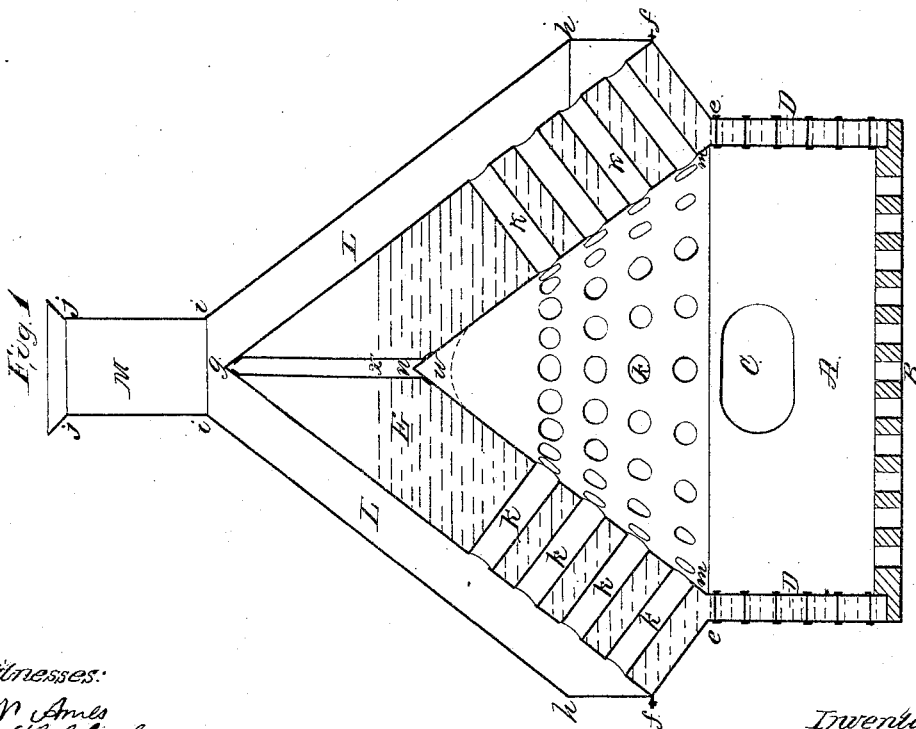
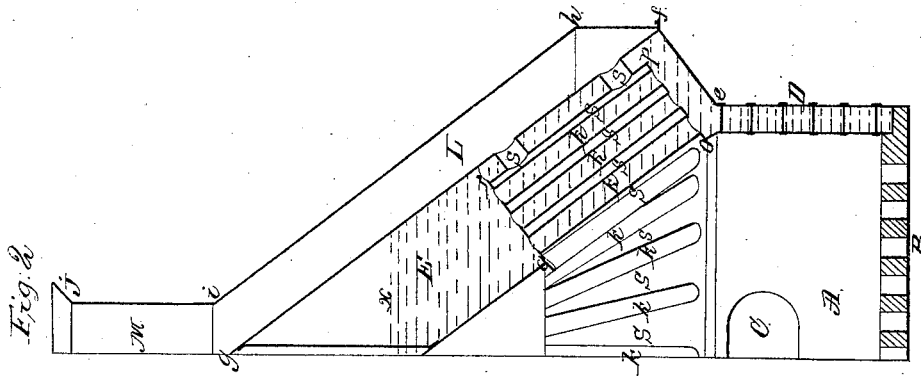


*T. W. Pratt,*  
*Steam-Boiler Fire-Tube.*  
*N<sup>o</sup> 50,161.      Patented Sep. 26, 1865.*



*Witnesses:*

*N. Ames*  
*Geo. H. Clarke*

*Inventor:*  
*Thos. Pratt*

# UNITED STATES PATENT OFFICE.

T. WILLIS PRATT, OF BOSTON, MASSACHUSETTS.

## IMPROVEMENT IN STEAM-BOILERS.

Specification forming part of Letters Patent No. **50,161**, dated September 26, 1865.

*To all whom it may concern:*

Be it known that I, T. WILLIS PRATT, of Boston, in the county of Suffolk and State of Massachusetts, have invented a new and useful Steam or Hot-Air Generator; and I do hereby declare that the following is a full, clear, and exact description of the construction and operation of the same, reference being had to the accompanying drawings, forming a part of this specification, in which—

Figure 1 is a vertical central section, and Fig. 2 is a similar view of one-half of the apparatus, showing a slight modification of the arrangement of the flue-tubes.

Like parts are indicated by the same letters in both figures.

The nature of my invention consists in so arranging the flues around a furnace, which is placed in the center of the system, that all the heating-surface beyond the fire-box or furnace is at an inclination, so that sediments will not be deposited from the water and ashes and cinders will not lodge in the flues.

My invention further consists in the combination of a conical chimney or case with the above arrangement of flues, so as to inclose the whole within itself, whereby sparks and cinders are separated from the products of combustion and consumed without being carried out of the chimney.

To enable others skilled in the art to make and use my invention, I will now proceed to describe its construction and operation.

The horizontal plan of the boiler is circular, and it may be made of any diameter, according to the power required to be developed.

A is the furnace or fire-box, surrounded by the water-legs D, to be of such depth as the nature of the fuel may require. From the top of the water-legs at *ee* the boiler E suddenly enlarges in the shape of an inverted frustum of a cone, as *efef*, and from *ff* upward the shape is conical, as *fgf*. The crown-sheet *mn* of the fire-box or furnace is also conical and parallel to the outer sheet or shell of the boiler *fgf*. This crown-sheet may, however, have its vertex in the shape of the segment of a dome, as shown by the dotted line *w*, in order not to encroach on the steam-space in the upper part of the boiler E, *x* being the water-line. The flues *k* are composed of tubes of small di-

ameter, and are inserted radially and at right angles to the surface of the tube-sheets *fg* and *mn*, as represented in Fig. 1. The angle of elevation of these tubes is calculated large enough (about thirty-five degrees) to compel cinders and ashes to slide down by their own gravity, and as the tube-sheet *mn* is at right angles to the flues the elevation of that will be sufficient to prevent much sediment from ever lodging upon it from the water.

In the crown-sheet *mn* the ends of the flues may be placed very near to each other, reserving only sufficient space to give strength to the metal between them, for the space immediately enlarges as we depart more and more from the center line of the boiler, thus giving more space for water between the flues. Comparatively short flues only will be needed, as their number can be made sufficient to give the proper proportion of flue-surface to grate-surface.

B is the grate, and C is the firing-door. There may be a number of these doors, if required, for a large-sized boiler, and the fire-box may be divided into any desirable number of compartments, one or more or all of which may be used at a time, according to circumstances.

When it is required to pass the water through the tubes, heating their outer surfaces, the arrangement represented in Fig. 2 is made, in which the flue-sheets *qr* and *op* are parallel to the surface of the lower frustum of the boiler. In this case the flame and products of combustion pass from the furnace through the spaces *s* to the outside of the boiler; but as in this case the faces of the flue-sheets and ends of the tubes are generally covered with water, and not easily accessible, the arrangement represented in Fig. 1 is preferred.

To create a draft and carry off the products of combustion, an outer casing, *fhihf*, is made to inclose the whole of the upper conical part of the boiler, above which is the chimney M, being a continuation, *ij*, of the outer casing. The other usual appendages common to all boilers, forming no part of my invention, need not be described, and are not represented in the drawings.

The advantages gained by my mode of constructing boilers, are—

First. The furnace is in some measure rever-

beratory, having a high space over the fuel for the better combustion of smoke and gases.

Second. As heat is most readily taken up by impingement at the ends of the tubes, my arrangement gives the greatest number of ends of tubes for the amount of surface required.

Third. By reason of the angle on which the flues are placed and their comparative shortness, they can never clog with ashes or cinders, whereby the surfaces for the heat to act upon are always clean.

Fourth. A perfect circulation of the water will always be insured, as the heated crown-sheet *m n*, with the ends of the tubes, is in the center of the whole mass to be heated, whereby the heated water (with steam made) will rise rapidly to the surface in the center from *m* to *n*, give off its steam, and pass outward and downward by the outer sheet, where the spaces between the tubes are greater.

Fifth. The chimney-space *L* inclosing the whole boiler acts as a lagging, and in some measure as a superheater, and also a separator of sparks and cinders from the current of draft, inasmuch as all cinders and sparks have greater specific gravity than the gases in which they are forced along; and in my method of construction a certain enlargement of space, *L*, around the lower part of the cone can be made without sacrifice of much metal or room, so as to reduce the velocity of the current below that

velocity which will move the sparks. They must, therefore, be left behind and consumed by reverberation, as undoubtedly some of the lower flues will, at times, have a return-current into the furnace.

Sixth. My boiler will require a much less amount of stay-bracing than many of the tubular or flue boilers in use, and, all parts being circular and the flues themselves acting partially as stays, there seems to be no necessity for braces, except in the water-legs, and perhaps between the point *g* and *n*.

Seventh. By adopting the system represented in Fig. 1, the whole surface of the boiler and the ends of all the tubes are easily accessible for construction or repairs.

Having thus described the construction and operation of my improvement, what I claim as new, and desire to secure by Letters Patent, is—

1. The cone-shaped boiler, constructed as set forth, provided with the inclined radial flues, substantially as and for the purpose described.

2. The conical chimney or case, in combination with the cone-shaped boiler, substantially as set forth, and for the purpose described.

T. WILLIS PRATT.

Witnesses:

N. AMES,

GEO. R. CLARKE.