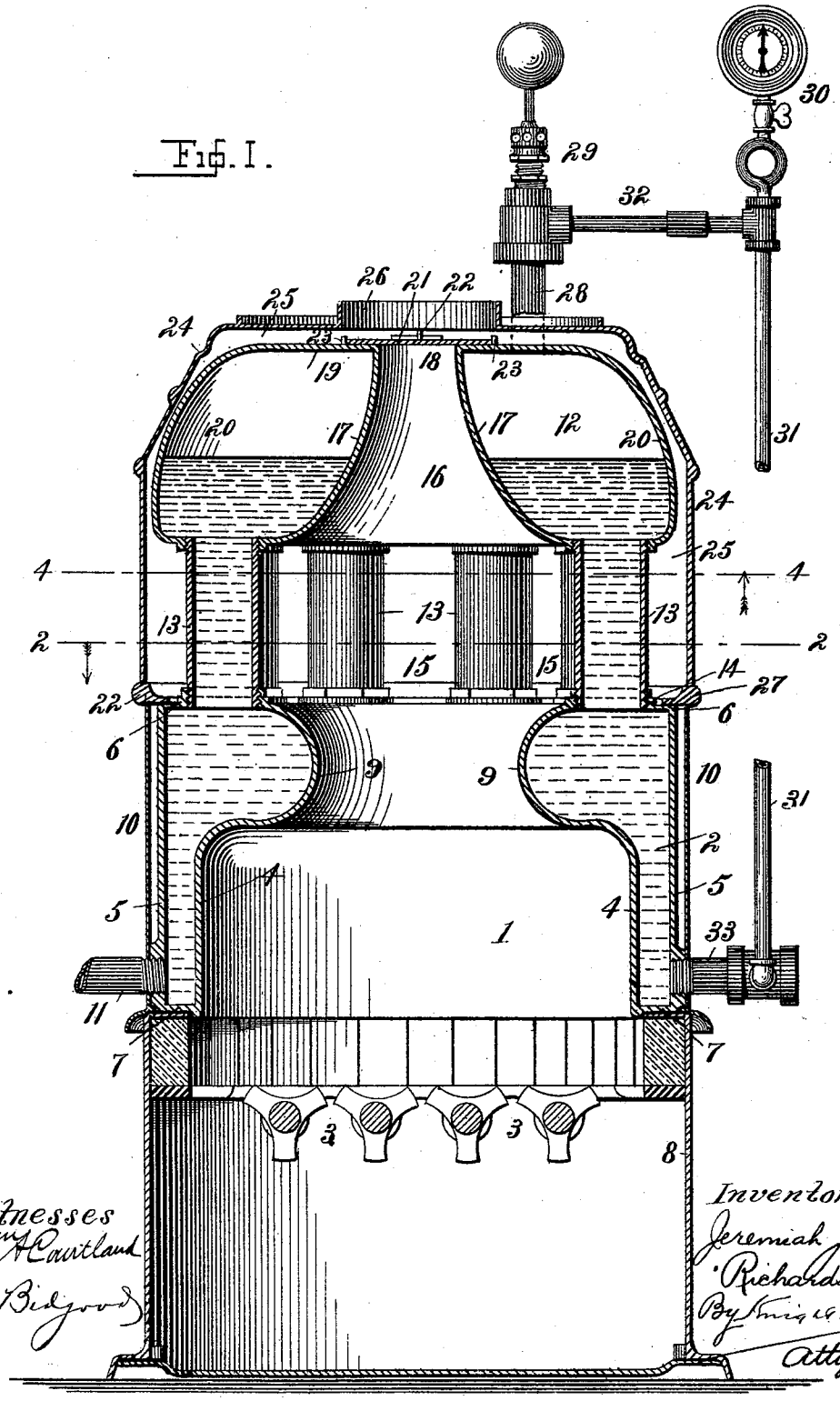
(No Model.) 6 Sheets—Sheet 1.

J. J. RICHARDSON.

STEAM BOILER.

No. 538,792. Patented May 7, 1895.

Fig. 1.



Witnesses
Wm. A. Cartland
Jno. V. Bidgood

Inventor
Jeremiah J. Richardson
By Knight Bros
Attys

(No Model.) 6 Sheets—Sheet 2.

J. J. RICHARDSON.

STEAM BOILER.

No. 538,792. Patented May 7, 1895.

Fig. II.

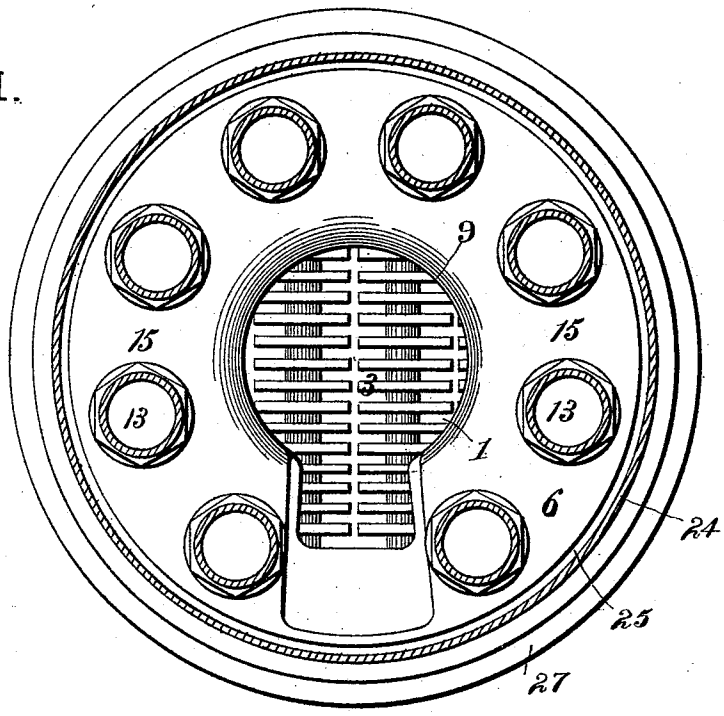
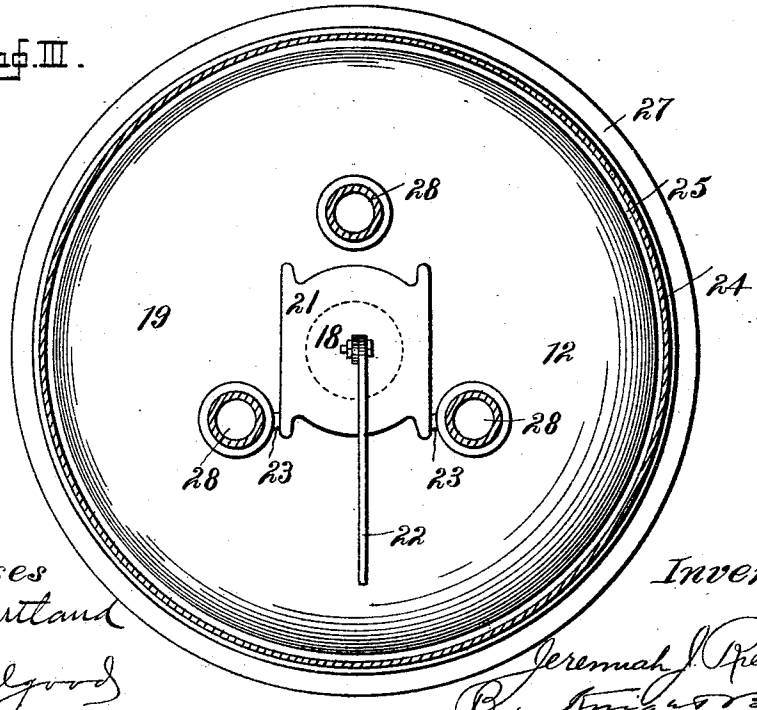


Fig. III.



Witnesses
Wm. A. Courtland
Jn. V. Bidgood

Inventor
Jeremiah J. Richardson
By Knight Bros
Attys.

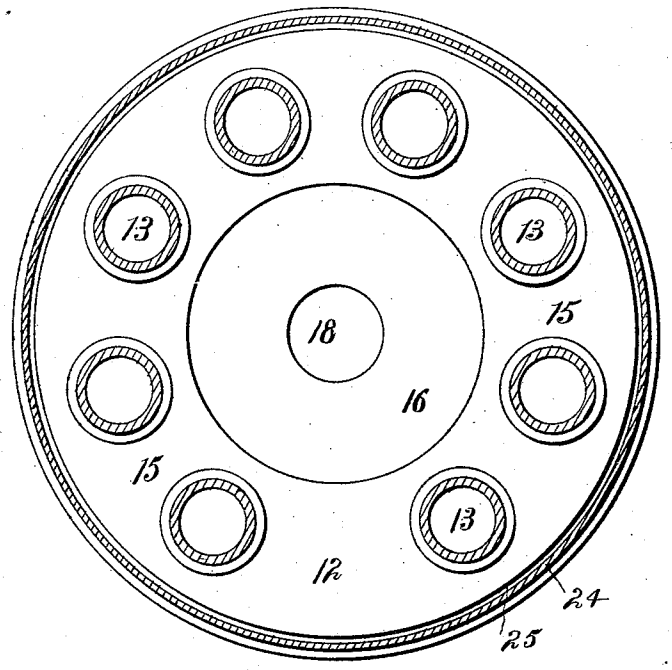
(No Model.) 6 Sheets—Sheet 3.

J. J. RICHARDSON.

STEAM BOILER.

No. 538,792. Patented May 7, 1895.

Fig. IV.



Witnesses
Wm. A. Countland.
M. V. Bidgood

Inventor
Jeremiah J. Richardson
By [illegible]
Attys.

(No Model.) 6 Sheets—Sheet 4.

J. J. RICHARDSON.

STEAM BOILER.

No. 538,792. Patented May 7, 1895.

Fig. V.

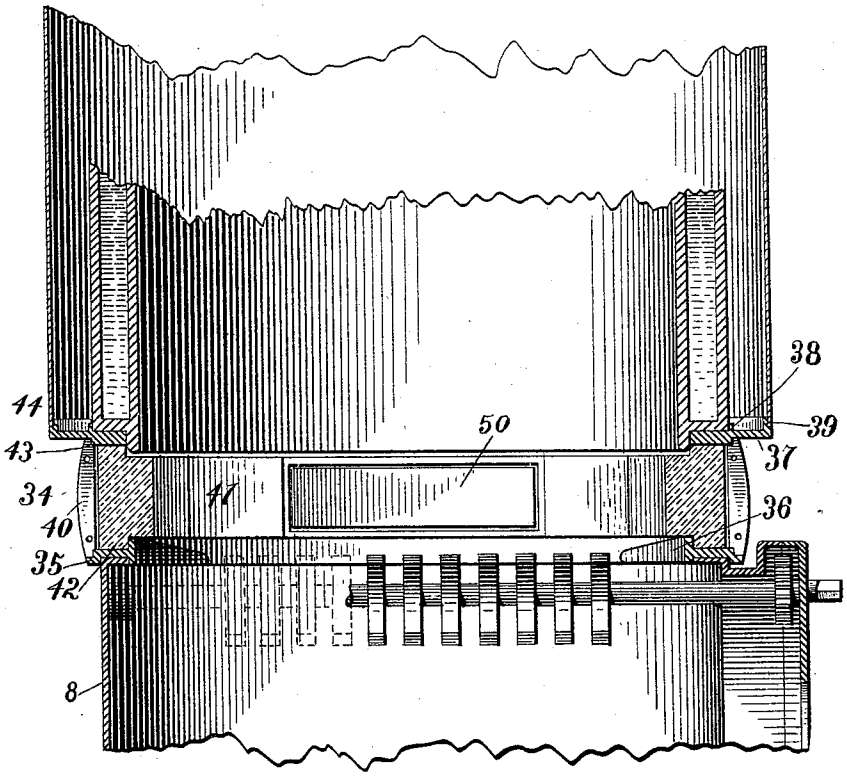
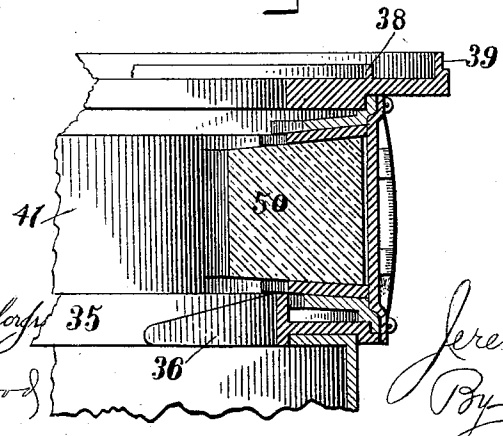


Fig. VI.



Witnesses
Geo. W. Naylor
M. V. Bilyeu

Inventor
Jeremiah J. Richardson
By Atkinson & Sons
Attys.

(No Model.) 6 Sheets—Sheet 5.

J. J. RICHARDSON.

STEAM BOILER.

No. 538,792. Patented May 7, 1895.

Fig. VII.

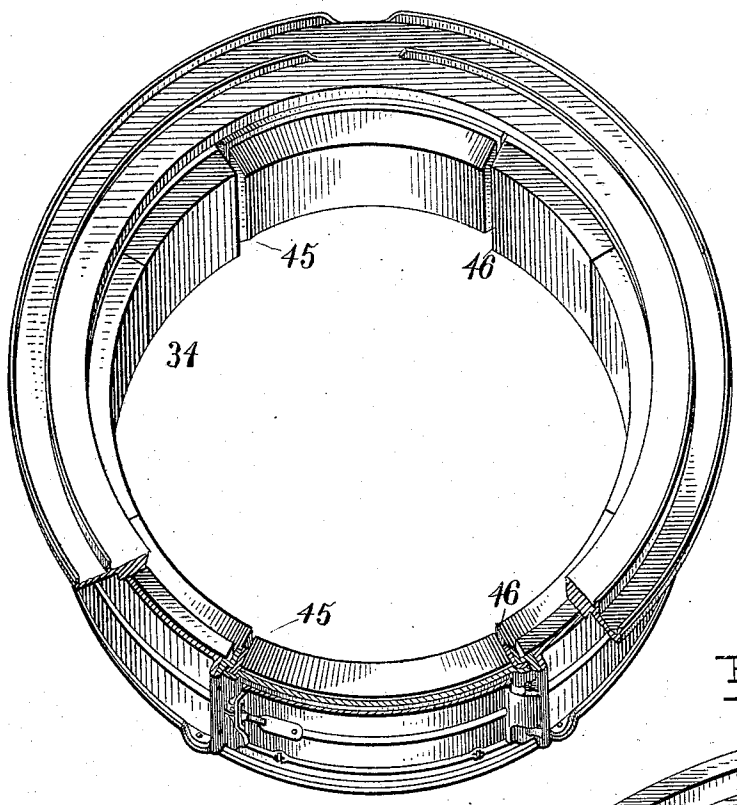


Fig. VIII.

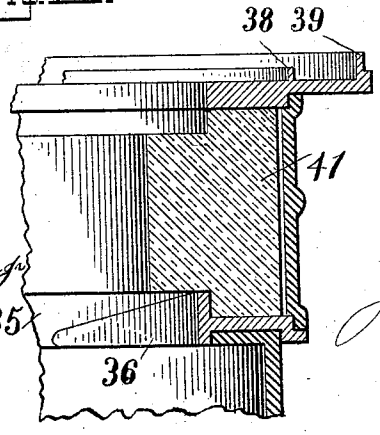
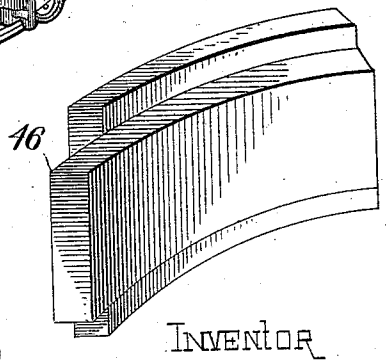


Fig. IX.



Witnesses
George W. Naylor Jr.
Jn. V. Bidgood

Inventor
Jeremiah J. Richardson
By Knight Bros.
Attys.

(No Model.) 6 Sheets—Sheet 6.

J. J. RICHARDSON.

STEAM BOILER.

No. 538,792. Patented May 7, 1895.

Fig X.

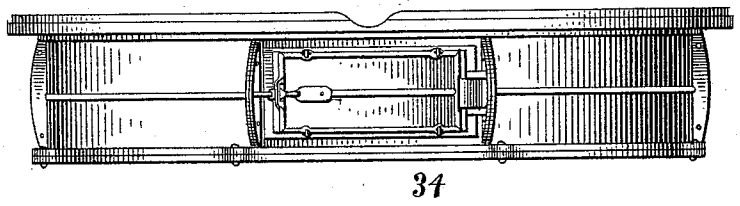


Fig XI.

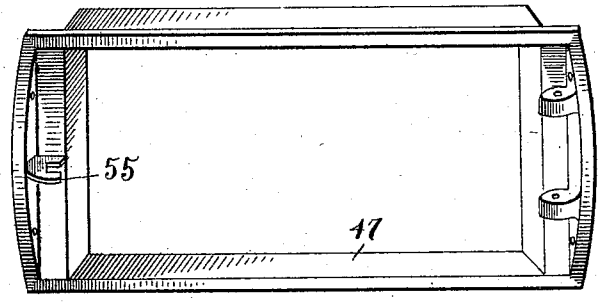


Fig XII.

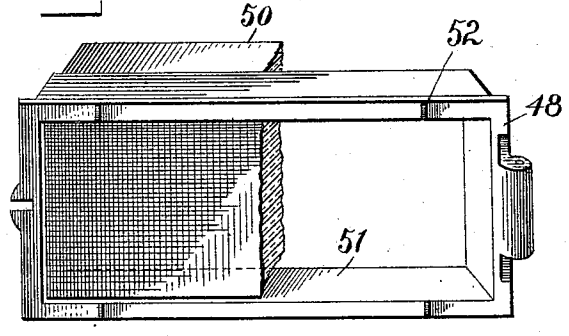
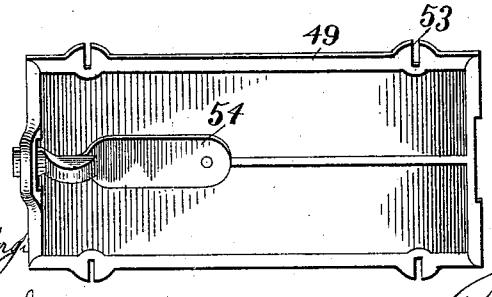


Fig XIII.



Witnesses
George W. Naylor
H. V. Bidgood

Inventor
Jeremiah J. Richardson
By Thos. G. Orr & Bro
Attys.

UNITED STATES PATENT OFFICE.

JEREMIAH J. RICHARDSON, OF BROOKLYN, NEW YORK.

STEAM-BOILER.

SPECIFICATION forming part of Letters Patent No. 538,792, dated May 7, 1895.

Application filed May 5, 1894. Serial No. 510,175. (No model.)

To all whom it may concern:

Be it known that I, JEREMIAH J. RICHARDSON, a citizen of the United States, residing at Brooklyn, county of Kings, State of New York, have invented certain new and useful Improvements in Steam-Boilers, of which the following is a specification.

My invention relates more particularly to boilers or steam generators for steam heating in dwellings, stores, &c., and it has for its object to increase the efficiency of such boilers by providing a large water surface in proximity to the heat, while so distributing the heat as to produce a maximum quantity of steam with a minimum amount of fuel.

A further object is to simplify and improve the general construction and arrangement of such boilers or steam generators so as to produce a safe and economical structure capable of being used by people generally.

The invention consists in the novel details of improvements and the combinations of parts that will be more fully hereinafter set forth and then pointed out in the claims.

Referring to the accompanying drawings, which form a part of this specification, Figure I is a vertical central section of my improved boiler or steam-generator. Fig. II is a horizontal section on the line II II in Fig. I, looking from the top. Fig. III is a plan view with the top casing broken away; and Fig. IV is a cross-section on the line IV IV, Fig. I, looking up. Fig. V is a vertical sectional view illustrating the preferred method of constructing the boiler-support. Fig. VI is a partial vertical sectional view, to a larger scale, through the door therein. Fig. VII is a perspective view of the boiler-supporting ring with its fire-brick lining. Fig. VIII is a vertical sectional view thereof, with a part of the base-piece. Fig. IX is a perspective view of one of the fire-bricks. Fig. X is a front view of the ring shown in Fig. VII. Fig. XI is a perspective view of the door-casing therein. Fig. XII is a perspective view of the door, part of its brick lining being broken away and its outer plate being removed. Fig. XIII is a perspective view of said outer plate.

In the accompanying drawings, the numeral 1 indicates a fire or combustion chamber surrounded by a water chamber 2 suitable grate bars 3 being placed beneath the chamber 1 to support the fuel. The chambers 1, 2 are formed by walls 4, 5 connected together at their tops and bottoms by plates or the like 6, 7 as shown, the chamber 1 being open at top and bottom as indicated. The walls or casings 4, 5 are supported upon a suitable frame or casing 8, joining an ash receiver. (See Fig. I.) The preferred construction of such ash receiver, with the rest of the boiler support, is shown in Figs. V to XIII and described farther on.

The walls 4, for a portion of their height are shown straight or parallel with walls 5 forming with the walls 5 at that portion, a narrow annular water space. The upper portion of the walls 4 are curved inwardly, upwardly and outwardly at 9 in semi-tube form, whereby the water chamber 2 is enlarged or widened at its upper part. The curved part 9 of wall 4 forms a partial crown sheet against which the flames and heated products of combustion are directed in their upward passage through chamber 1, making an enlarged water-heating surface.

The walls 4 and 5 and the plates or rims 6, 7 are shown as cast or made in a single piece of metal, whereby joints are reduced and leakage prevented. The wall 5 is shown surrounded by a jacket 10 to retard radiation of heat. 11 is a water inlet pipe leading into the chamber 2 at its lower part whereby the desired circulation within the water chambers is produced.

Above the chamber 2 is located an annular water and steam chamber 12, said chambers 2 and 12 being in communication by means of tubes 13. The plate 6 on chamber 2 is shown provided with threaded apertures 14 into which the tubes 13 are screwed, the tubes 13 being shown arranged in a circle with spaces 15 between them for the passage of the heated products of combustion from the chamber 1. The tubes 13 are also shown screwed into the bottom of chamber 12 but the connection of tubes 13 with the chambers 2 and 12 may be otherwise suitably arranged.

The annular chamber 12 is mainly composed of curved walls as shown and it has a central flue 16 in line with the top of chamber 1. The flue 16 is of substantially inverted funnel shape and constitutes a central chamber for the passage of the products of combustion,

the walls 17 being shown in somewhat parabolic form, the small end 18 of flue 16 opening through the top 19 of chamber 12. The top 19 of chamber 12 is shown flat or level, the outer walls 20 being curved downward to the bottom of said chamber. I prefer that the walls 17—20 and top 19 of chamber 12 should be made or cast in a single piece of metal to avoid joints and thus prevent leakage. On the top of chamber 12, over opening 18 is placed a damper or cover 21 which may slide on said top 19, a suitable handle or lever 22 being provided for that purpose, so that the opening 18 of flue and combustion chamber 16 may be more or less closed, as desired, to retain the heat on the inner walls of chamber 12. 23 are guides on the top 19 of chamber 12 to guide the damper 21. Of course the damper 21 may be otherwise carried and operated, but by having a flat sliding damper I am enabled to use a narrow smoke and heat space above the steam and water chamber 12.

24 is a casing or jacket placed over the chamber 12 and tubes 13 and forming a heat space 25 for the heat and products of combustion that pass from the chamber 1, between the tubes 13. At the top of casing 24 is an opening 26 for the escape of smoke, &c., to which a suitable smoke pipe or flue may be connected. The opening 18 is shown smaller than opening 26, so that when damper 21 is open all the heat and products of combustion will not pass through flue 16, but part will be directed through chamber 25, thus causing the heat to be applied to both walls 17 and 20 of chamber 12. The distance between walls 20 and 24 is preferably made small so that the area of space 25 at those points will about approximate the area of opening 26 so that the volume of heat will be kept close upon chamber 12.

The casing 24 is shown carried by or resting upon a ring or flange 27 supported by the wall 5 of chamber 2.

28 are steam tubes or pipes passing into the upper part of chamber 12 for conducting away the steam from said chamber. One of the tubes or pipes 28 may be provided with a safety valve 29 and with a steam gage 30 and water gage 31. As shown, the steam gage 30 is connected by a tube 32 with a pipe 28 the gage glass 31 being also connected with tube 32, and with the bottom of chamber 2 by a tube 33; but of course these valves or gages may be arranged as desired.

In a boiler or steam generator organized as above described, the heat within chamber 1 strikes the walls 4 and passes along the curved walls or partial crown sheet 9, thereby heating a large surface of water in chamber 2. The heat and heated products of combustion thence pass along tubes 13 into the flue 16 as well as into the space 25. If damper 21 is closed the flue 16 will retain the heat in proximity to the water in chamber 12, while the products will pass away through space 25 and opening 26. If damper 18 is open, or partly so, a portion of the heated products will pass through opening 18 and part through space 25; but in both cases the heat and products of combustion envelop tubes 13, pass along walls 17 and 20, and over the top 19 of chamber 12, thus presenting a large heat area to the body of water in chamber 12. At the same time the steam space in chamber 12 is surrounded by heat and heated products of combustion whereby the temperature of the steam is increased, or the steam is superheated.

It will be observed that the upper part of the water in chambers 2, 12 and tubes 13 presents a greater surface to be heated than the lower part. By this means a thorough and advantageous circulation is obtained, for as the water is heated in chamber 2 it will rise to a hotter position above and so on so that the steam will be more quickly and easily liberated than if the whole body of water were heated upon a uniform area. By this means the consumption of fuel is lessened and thus I am enabled, in a simple and economical manner, to highly heat the water and simultaneously dry the steam. By having all the water spaces vertically arranged a free and uninterrupted circulation of the water is obtained.

Any suitable openings, doors, &c., may be provided for the entrance of fuel and removal of ashes, &c.

Referring now to Figs. V to XIII which represent the preferred form of the ash receiving casing and other parts beneath the boiler, it will be seen that the casing 8 has supported on it, the composite ring 34 illustrated detached in Figs. VII and X. This ring is made up of the lower annulus 35 T-shaped in cross section, and bearing on its inner periphery, projections or teeth 36 which serve as part of the grate surface filling up the segmental spaces left by the transverse grate bars 3; of the upper annulus or ring 37 which is provided with annular shoulders or ridges 38, 39 to afford seating for the boiler and its outer casing as shown in Fig. V; the sectional side plates 40 bolted to, and holding apart, the two rings 35 and 37 and the fire brick lining 41 made up of separate bricks which are provided with shouldered portions 42 engaging the lower lip 43 of the boiler and the upper lip 44 of the ring 35. This construction enables the bricks 41 to be inserted and removed at will. They are passed through one or other of the door-ways 45 provided at opposite sides of the ring 34 and are slid to their places in the ring. They may thus be renewed without taking the boiler down and the under surface of the boiler may thus be kept thoroughly protected from the direct heat of the flame. The bricks adjoining the door-ways are formed with the extension 46 shown in Fig. IX to provide a seat for the door. The construction of the door and its frame and casing is best gathered from Figs. X to XIII. The casing 47 is of the form

shown in Fig. XI and is bolted to its place in the ring 34. The door is shown in Figs. XII and XIII and consists of a frame 48 and an outside plate 49 with a fire brick 50 resting in tapered seat 51 in frame 48. On said frame 48 I provide lugs 52 which enter slots 53 in the outside plate 49 and said plate is then held in place on said frame by means of suitable bolts.

A latch 54 carried by the outside plate 49 engages a lip 55 on the door casing 47 to hold the door closed. When the fire bricks 41 are to be renewed, the door casing 47 and the door carried thereby are removed bodily from the ring 34 so that the old bricks may be slid around and moved through the door aperture and new bricks may then be inserted through the same aperture and slipped into place.

It is obvious that the door-ways 45 are useful not only in enabling the insertion of new fire bricks 41 but make the grate accessible for the purpose of cleaning from clinkers, &c.

Having thus described my invention, the following is what I claim as new therein and desire to secure by Letters Patent:

1. A steam or water boiler comprising two chambers constructed substantially as shown and described, said chambers having a product of combustion passage centrally arranged and extending the entire length of the boiler in combination with a product of combustion chamber located over the exterior of the upper of said water chambers and communicating with the interior combustion chamber as shown and described, the two water chambers being connected by vertical tubes.

2. A steam or water boiler provided with two water chambers, one arranged directly over the other and the two being connected to each other by vertical tubes, a centrally located product of combustion chamber divided into two compartments one arranged inside and contiguous to the lower water chamber and the other arranged inside and contiguous to the upper water chamber, both of said compartments constructed to flare outwardly and downwardly as and for the purposes set forth.

3. A steam or water boiler having two water chambers horizontally divided, one of said water chambers being arranged over the other, the two chambers being connected to each other by vertical tubes and both water chambers having inwardly extending portions located over and extending into a centrally located product of combustion passage, as and for the purposes set forth.

4. In a steam or water boiler provided with a centrally located product of combustion passage extending from the fire box to the discharge orifice and terminating in a bell-shaped crown 17 as shown, a water chamber surrounding said product of combustion passage and constructed substantially as and for the purposes set forth.

5. In a boiler a water chamber 4, 5 forming a very narrow water space, having on top an inwardly curved wall 9, exposing a rounded surface to products of combustion on the inside and which forms a partial crown sheet over which the heat and flame are forced to pass in their passage to, across and through the perpendicular water pipes which connect over the fire pot to the bell mouth steam dome on top, with said water pipes and steam dome connected and located, substantially as and for the purposes set forth.

6. In a steam or water boiler, a water and steam chamber having an enlarging central flue, bell-shaped, the largest part of opening with its rounding surface exposed to the direct action of the fire and products of combustion, having openings between the perpendicular water pipes which connect the fire pot to the dome through which the products of combustion pass in their upward current, as they flow over the rounding surfaces of the dome, combined with a casing surrounding said top dome only forming a narrow space for products of combustion to pass over the outside of said dome.

7. In a boiler an upper water and steam chamber having walls 17, 19 and 20, all cast in a single piece of metal forming a central bell shaped flue or heat passage and means for supplying said chamber with water through perpendicular water pipes, which connect the fire pot section to the steam and water dome as described.

8. In a boiler, a water chamber having an inner flue, opening on its exterior, a damper to close said flue and means for supplying said boiler with water, combined with a jacket outside of said chamber forming a heat space 25 in communication with said flue, said jacket having a smoke opening, substantially as described.

9. In a boiler, a water chamber having an inner flue that opens on the exterior of the water chamber and is downwardly flaring, combined with a water chamber having an inner flue in line with the first mentioned flue, tubes connecting said chambers, said tubes having spaces between them, and a jacket surrounding said upper chamber and tubes and having a smoke opening larger than the top of upper flue and communicating with the inner flue, substantially as described.

10. A boiler, comprising an ash receiving casing, a water chamber mounted thereon, a superposed annular steam and water chamber thereon, vertically arranged tubes connecting said chambers and having spaces 15 between them, interior vertical flues in said chambers in communication and opening above and below said chambers, a jacket surrounding the upper chamber and having heat space 25 between them, the spaces 15 and 25 communicating, said jacket having a smoke opening said flues opening direct into the heat space 25, substantially as described.

11. In a boiler, a water chamber having walls, 4, 5 and plate or rim 7, said walls be-

ing parallel for part of their height, the wall 4 also having an upper inwardly curved portion 9, the walls 4, 5 and plate or rim 7 being all made or cast in a single piece of metal, as and for the purpose specified.

12. The combination of the fire chamber 1 with vertical walls 4 and rounding out over fire chamber at top, so as to bring products of combustion more directly against these inwardly rounding projecting surfaces, the water chamber 2, having vertical walls on outside only, closely surrounding said inner wall of fire chamber, the perpendicular water tubes, 13, directly over said chamber 2 the annular water and steam chamber 12, directly over said perpendicular connecting pipes, which connect chamber 12 to chamber 2, and the heat passages or chambers 9, 15, 16 and 25, substantially as described.

JEREMIAH J. RICHARDSON.

Witnesses:
FREDERICK KOCH,
J. W. KENT.