

No. 691,044.

Patented Jan. 14, 1902.

F. BURGER & H. M. WILLIAMS.

STEAM BOILER.

(Application filed Oct. 11, 1900. Renewed June 17, 1901.)

(No Model.)

2 Sheets—Sheet 1.

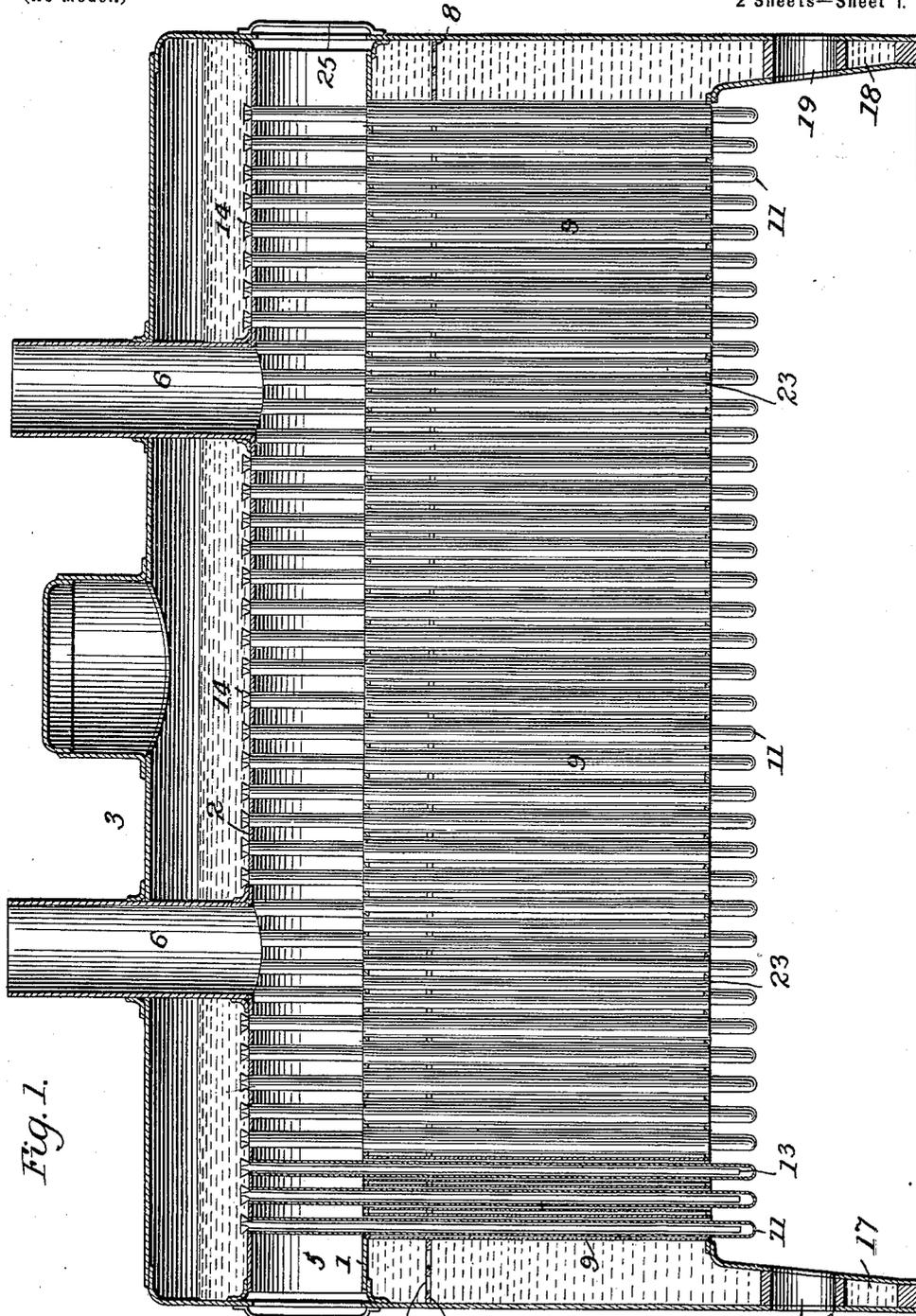


Fig. 1.

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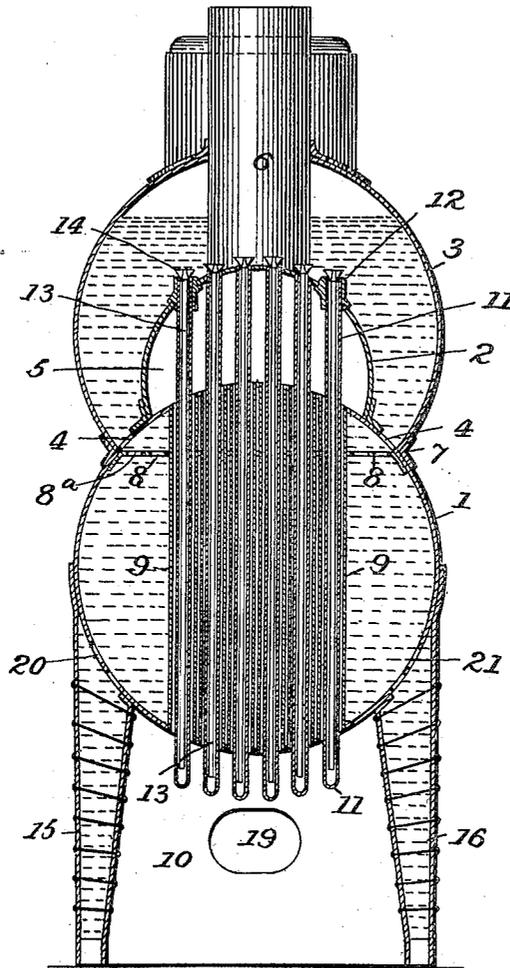
STEAM BOILER.

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(No Model.)

2 Sheets—Sheet 2.

Fig. 2.



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# UNITED STATES PATENT OFFICE.

FRANZ BURGER AND HENRY M. WILLIAMS, OF FORT WAYNE, INDIANA;  
SAID BURGER ASSIGNOR OF ONE-HALF HIS RIGHT TO SAID WILLIAMS.

## STEAM-BOILER.

SPECIFICATION forming part of Letters Patent No. 691,044, dated January 14, 1902.

Application filed October 11, 1900. Renewed June 17, 1901. Serial No. 64,931. (No model.)

*To all whom it may concern:*

Be it known that we, FRANZ BURGER and HENRY M. WILLIAMS, citizens of the United States, residing at Fort Wayne, in the county of Allen and State of Indiana, have invented certain new and useful Improvements in Steam-Boilers, of which the following is a specification.

This invention relates to steam-boilers, its object being to improve the general structure, with a view to increase the heating-surface and the steaming capacity of the boiler and to dispense with the use of many of the stays usually employed in the construction of a boiler, and thereby largely reducing the work, and consequently the expense, of construction.

A boiler according to this invention is provided with a fire-box extending its entire length. The sides and ends of the fire-box are flat and constitute water-legs, and the top is formed by a segment of a cylindrical shell, to which shell the sides and ends are secured. The radius of the shell is substantially equal to half the width between the side walls of the fire-box. Supported upon and riveted to the upper portion of the cylindrical shell is a semicylindrical shell, and the part of the cylindrical shell inclosed by the semicylindrical shell is provided with openings to establish circulation of water between the two shells. The upper portion of the semicylindrical shell forms the steam-space of the boiler. A smaller semicylindrical shell is also secured to the cylindrical shell within the larger semicylindrical shell and forms the smoke-box. It extends the whole length of the boiler and is open at both ends. Openings are formed in the ends of the larger semicylindrical shell, provided with removable closures in order to afford access to the interior of the smoke-box. Vertical fire-tubes are secured in the cylindrical shell and open at their lower ends into the fire-box and at their upper ends into the smoke-box. Field-tubes of less diameter than the fire-tubes are secured at their upper ends in the upper part of the shell forming the smoke-box and extend therefrom down through the smoke-box and the fire-tubes. Their upper ends are open and below the water-level of

the boiler, and their lower ends are closed and project a short distance into the fire-box. Smaller tubes, open at both ends, are supported within the field-tubes, and their lower ends do not extend to the bottom of the field-tubes, while their upper ends are level with or slightly above the upper ends of the field-tubes. By passing the field-tubes through the fire-tubes and extending them into the fire-box the heating-surface is greatly increased, and the water will pass down the small tubes within the field-tubes and up through the spaces between the small tubes and the field-tubes and be there converted into steam. A horizontal plate is riveted to the inner surface of the cylindrical shell, where the outer semicylindrical shell is connected to it. This plate acts as a stay-plate and is perforated to permit circulation of the water. It is also perforated for the passage of the fire-tubes, such perforations being of somewhat greater diameter than the fire-tubes, so that the water may also circulate through them.

For a detailed description of the invention reference must be had to the accompanying drawings, in which—

Figure 1 is a vertical longitudinal section, and Fig. 2 a vertical transverse section, of a boiler constructed in accordance with our invention.

To the lower horizontally-disposed cylindrical shell 1 are riveted two horizontally-disposed semicircular shells 2 and 3, the shell 2 being of a smaller diameter than shell 3, and all the shells being substantially coextensive in length. The space on the lower shell between the two upper shells, where they are riveted to the lower shell, is provided with a number of perforations 4, through which the steam and water can circulate. The inside of the shell 2 forms a smoke-box or secondary fire-chamber 5, from which the gases escape through the exits 6. At the junction 7, where the shells 3 and 1 meet, and on the inside of the shell 1 is located a perforated stay-plate 8. This stay-plate 8 extends from one end to the other of the shell 1 and is provided with perforations larger than the fire-tubes 9, which pass through the plate. It is also preferably provided with perforations 8<sup>a</sup> on

each side of the fire-tubes to still further increase the circulation. The fire-tubes 9 are expanded into the upper part of shell 1, forming the bottom of the secondary fire-chamber 5, and also into the lower part of the same shell to connect with the fire-box 10. Into these tubes 9 are placed the field-tubes 11, of smaller diameter than the fire-tubes, and the upper ends of the field-tubes are expanded into the crown of the semicircular shell 2. These tubes 11 extend from the upper part of shell 2 through the secondary fire-chamber 5, also through the fire-tubes 9, and their lower ends are closed and project into the fire-box 10. In order to fasten the outside tubes 11 into the inclined portion of the shell 2, metallic bushings 12 are used, which are first fastened to the shell 2 and the tubes 11 then inserted and expanded into the bushings. Into the tubes 11 are hung the tubes 13, which are open at both ends and of smaller diameter than the tubes 11. For hanging the tubes 13 into the tubes 11 the tubes 13 are provided at their upper ends with three small taper projections or lugs 14. The tubes 13 do not reach to the bottom of the tubes 11, but are some distance from the same. The water will flow down the central tubes 13 and up again through the space between the tubes 11 and 13 in the form of steam. The circulation will be so rapid in these tubes that no sediment will occur. The fire-box is composed of two side water-legs 15 and 16 and the two end water-legs 17 and 18, each of the latter being provided with doors 19. The water-legs 15 and 16 are riveted on the sides of the shell 1. The shell between the side water-legs is perforated at 20 and 21. Stay-bolts are of course required in the water-legs. As the exits 6 cut off a number of the field-tubes smaller fire-tubes 23 take their place. The flame and hot gases pass up through the fire-tubes 9, surrounding the tubes 11, into the secondary fire-chamber 5, surrounding the field-tubes 11, on their way to the exits. The ends of the shell 3 are provided with openings opposite the ends of the shell 2, and removable closures 25 are provided for these openings. By removing the closures access may be had to the interior of the smoke-box 5.

It will be seen that by making the main parts of the boiler cylindrical and interlapping a very strong boiler is produced, and by the combined use of the fire-tubes having field-tubes on the inside a very efficient steam-boiler is procured.

In the event it should be necessary to replace any one of the fire-tubes with another the field-tube extending through it may be loosened at its upper end and will then be free to move up or down. The old fire-tube will then be removed and the new one inserted, and by lowering the field-tube to the bottom of the fire-box a suitable instrument can be inserted through the hole in the shell 2 to expand the upper end of the fire-tube into its opening in the shell 1. By such arrangement

it will not be necessary to loosen a large number of the field-tubes to permit the workman to get into the smoke-box 5. 70

Without limiting ourselves to the precise details of construction and arrangement illustrated and described, we claim—

1. In a boiler, three horizontally-disposed shells substantially coextensive in length, one of said shells being cylindrical and supporting the other two, and one of the supported shells forming the smoke-box, substantially as set forth. 75

2. In a boiler, three horizontally-disposed shells substantially coextensive in length, one of said shells being cylindrical and supporting the other two, and one of the supported shells being within the other supported shell and forming the smoke-box, substantially as set forth. 80

3. In a boiler, a horizontally-disposed cylindrical shell, two semicylindrical shells supported thereon and secured thereto, one of said supported shells forming a smoke-box, substantially as set forth. 90

4. In a boiler, a horizontally-disposed cylindrical shell, two semicylindrical shells supported thereon and secured thereto, one of said supported shells being within the other supported shell and forming a smoke-box, substantially as set forth. 95

5. In a boiler, a horizontally-disposed cylindrical shell, two semicylindrical shells supported thereon and secured thereto, one of said supported shells being within the other supported shell and forming a smoke-box, and the outer semicylindrical shell being in communication with the cylindrical shell, substantially as set forth. 100

6. In a boiler, the combination with a horizontally-disposed cylindrical shell supported above a fire-box, two horizontally-disposed shells, one within the other, supported upon the cylindrical shell, the inner supported shell forming a smoke-box, and vertical fire-tubes extending through the cylindrical shell and opening into the fire-box and the smoke-box, substantially as set forth. 105

7. In a boiler, the combination with a horizontally-disposed cylindrical shell supported above a fire-box, two horizontally-disposed shells, one within the other, supported upon the cylindrical shell, the inner supported shell forming a smoke-box and the outer one being in communication with the cylindrical shell, and fire-tubes extending through the cylindrical shell, and opening into the fire-box and the smoke-box, substantially as set forth. 110

8. In a boiler, the combination with a horizontally-disposed cylindrical shell supported above a fire-box, two horizontally-disposed shells, one within the other, supported upon the cylindrical shell, the inner supported shell forming a smoke-box, and vertical fire-tubes extending through the cylindrical shell and opening into the fire-box and the smoke-box, and field-tubes communicating at their upper ends with the interior of the outer sup- 115

ported shell, said tubes extending through the fire-tubes into the fire-box and having their lower ends closed, substantially as set forth.

5 9. A fire-box, a horizontal boiler supported above said box, a smoke-box extending through the water-space the entire length of the boiler, and vertical fire-tubes extending through the water-space between the smoke-box and the fire-box and opening into said smoke and fire boxes, substantially as set forth.

10. A fire-box, a horizontal boiler supported above said box, a smoke-box extending through the water-space the entire length of the boiler, vertical fire-tubes extending through the water-space between the smoke-box and the fire-box, and field-tubes extending through the fire-tubes, the upper ends of said field-tubes being open and within the water-space of the boiler, and their lower ends closed and projecting into the fire-box, substantially as set forth.

11. In a boiler, the combination with a horizontally-disposed cylindrical shell supported above a fire-box, of two horizontally-disposed shells, one within the other, supported upon

the cylindrical shell, the inner supported shell forming a fire-box, vertical fire-tubes extending through the cylindrical shell and opening into the fire-box and the smoke-box, field-tubes extending through the fire-tubes, said field-tubes being open at one end and closed at the other, and water-tubes open at both ends and supported within and of less diameter than the field-tubes and terminating at a point removed from the closed ends of the field-tubes, substantially as described.

12. In a boiler, a horizontally-disposed cylindrical shell, a semicylindrical shell supported thereon and secured thereto and a horizontal stay-plate secured to the interior of the cylindrical shell on the line of junction between the cylindrical and semicylindrical shells, substantially as set forth.

In testimony whereof we have signed our names to this specification in the presence of two subscribing witnesses.

FRANZ BURGER.  
HENRY M. WILLIAMS.

Witnesses:

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