(No Model.) 2 Sheets—Sheet 1.

B. W. HOYT.

STEAM DRYING AND SUPERHEATING APPARATUS FOR STEAM BOILERS.

No. 490,965. Patented Jan. 31, 1893.

Fig. 1.

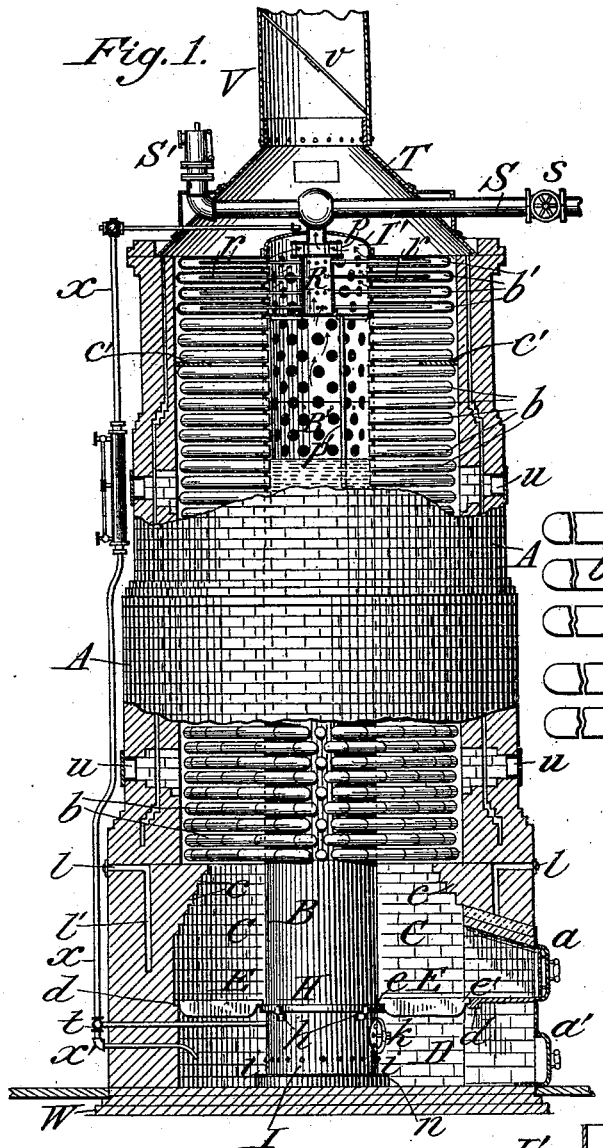


Fig. 6.

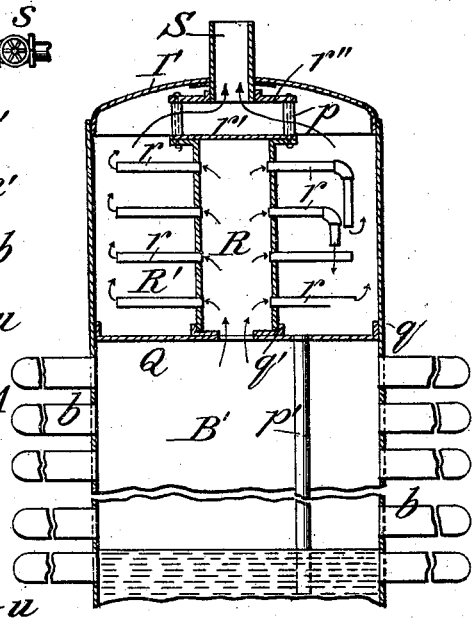
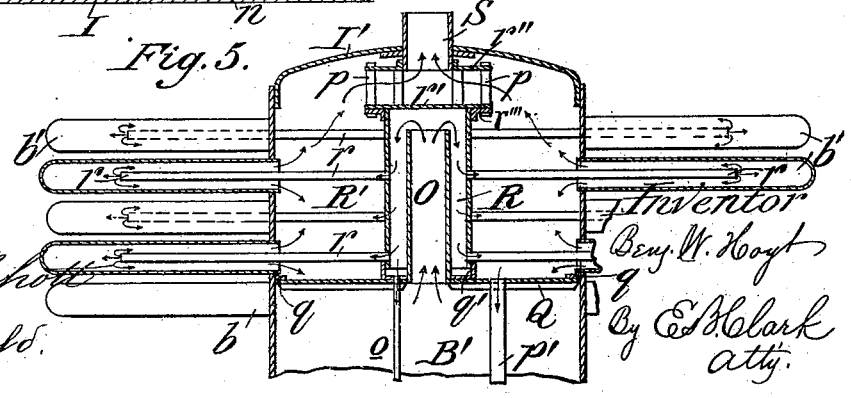


Fig. 5.



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(No Model.) 2 Sheets—Sheet 2.

B. W. HOYT.

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Fig. 2.

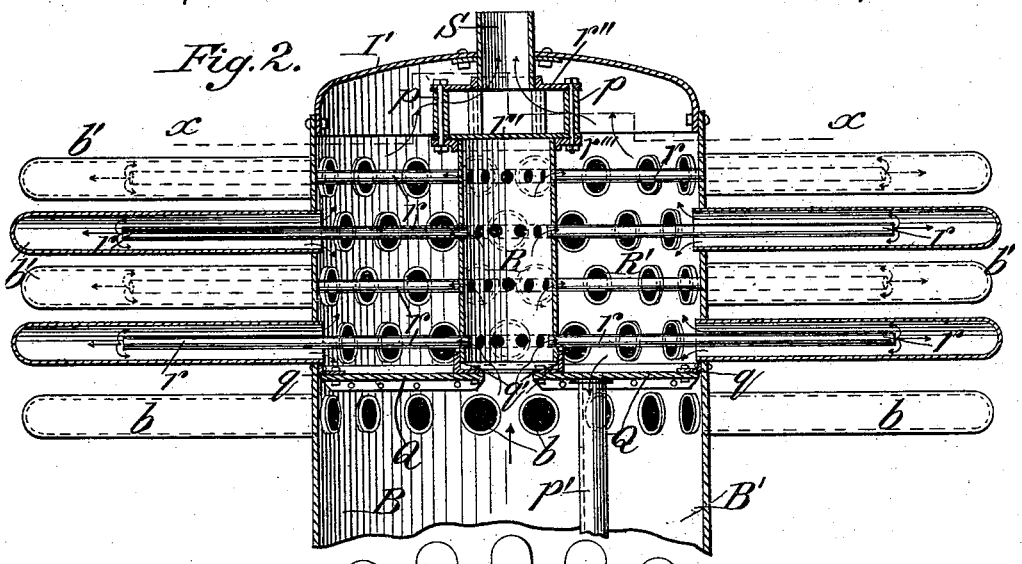


Fig. 3.

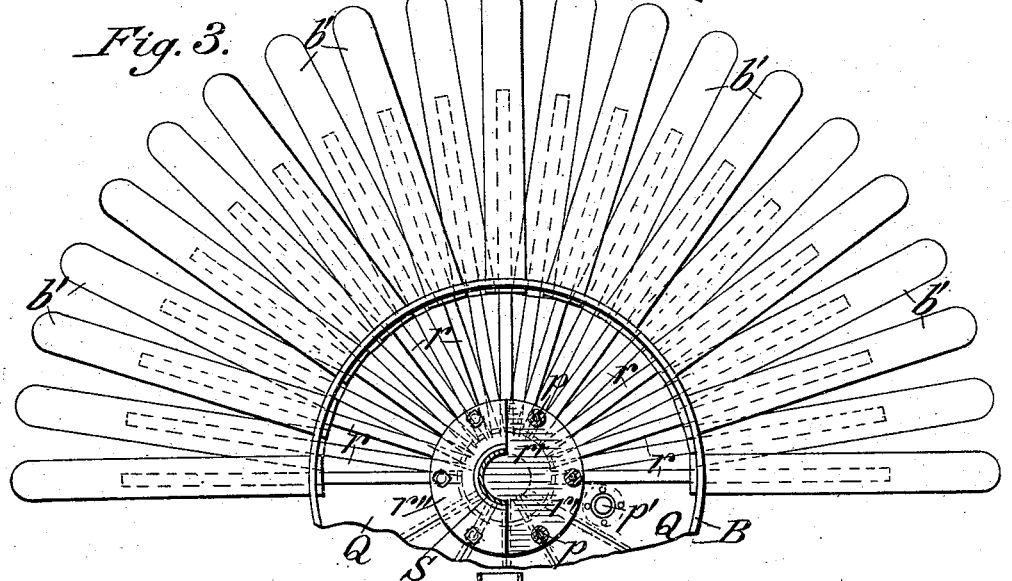
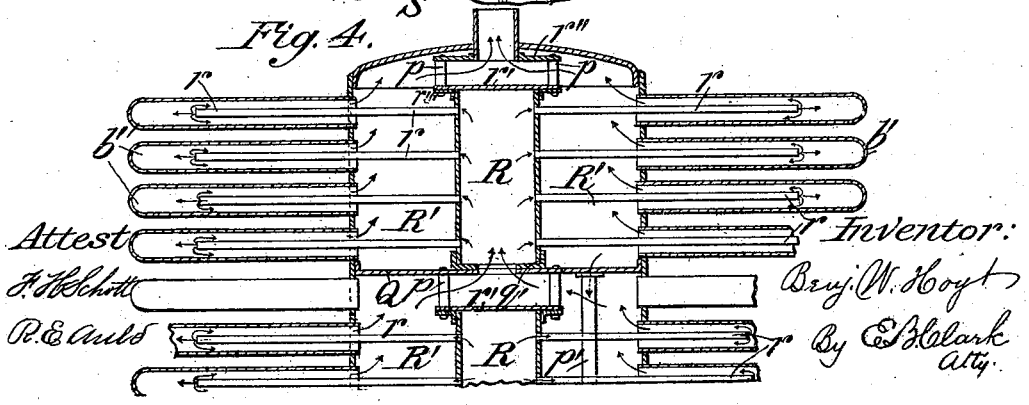


Fig. 4.



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UNITED STATES PATENT OFFICE.

BENJAMIN W. HOYT, OF BROOKLYN, ASSIGNOR TO EDWARD SELDEN TOWNSEND KENNEDY, OF NEW YORK, N. Y.

STEAM DRYING AND SUPERHEATING APPARATUS FOR STEAM-BOILERS.

SPECIFICATION forming part of Letters Patent No. 490,965, dated January 31, 1893.

Application filed March 28, 1892. Serial No. 426,717. (No model.)

To all whom it may concern:

Be it known that I, BENJAMIN W. HOYT, a citizen of the United States, residing at Brooklyn, in the county of Kings and State of New York, have invented certain new and useful Improvements in Steam Drying and Superheating Apparatus for Steam-Boilers; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to radial-tube or "porcupine" steam-boilers of the kind having a central cylinder or stand-pipe, provided with radial water and steam tubes; and more particularly the invention relates to the steam drying and superheating apparatus connected with the top of the stand-pipe.

My steam drying and superheating apparatus is composed mainly of a central steam distributing chamber, a surrounding discharge chamber, radial distributing pipes connecting with the central distributing chamber and passing through said discharge-chamber, and radial superheating tubes connecting with the discharge chamber and extending into the hot air chamber of the boiler shell. The radial steam distributing pipes may extend simply through the discharge chamber with their ends near the circumferential wall thereof; or they may extend through such chamber and out into the radial superheating tubes, and this latter arrangement is preferable, as the steam drying and superheating surface is thereby greatly extended.

My improved steam drying and superheating apparatus also embraces certain details of construction and arrangement of parts which will be fully pointed out with reference to the accompanying drawings, in which,—

Figure 1 represents an elevation of the boiler with the inclosing shell and part of the stand-pipe in vertical section; with my improved steam drying and superheating apparatus in position; Fig. 2 represents a vertical section on enlarged scale of my steam drying apparatus; Fig. 3 represents a horizontal section thereof on the irregular line x—x, Fig. 2; Fig. 4 represents a vertical section of the steam drying apparatus arranged in duplicate; Fig. 5 represents a vertical section thereof in modified form; Fig. 6 represents a vertical section of another modified form of apparatus.

The boiler shown in Fig. 1, embodies the general form and features of construction used by "The Hazelton Boiler Co.," of New York city, with my improved steam drying superheating apparatus applied at the upper end of the stand-pipe. In the construction of this boiler, it has been the usual practice to arrange in the upper part of the stand-pipe, a steam delivery pipe, closed at its inner and lower end and provided with a series of small open ended tubes radiating therefrom into the radial steam tubes of the stand-pipe, and such arrangement broadly considered is not my invention. By the old construction, the steam was compelled to pass first out through the larger radial tubes of the stand-pipe and return through the inner smaller tubes to the discharge pipe, and the results were not altogether satisfactory.

In order that my improvement may be better understood, I will first briefly describe the boiler and then particularly point out my improved features of construction.

The brick shell, A, having a lining of firebrick, is mounted upon a foundation, W, and is provided at suitable intervals with sight openings and doors, u. A hood, T, and smoke-stack, V, having valve, v, are supported at the top of the shell above the boiler. A fire-chamber, C, grate, E, and ash-pit, D, are constructed in the lower part of the shell, and the fire-chamber is provided near its top with an inwardly projecting brick deflector c. Annular deflecting plates, c', project inward at different heights from the walls between the radial tubes of the boiler, and these deflectors serve to protect the ends of the radial tubes all around the boiler and uniformly deflect the flame and hot products of combustion inward toward the stand-pipe. At a suitable height above the floor of the ash-pit, a ledge, d, is formed in the brick furnace wall, and at the same height the stand-pipe has riveted to it the brackets, h, which support the wrought iron ring, H, and this ledge and ring serve to support the grate, E. The fire chamber and ash-pit are provided with doors, a. Air inlet openings, l, extend from the out-

side of the furnace wall to the annular air-space, l', in the brick work, which connects by ports with the interior of the fire-chamber, C, whereby air may be heated for supporting combustion.

The central stand-pipe, B, is provided at the bottom with a head, I, riveted to the cylindrical portion, the walls of which rest upon the iron foundation plate, i, placed upon the supplementary brick foundation n. The stand-pipe is provided around its entire circumference above the fire-box with the radial wrought metal tubes, b, extending out nearly to the furnace wall or shell, as shown in Fig. 1, and these tubes are inserted at their inner open ends in holes of the stand-pipe and are then expanded by means of a suitable tool, so as to securely hold them in place and form a tight joint between them and the metal of the stand-pipe. The stand-pipe is closed at the top by means of a flanged and dished head, I', through which passes the steam discharge pipe S. The lower end of the stand-pipe, below the grate, forms a mud-drum, which receives sediment from the currents of water circulating above, and is provided with a man-hole closed by a tight-fitting plate, k. This man-hole affords access to the stand-pipe for expanding the tubes in their holes and also for inspecting and cleaning the tubes and stand-pipe.

In practice a water feed-pipe connects with the stand-pipe below the grate; also a blow-off pipe, not here shown. A water-column pipe, x, connects with the top of the stand-pipe and also with the bottom below the grate and is provided at the junction of its horizontal and vertical portions with a three-way valve, t, from which leads a discharge pipe, x', into the ash-pit.

The upper end of the stand-pipe above the water line forms a steam chamber, or dome B', in which is fitted my improved steam drying and superheating apparatus or devices. All the radial tubes, b, above the water line serve for drying steam, and in order to compel steam to better circulate through part of them, I arrange a central steam distributing chamber R, closed at its upper end, and connect with such chamber a series of open ended tubes or pipes, r, extending radially, in different planes, into the surrounding discharge chamber, R', as shown in Figs. 2 to 6 inclusive. In constructing the distributing chamber, R and annular discharge chamber, R', I secure a flange r'', to the end of the steam discharge pipe S, which is fitted in the head, I', and to such flange, r'', I connect the distributing chamber, R, by means of the long bolts and their ferrules or sleeves, p. The long bolts pass through flanges, r'' and r''' and the top of plate or disk, r' of chamber R, and the ferrules are interposed between flange, r'' and the plate r', so as to form a suitable space between such parts for the passage of steam to the discharge pipe S. Chamber, R, is open at the bottom, where it is connected to the annular plate, Q. A series of open ended distributing tubes, r, arranged in different horizontal planes are connected to the distributing chamber, R, and extend radially through the annular discharge chamber R', in which they may end near its circumferential wall, as shown in Fig. 6. These distributing tubes, r, however, are preferably extended out into the radial superheating tubes, b', connecting with chamber, R', as shown in Figs. 2 and 3.

The angle-ring, q, is riveted or otherwise secured to the stand-pipe a sufficient distance below its top and to such ring is fastened the annular bottom-plate, Q, formed of segmental plates united by flanges. The inner edge of plate, Q, at its central opening is bolted to the interior angle-ring, q', which had previously been secured to the lower end of chamber R.

In case the distributing tubes, r, terminate in the chamber, R', the outer ends of a part or all of them may be turned downward, as shown, in Fig. 6, for discharging condensable matter upon the plate Q. Under ordinary conditions, the radial steam superheating tubes, b', having the distributing tubes, r, extending into them, as shown in Fig. 2, are preferably used; but, under some conditions, the tubes, b', may be dispensed with, and in such cases, I may use to advantage the distributing tubes, r, terminating in chamber R', as shown in Fig. 6. The bottom plate, Q, is provided with an opening in which is fitted the end of a drip pipe, p', which, in practice, extends down into the water in the stand-pipe for draining off any water of condensation which may collect in chamber R'.

For the purpose of more thoroughly drying and superheating steam, I may construct in duplicate the distributing chamber R and discharge chamber R', with their systems of radial tubes, as shown in Fig. 4. Ordinarily, however, this duplication of the apparatus will not be required. As an additional means for separating condensable vapor from the steam, I provide an internal cylinder, O, open at both ends and secured at its lower end within distributing chamber R, as shown in Fig. 5. In this case, I connect a drip pipe, o, to the bottom of chamber R, and extend such pipe down into the water of the stand-pipe.

In the operation of my steam drying and superheating apparatus, the steam rising in the stand-pipe and its dome B' is caused to flow first into the distributing chamber R, from which it is distributed in numerous small streams through radial tubes, r, and discharged into the outer radial superheating tubes, b', where it is superheated and flows thence into the annular discharge chamber, R', and thence escapes through the take-off pipe S, to the engine or other place of use. Since the radial tubes, b', extend into the combustion chamber around the stand-pipe, they will be highly heated and since the steam is compressed into the distributing chamber

R, it will be forced under pressure through the distributing tubes, r, into the superheating tubes, b', where, by contact with the highly heated metal, it is thoroughly and uniformly superheated. The tubes, b', being of larger diameter than tubes, r, the steam passes along in them at a much reduced velocity of flow allowing any water which may have passed with it through the distributing tubes, r, to drop to the bottom and hottest part of the tubes, b', whereby all or most of the water will be converted into steam. If water is carried along the bottom of tubes, b', to the chamber, R', it may fall on to the plate, Q, from which it drains through drip-pipe P'. The arrangement of the bottom plate, Q, and the central distributing chamber, R, effectively overcomes any tendency to priming.

As indicated above, the upper end of the stand-pipe is in the nature of a steam dome, and I wish it understood that my steam drying and superheating apparatus may be effectively applied to the steam dome of other boilers besides the one herein shown. Especially is this true of my invention in the form shown in Fig. 6, in which the outer steam tubes are omitted.

It is my purpose to apply the form of my invention, illustrated in Fig. 6, to the steam dome of any boiler, and I wish it understood, therefore, that such invention is not limited to application and use with a boiler having a central stand-pipe and radial tubes, such as herein illustrated.

Having described my invention, what I claim and desire to secure by Letters Patent is,—

1. In a radial tube boiler a steam drying and superheating apparatus comprising a steam distributing chamber closed at top and opening at the bottom into the stand pipe, a surrounding steam discharge chamber closed at the bottom, and a series of distributing pipes radiating from the distributing chamber, substantially as described.

2. In a radial tube boiler the combination with the stand-pipe of a steam distributing chamber, a surrounding discharge chamber, and a series of open ended pipes leading from the distributing chamber into the discharge chamber, substantially as described.

3. In combination with the stand-pipe a diaphragm plate, having an opening, a steam distributing chamber connecting therewith at its opening and closed at the top, the annular discharge chamber and a series of distributing pipes, connecting with said distributing chamber, substantially as described.

4. In combination with the stand pipe, a steam distributing chamber closed at the top and open at the bottom, a surrounding discharge chamber closed at the bottom and having a series of radial superheating tubes, and a series of steam distributing pipes leading from said distributing chamber into the outer superheating tubes, substantially as described.

5. In combination with a stand-pipe or other steam dome a steam distributing chamber closed at the top and containing an open ended pipe or cylinder communicating with the stand-pipe, a discharge chamber surrounding said distributing chamber, and a series of distributing pipes radiating from the distributing chamber, substantially as described.

6. In combination with the distributing and discharge chamber and distributing pipes arranged as described, a drain pipe leading from the bottom of the discharge chamber down into the stand-pipe, substantially as described.

7. In combination with a stand-pipe, or steam dome, a diaphragm plate connecting therewith and having a central opening, a steam distributing chamber, secured to said plate at its opening and having a closing plate at the top, a second plate secured to the steam escape pipe above and connected by long bolts and spacing sleeves or ferrules to a flange of the distributing chamber, substantially as described.

8. In combination with the steam dome of a boiler, the diaphragm plate having a central opening and a distributing chamber, connecting with the plate at said opening, and having numerous small outlets for dividing the steam into numerous currents or streams, said diaphragm-plate and distributing chamber forming a discharge chamber in the dome, substantially as described.

In testimony whereof I affix my signature in presence of two witnesses.

BENJAMIN W. HOYT.

Witnesses:

LUTHER S. CONKLIN,

WM. F. KENNEDY.