

May 9, 1933.

H. S. CHEETHAM ET AL

1,907,736

STEAM BOILER

Filed Oct. 27, 1931

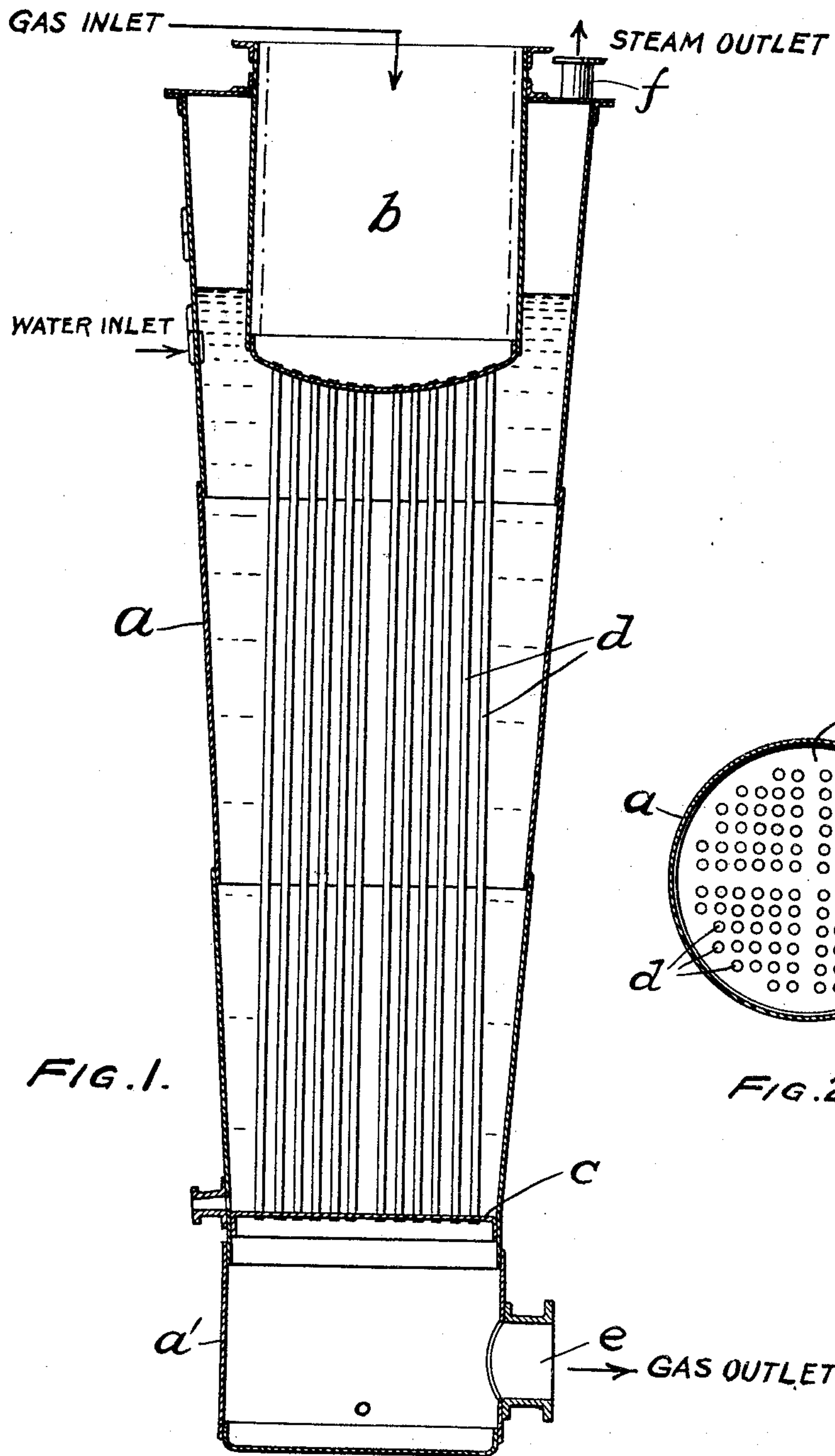


FIG. 1.

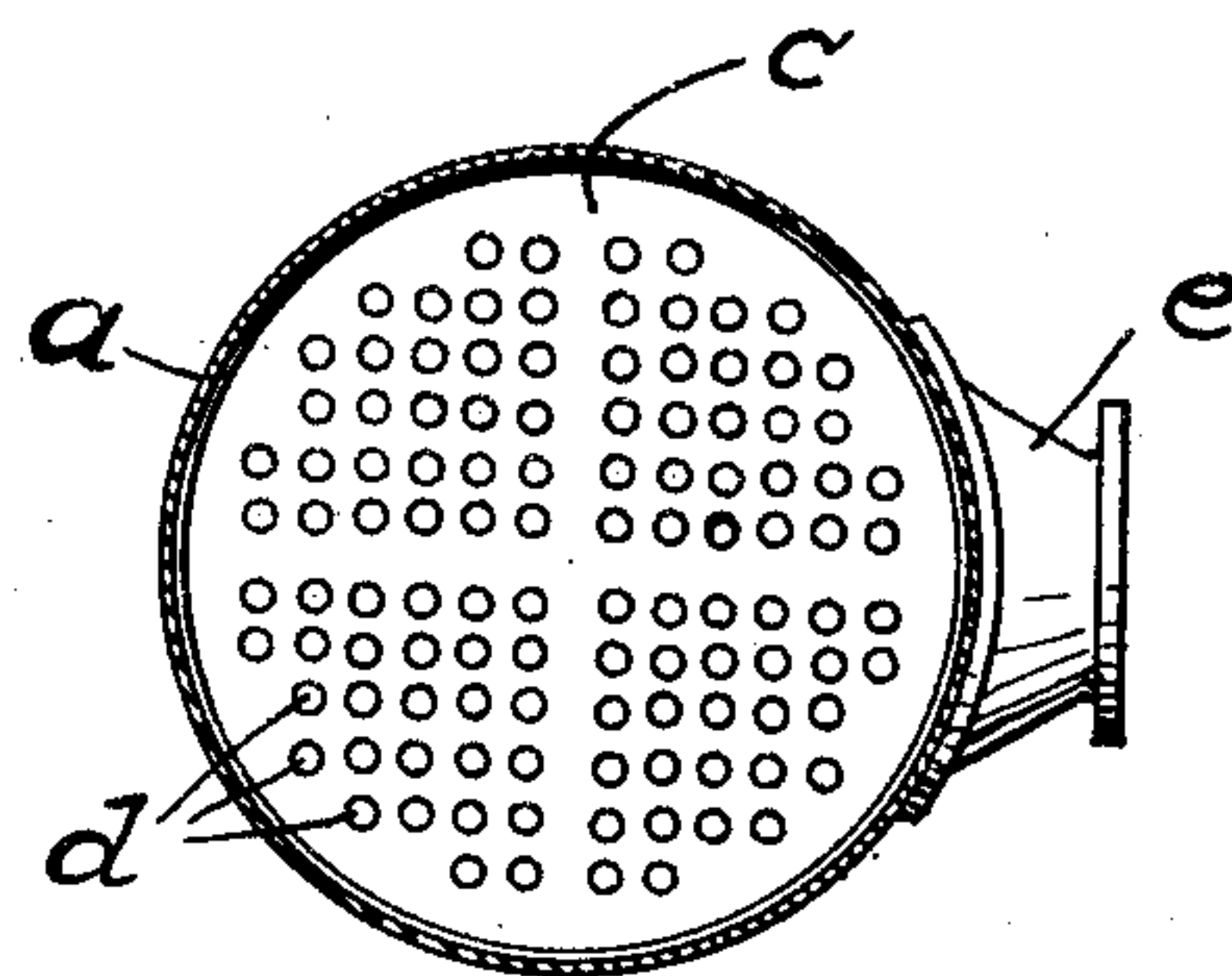


FIG. 2.

WITNESS:

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STEAM BOILER

Application filed October 27, 1931, Serial No. 571,294, and in Great Britain November 6, 1930.

This invention has reference to steam boilers and more especially to boilers intended for use in connection with water gas and like apparatus to utilize the waste heat of the gases for the generation of steam.

Objects of the invention are to provide a simple construction of boiler of the vertical fire tube type which will avoid risk of steam becoming locked against the upper tube plate and which will provide ample water surface for the release of steam without priming and will promote a downward circulation of water outside the bank of fire tubes the upward currents having a free passage through the spaces between the tubes.

According to the invention the shell of the boiler enclosing the water and steam spaces is of upwardly increasing diameter; the bottom of the water space is provided with a tube plate and the steam space has projecting into it through the top a cylindrical gas inlet chamber of considerably less diameter than the boiler shell at that level and the bottom of which is formed by an inclined, downwardly dished or domed tube plate, the two tube plates being preferably of similar diameter and connected by a bank of preferably straight parallel tubes. Below the lower tube plate, a gas outlet chamber is formed, preferably by a cylindrical extension of the boiler shell with a lateral gas outlet pipe connection.

The normal water level is somewhat above the upper tube plate, the inclined, dished or domed shape of which ensures that steam can pass freely from beneath it around its edge into the steam space surrounding the pendent gas inlet chamber, the space between the wall of which and the boiler shell affords adequate water surface for release of steam without priming: the heated gas inlet chamber wall assists in the generation and drying of steam.

The conical shell provides a clear downward passage for the cooler water away from the steam generating zone of the tubes, thus inducing systematic circulation and guiding the downward water currents into the bank of tubes ready to reascend, and so avoiding the indefinite circulation which may obtain

when the shell of the boiler is parallel to the tubes throughout their length.

In some cases, the gas inlet chamber wall may be lined wholly or partially with heat insulating material.

The accompanying drawing illustrates the invention, Fig. 1 being a vertical section and Fig. 2 a horizontal section.

a is the boiler shell of upwardly increasing diameter, b the gas inlet chamber, which is connected to the waste gas outlet from say a water gas plant by a lined pipe not shown, c is the lower tube and d are straight parallel fire tubes; the bottom of the chamber b is formed by a downwardly dished or domed tube plate against which steam cannot become locked but passes upwards from beneath it to the ample water surface whence it releases itself and passes from the annular steam space around the chamber b through an outlet pipe of which may be connected to the top plate of the steam space. The gas outlet chamber below the tube plate c is shown formed by a cylindrical extension a^1 of the boiler shell having a lateral gas outlet connection e .

The upward increase in diameter of the shell a may be continuous as shown, or the several tiers or rings of shell plating above the lower tube plate c may be cylindrical and of successively increasing diameters, the tiers or rings being connected by flanges or junction rings: or the upward increase in diameter may be continuous from the lower tube plate for some distance, for example, to the bottom of the top tier or ring of plating which may be cylindrical and of the same or greater diameter than the upper part of the tier or ring below it, the cylindrical part being jointed to the conical part directly or through a flange or junction ring.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed we declare that what we claim is:—

1. A steam boiler including in combination an outer shell of uniformly upwardly increasing diameter, a gas inlet chamber of less diameter than the shell at that level project-

ing into the upper end of said shell defining a steam chamber therebetween, a downwardly dished upper tube plate forming the bottom of said gas inlet chamber, a lower tube sheet
5 adjacent the bottom of said shell, and a bank of vertical fire tubes connecting said upper and lower tube plates.

2. A steam boiler including in combination a shell of upwardly increasing diameter, a gas
10 inlet chamber projecting into the upper end of said shell and of less diameter than the shell at that level to define a steam chamber therebetween, a downwardly dished upper tube plate forming the bottom of said gas
15 inlet chamber, an inlet for water above the bottom of said upper tube plate and below the top of said shell, a lower tube plate adjacent the bottom of said shell, and a bank of vertical fire tubes connecting said upper and
20 lower tube plates.

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