upright tubular portion of the boiler, and extends down and under the said tubular portion.

The products of combustion pass through the large flue G over the bridge-wall at a

very high temperature. In this condition they are compelled to descend, and are retarded in their course long enough to become thoroughly mixed with the atmospheric air which passes in and through the furnace, whereby the smoke and gases are almost entirely consumed. A much more perfect combustion is here obtained than I have ever known in any other arrangement, the deposition of soot upon the inside of the tubes being small, so that cleaning is seldom necessary.

The water-space C, forming the bridge-wall, is in open communication with the water-spaces which surround the furnace. It is curved upward at the sides of the furnace, as seen at *k*, in Fig. 3. This curved portion is also open to those water-spaces, like the lower part, and it is curved for the purpose of allowing a free circulation of water and a free escape for the globules of steam formed in it.

The sides of the fire-box or furnace are cut away where this bridge-wall is situated, thus allowing a free circulation of water through it. It is firmly riveted to the sides of the furnace, its lower edge resting upon the common foundation. This water-space or bridge-wall C, although described as containing water, or as being a water-wall, may be constructed of brick or any other incombustible material, and in that case the sides of the furnace would be left whole.

The furnace and horizontal portion of the boiler is lapped on and firmly secured to the upright tubular portion, the lower surfaces or bottom of each being on a level and resting on a common foundation. The upper and lower heads of this tubular boiler are secured to the shell in the usual manner, and the tubes are distributed over the entire diameter or surface of the heads at suitable distances from each other and from the shell, with the exception of a space sufficiently large to admit the dry or discharge pipe P. These tubes have free communication with the water of the horizontal portion of the boiler over the furnace, and are surrounded with water up to the water-line *e*, as seen in Fig. 2.

The heated air and products of combustion pass from the combustion-chamber upward through the tubes in their course to the chim-

ney I. The upper portion of these tubes extend above the water-line through the steam-space, their surfaces being at a high temperature from the products of combustion.

The discharge-pipe P is placed in the space left for it among these tubes, but near their top, and is supported from the head or tube-sheet, and also at the point where it passes through the shell. It extends from the outside through the shell and runs nearly across the whole diameter of the tubular boiler. That portion of it which lies inside, among the tubes, is perforated through its upper surface, nearly its whole length, with holes sufficiently large for the admission of the steam. When this pipe is discharging there is a rush of steam to it from every direction, and the steam, coming in contact with and impinging against the heated surfaces of the tubes, becomes superheated, and all watery particles held in suspension are at once converted into steam.

The importance of this arrangement will at once be understood by any one at all conversant with the use of steam, and the advantage gained in using dry steam—that is, steam which holds no watery particles in suspension—can scarcely be overrated.

H is the hood supporting the chimney I. There may be doors in this hood (which sits upon the top of the boiler directly over the tubes) to allow the tubes to be scraped or cleaned when necessary.

d is a door into the lower part of the combustion-chamber, which allows any soot or ashes which may accumulate there to be re-

moved. T is a door into the ash-pit S under the grate, and E is the foundation of the boiler. R is the furnace-door, and p is a man-hole into the horizontal boiler over the furnace.

Hand-holes may be introduced through the shell into the water-spaces to allow any sediment which may be precipitated to be removed.

The furnace can be made of any size to suit any kind of fuel, and the construction of the whole boiler is such that very little bracing is required.

The water is free to circulate around and between the tubes *f* and around the radiating surfaces of the furnace and combustion-chamber, the lower plate, *i*, of the water-spaces being lower than the grate-bars.

The course of the products of combustion is indicated in colors, and is easily traced.

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

1. The horizontal chamber A', combustion-chamber D, portion B, provided with vertical tubes, and water-space or bridge-wall C, when combined and arranged substantially as herein shown and described.

2. The arrangement of the perforated discharge-pipe P with the tubes of a vertical boiler, substantially as herein shown and described, for the purpose of receiving and discharging the steam in a superheated state, as set forth.

THOMAS MAIN.

Witnesses:

WM. F. MCNAMARA,  
ALEX. F. ROBERTS.