

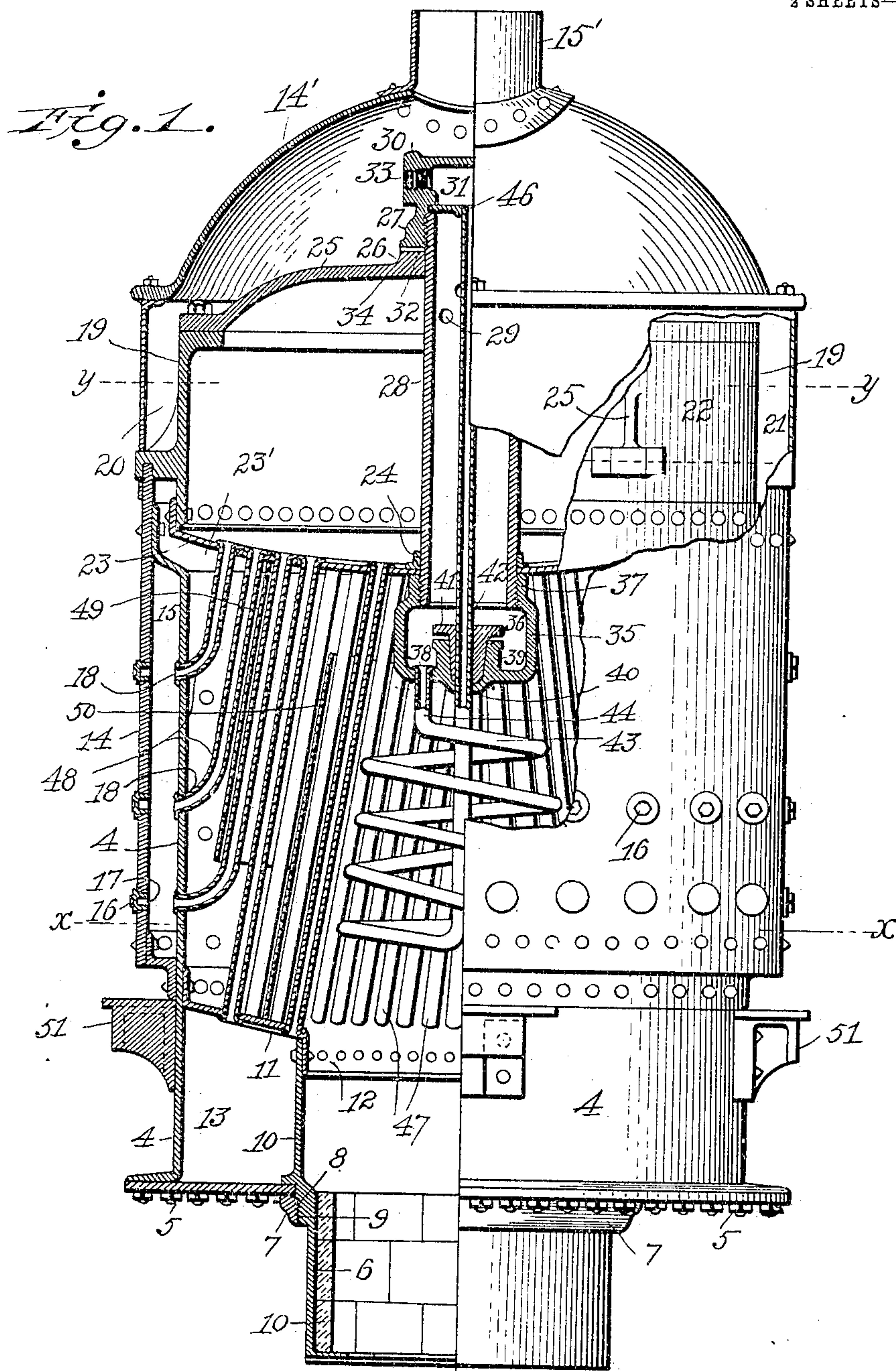
No. 788,068.

PATENTED APR. 25, 1905.

L. RHODES.  
STEAM BOILER.

APPLICATION FILED MAY 6, 1904.

2 SHEETS—SHEET 1.



Witnesses

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2 SHEETS—SHEET 2.

Fig. 2.

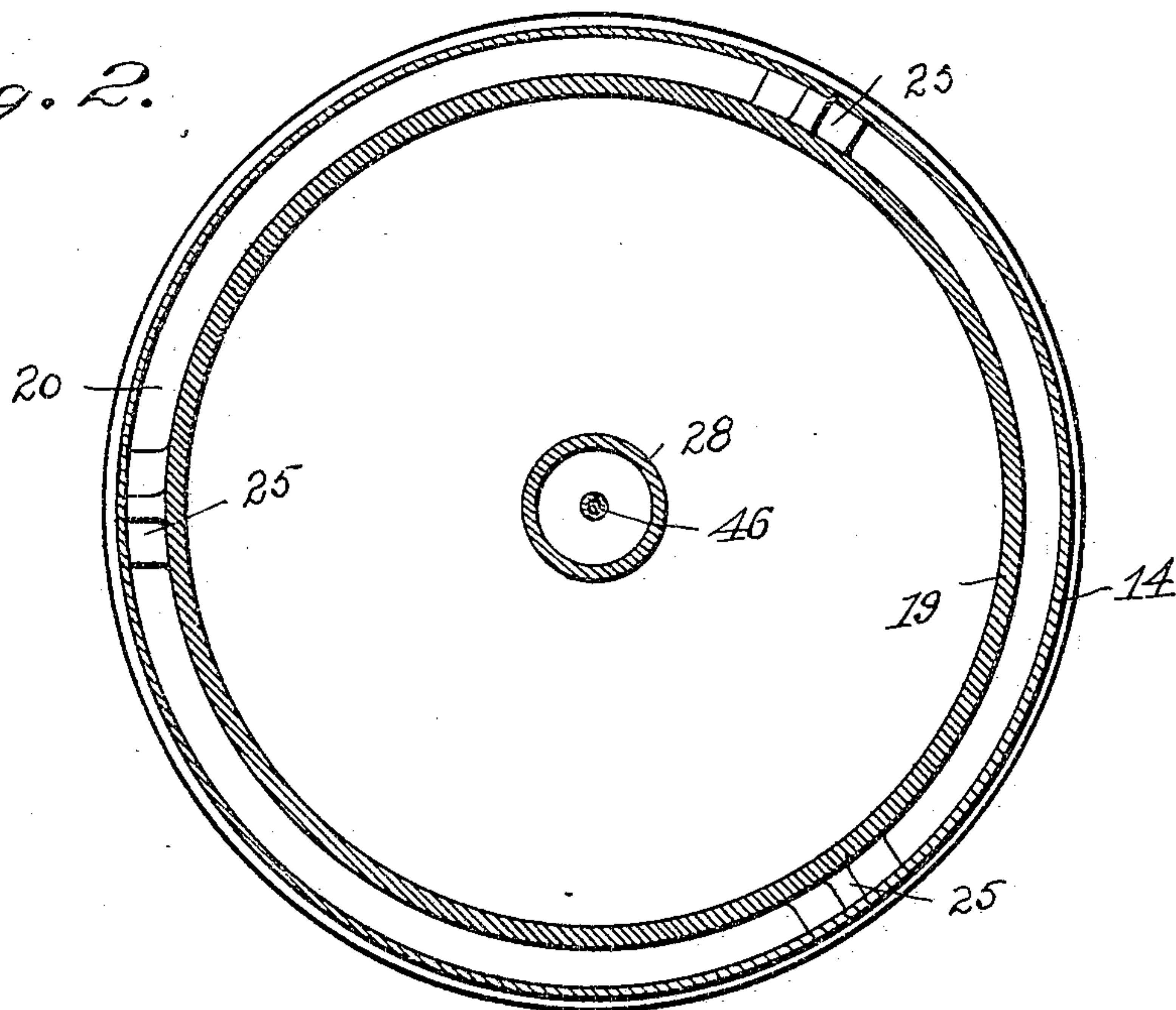
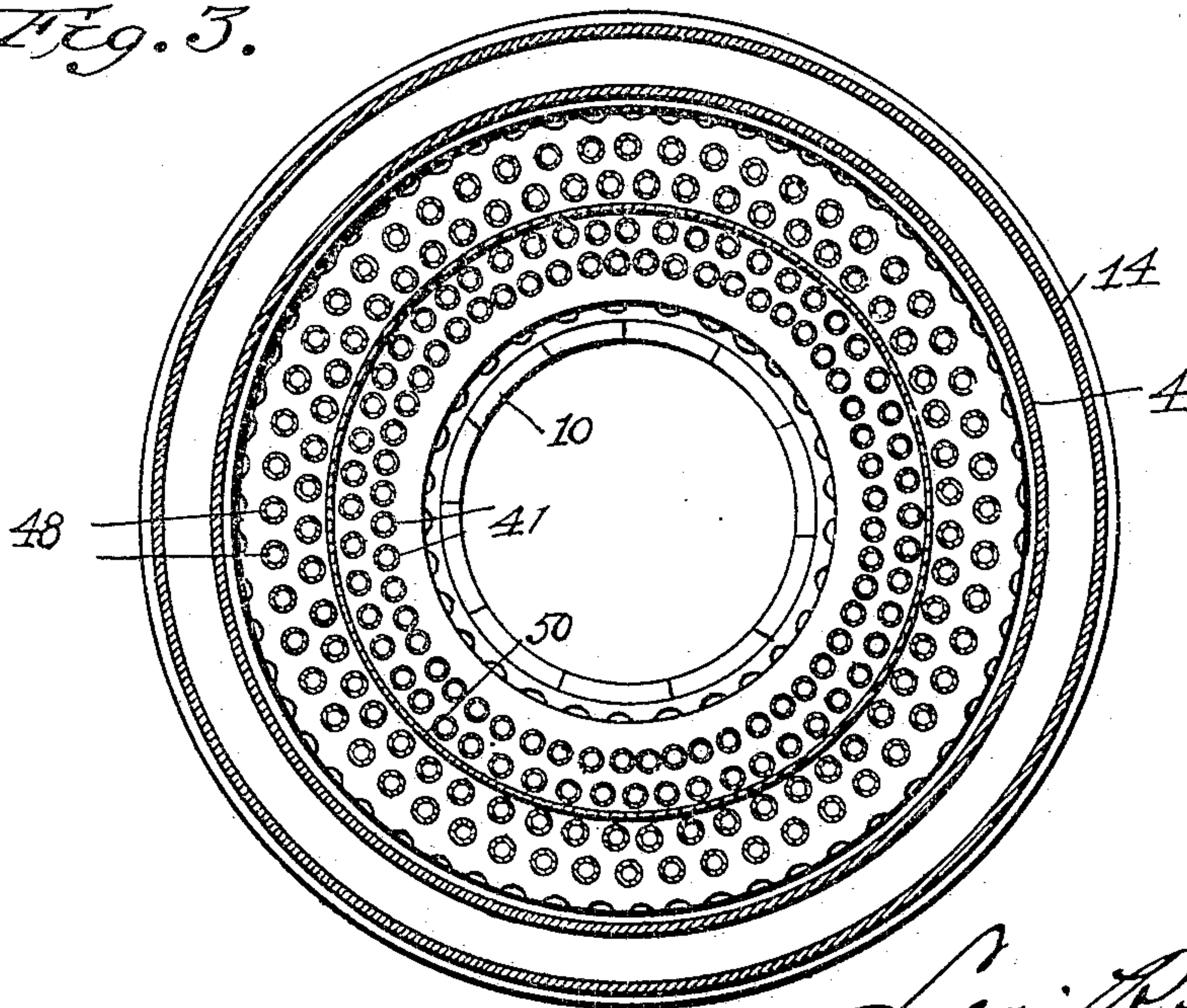


Fig. 3.



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# UNITED STATES PATENT OFFICE.

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## STEAM-BOILER.

SPECIFICATION forming part of Letters Patent No. 788,068, dated April 25, 1905.

Application filed May 6, 1904. Serial No. 206,690.

*To all whom it may concern:*

Be it known that I, LEVI RHODES, a citizen of the United States, residing at Spokane, in the county of Spokane and State of Washington, have invented new and useful Improvements in Steam-Boilers, of which the following is a specification.

This invention relates to a vertical water-tube steam-boiler; and its object is to provide an improved construction of the same.

The invention consists in the combinations and subcombinations to be hereinafter described.

In the accompanying drawings, Figure 1 is an elevation, partly in section, of the steam-boiler constructed in accordance with my invention. Fig. 2 is a transverse section taken on the line *y y* of Fig. 1, and Fig. 3 a transverse section taken on the line *x x* of Fig. 1.

Like numerals indicate like parts in the several figures.

Referring to said drawings, 4 indicates the inner shell or section of the boiler, the lower end of which is bolted to the annular detachable head or flange 5, which has a central opening of a size to admit the introduction of the annular fire-box or combustion-chamber 6, which is shouldered upon the head or flange 5, as shown.

7 designates a band or collar that is provided with internal screw-threads 8, that are adapted to engage threads 9 on the exterior of the fire-box, thereby enabling said bands to be screwed up against the said flange or head to make a substantial joint, and also provide for the removal of the said flange or head for the purpose of cleaning the surrounding water-chamber.

The fire-box is provided at its bottom with an opening to admit air to support combustion and is lined with fire-brick, as indicated at 10. Within said fire-box it is designed to arrange a vapor-burner adapted to throw a disk-shaped flame upward into the heating-chamber.

11 designates a tube-sheet that is provided with an annular downwardly-extending flange or skirt 12, that fits snugly within the annular opening of the upper end of the fire-box and is riveted thereto, while the opposite end of

this tube-sheet extends upwardly to form a flange or skirt 12', that is shaped to fit against the wall of the inner shell 4 to which it is riveted. This tube-sheet serves the twofold function of inclosing the space between the fire-box and the shell 4 to form the water-space or mud-drum 13, that surrounds the fire-box, as well as providing a stay means between the upper end of the fire-box and the shell 4, while the horizontal portion of it is perforated to receive the inner series of vertical water-tubes, to be hereinafter referred to.

14 designates an outer shell that surrounds the shell 4 throughout the central portion that constitutes the heating or final combustion chamber, and which is connected to the walls of the shell 14 at top and bottom by bolting-rivets, as shown, and which serves to form a shallow water space or jacket 15 about said shell 4.

16 designates plugs that are secured, respectively, into openings 17, formed in the shell 14, which openings are arranged opposite a like series of openings or perforations 18, formed in the shell 4 for the reception of the lower ends of the outer series of vertical water-tubes, to be hereinafter referred to, which plugs are so placed as to make it convenient to get at the said tubes for cleaning and repairing. Superimposed upon said outer shell 14 is a hood 14', that is provided with a stack 15'.

19 designates an elevated steam and water drum or chamber that is provided with three projecting lugs 20, that extend radially therefrom and serve to rest on the upper edge of the outer shell to support said drum in position in a manner to allow of an annular draft-exit 21 between said drum and the wall of the shell 4. The steam and water drum thus elevated and positioned comprises an annular wall or casting 22, to the bottom of which is securely bolted a tube-plate 23, that is provided with openings 23' for the reception of the upper ends of the vertical water-tubes and a central opening 24 for the reception of the dry-steam pipe, to be hereinafter referred to, while the top of said drum is inclosed by a dome-shaped plate 25, that is bolted there-



to, which latter is provided centrally with a shoulder 26, having a central opening 27, that registers with the central opening 24 in the tube-plate 23 and corresponds with it in diameter.

28 designates the dry-steam-collecting pipe and supporting - column, which is screw-threaded at its respective ends and is provided in its upper portion with perforations 29. This pipe is adapted to be introduced downwardly through the openings 27 and 24 to extend centrally through the steam and water drum and is supported at its top by the nozzle fitting or casting 30, that is provided with a chamber 31 and supply and discharge openings 32 and 33, respectively, and an annular flange 34, that is screw-threaded interiorly and adapted to screw down on the upper screw-threaded end of the pipe 28 to seat on the central shoulder and form a tight joint. The discharge-opening is also screw-threaded and is intended to receive a steam-delivery pipe. (Not shown.)

35 designates a casting that is enlarged in cross-section to provide a chamber 36 and which is provided at its top with a screw-threaded feed inlet or opening 37 of a size to engage with the bottom screw-threaded end of the pipe 28 and which is intended to screw up upon said pipe to a point where it seats against the tube-plate to form a tight joint. This casting is also provided with a discharge-opening 38 and a central cup-shaped portion 39, that is provided centrally with an opening 40 and which is adapted to seat a gland 41, which is provided with a passage 42, that registers with the opening 40 when seated in the position shown. The fitting 35 forms a coupling between the dry-steam pipe and the superheating-coil 43. This superheating-coil comprises a drop-tube 44, that connects with the discharge-opening 38 and projects in a downward zigzag course through a central heated zone of the combustion-chamber and terminates in a return-riser 45, that extends vertically through the gland 41 of the casting 35 and centrally up through the dry-steam pipe 28 to and in connection with the opening 46 in the nozzle.

47 designates an interior set or bank of vertical water-tubes that surround the superheating-coil 43 and which are slightly inclined, as shown, and connect at their respective upper and lower ends with the tube-sheets 23 and 11, respectively. 48 designates the outer series of water-tubes, which are likewise slightly inclined and which connect with the said tube-sheet 23 and the shell 4. These two sets of water-tubes thus arranged in the heating-chamber constitute a reversely-arranged circulating means between the water-jacket and the steam and water drum and between the latter and the mud-drum, and as the tubes are only slightly inclined there is little chance for soot and dust to collect on any portion of them,

as in the case of a boiler of the horizontal type.

49 and 50, respectively, designate two baffle-plates that are placed between the water-tubes, as shown, and which cause the gases from the fire-box to be led first up among one set or bank of tubes and from thence to the other set in a circuitous passage in order that every particle of the gases may come in contact with the tubes and insure an exhaustive delivery of heat to the water contained therein.

51 indicates brackets that are secured to the shell 4 for the purpose of attaching the boiler to a suitable frame or structure.

From the construction hereinbefore described it will be observed that the feed-water enters the water space or jacket 15—that is, the coolest part of the boiler—and as it descends therein is gradually heated, whereupon it rises in the outer series of water-tubes 48 to the steam and water drum, from which the circulation continues through the inner series of water-tubes 47 to the mud-drum 13 and from thence into said steam and water drum 19. From the steam-space of the drum 19 the steam escapes through the opening 29 to the dry-steam pipe and from thence into the coil 43 through the coupling-chamber 36 and from said coil is delivered through the vertical tube to the nozzle 30, to which the steam-delivery pipe (not shown) is connected.

Having described my invention, what I desire to claim as new and useful is—

1. The combination in a steam-boiler having a fire-box, of a water-drum surrounding said fire-box, a water-jacket surrounding the central portion of said boiler above said water-drum, a steam and water drum positioned above said water-jacket, and two sets of water-tubes, one set connecting the water-jacket with the steam and water drum, and the other set connecting said drum with the lower drum, substantially as and for the purpose set forth.

2. A water-tube boiler consisting of an inner and outer shell to provide a water-space, and having an upper and a lower water-drum, water-tubes connecting said water-space with the upper drum and the latter with the lower drum, a dry-steam pipe connected with said upper drum, a superheating-coil communicating with said dry-steam pipe, the whole arranged and operating, substantially as and for the purpose set forth.

3. The combination in a steam-boiler having a fire-box of a water-drum surrounding said fire-box, a water-jacket surrounding the central portion of said boiler above said water-drum, a steam and water drum positioned above said water-jacket, two sets of water-tubes, one set connecting the water-jacket with the steam and water drum, and the other set connecting said drum with the lower drum, and an upstanding baffle between the water-tubes, substantially as and for the purpose set forth.



4. The combination, in a steam-boiler having a fire-box, of a water-drum surrounding said fire-box, a water-jacket surrounding the central portion of said boiler above said water-drum, a steam and water drum positioned at a point above said water-jacket, two sets of water-tubes arranged in a parallel series, one set connecting the water-jacket with the steam and water drum, and the other set connecting said drum with the lower drum, an upstanding baffle between said water-tube, a dry-steam pipe arranged in communication with said steam and water drum, and a superheating-coil communicating with said dry-steam pipe and terminating in a steam-delivery pipe, substantially as and for the purpose set forth.

5. The combination in a steam-boiler having a fire-box, of a water-drum surrounding said fire-box, a water-jacket surrounding the central portion of said boiler above said water-drum, a steam and water drum positioned above said water-jacket and in spaced relation thereto to provide a passage for the products of combustion around said drum, two sets of water-tubes, one set connecting the water-jacket with the steam and water drum, and the other set connecting said drum with the water-drum, and an inner upstanding and an outer depending baffle-wall arranged between the water-tubes, substantially as and for the purpose set forth.

6. The combination in a steam-boiler having a fire-box, of a water-drum surrounding said fire-box, a water-jacket surrounding the central portion of said boiler above said water-drum, a steam and water drum positioned at a point above said water-jacket, two sets of water-tubes arranged in a parallel series, one set connecting the water-jacket with the steam and water drum, and the other set connecting said drum with the lower drum, a baffle-wall extending upward from said lower drum, and a baffle-wall depending from the steam and water drum, a dry-steam pipe in communication with said steam and water drum, and a superheating-coil communicating with said dry-steam pipe and terminating in a steam-delivery pipe, substantially as and for the purpose set forth.

7. The combination of an upright boiler-shell, a smoke-hood superimposed on said shell, a fire-box arranged centrally under said shell, a heating-chamber space formed centrally within said shell, a water-jacket surrounding said shell, a steam and water drum located above said heating-chamber and positioned in a manner to provide an annular draft-exit between said drum and the walls of said heating-chamber to the smoke-space formed by said hood, a lower water-drum, water-tubes arranged to connect the steam and water drum with the water-jacket and with the lower water-drum, substantially as and for the purpose set forth.

8. The combination of an upright boiler-

shell, a smoke-hood superimposed on said shell, a fire-box arranged centrally under said shell, a heating-chamber space formed centrally within said shell, a water-jacket surrounding said shell, a steam and water drum located above said heating-chamber and positioned in a manner to provide an annular draft-exit between said drum and the walls of said heating-chamber to the smoke-space formed by said hood, a lower water-drum, water-tubes arranged to connect the steam and water drum with the water-jacket and with the lower water-drum, a dry-steam pipe arranged as shown in connection with said steam and water drum, and a superheating-coil communicating with said dry-steam pipe and terminating in a steam-delivery pipe, substantially as and for the purpose set forth.

9. In a water-tube boiler the combination with a water-jacket, an elevated steam and water drum, a lower mud-drum, a double series of tubes connecting respectively, the water-jacket with the elevated drum and the latter with the mud-drum, baffle-walls for controlling the course of the heated gases through the series of water-tubes, with which they are adjacently arranged, a dry-steam pipe connected to said elevated drum, and a superheating-coil communicating with said dry-steam pipe, substantially as and for the purpose set forth.

10. In a water-tube boiler, the combination of an elevated steam and water drum, a fire-box, a lower mud-drum surrounding said fire-box, an interior set of vertical water-tubes connecting said elevated drum with said lower drum, a heating-chamber surrounding said water-tube, a water-jacket surrounding said heating-chamber, an outer series of water-tubes arranged within said heating-chamber, that connect the water-jacket to said elevated drum, a dry-steam pipe arranged in communication with the steam-space of said elevated drum, a superheating-coil communicating with said dry-steam pipe and arranged in the central heat zone of said heating-chamber, and terminating in a steam-delivery pipe, substantially as and for the purpose set forth.

11. A boiler comprising a shell or casing, a fire-box, a mud-drum surrounding said fire-box, a combustion or heating chamber arranged above said fire-box, a double series of water-tubes arranged within said combustion-chamber, a water-jacket surrounding said combustion-chamber, an elevated steam and water drum, the said water-jacket and mud-drum being reversely connected through the steam and water drum by the series of water-tubes, a dry-steam pipe connected with said steam and water drum, and a superheating-coil communicating with said dry-steam pipe, substantially as and for the purpose set forth.

12. In a steam-boiler the combination with the steam and water drum, of a water chamber or chambers surrounding the combustion-



chamber of the boiler, water-tubes connecting said water chamber or chambers with the steam and water drum, a dry-steam chamber in communication with the steam-space of the steam and water drum, and a superheating-coil in the combustion-chamber and in communication with the dry-steam chamber, substantially as and for the purpose set forth.

13. In a steam-boiler the combination with the steam and water drum, of a water chamber or chambers surrounding the combustion-chamber of the boiler, water-tubes connecting said water chamber or chambers with the steam and water drum, a dry-steam chamber in communication with the steam-space of the steam and water drum, and a superheating-coil within the combustion-chamber and in communication with the dry-steam chamber, said coil having a return-riser extending through said dry-steam chamber and terminating in a steam-delivery pipe, substantially as and for the purpose set forth.

14. In a steam-boiler the combination with a main outer shell, of a water-chamber surrounding the fire-box, having its outer shell extending within said main outer shell and spaced therefrom, upper and lower connecting portions for said shells, a steam-chamber, and tubes connecting the same with the water-chamber and the water-space between the inner and outer shell, substantially as and for the purpose set forth.

15. In a steam-boiler having a steam and

water drum, a water-drum, and tubes connecting said drums, the combination with the boiler-shell, of a bottom plate therefor having a central opening, a fire-box disposed within said opening, having a flange or shoulder adapted to seat on the inner side of said bottom plate and having a screw-threaded portion adjacent said flange or shoulder, a screw-threaded clamping-collar adapted for operation on said screw-threaded portion of the fire-box, and a tube-sheet connecting said fire-box with the boiler-shell, substantially as and for the purpose set forth.

16. In a steam-boiler having a steam and water drum, a water-drum below the same, and tubes connecting said drums, the combination with the boiler-shell, of a bottom plate therefor having a central opening, a fire-box disposed within said opening, having a flange or shoulder adapted to seat on the inner side of said bottom plate, a clamping-collar movably mounted on said fire-box, and a tube-sheet connecting said fire-box with the boiler-shell, substantially as and for the purpose set forth.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

LEVI RHODES.

Witnesses:

H. L. HERKELRATH,  
E. J. S. MILLER.