

(No Model.)

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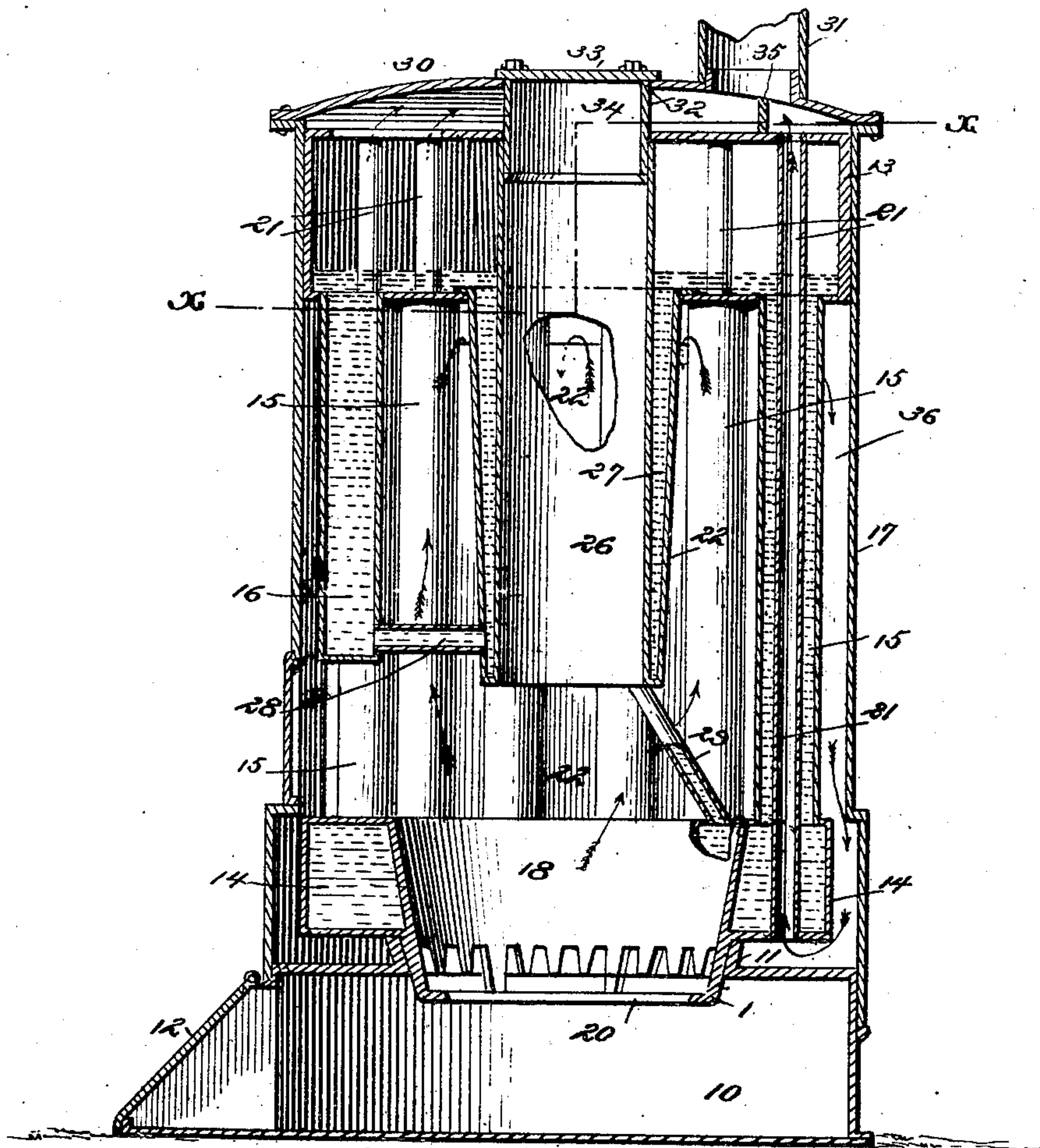
G. F. SPENCER.

BOILER.

No. 399,443.

Patented Mar. 12, 1889.

Fig. 1.



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ATTORNEYS.

(No Model.)

2 Sheets—Sheet 2.

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Fig. 2.

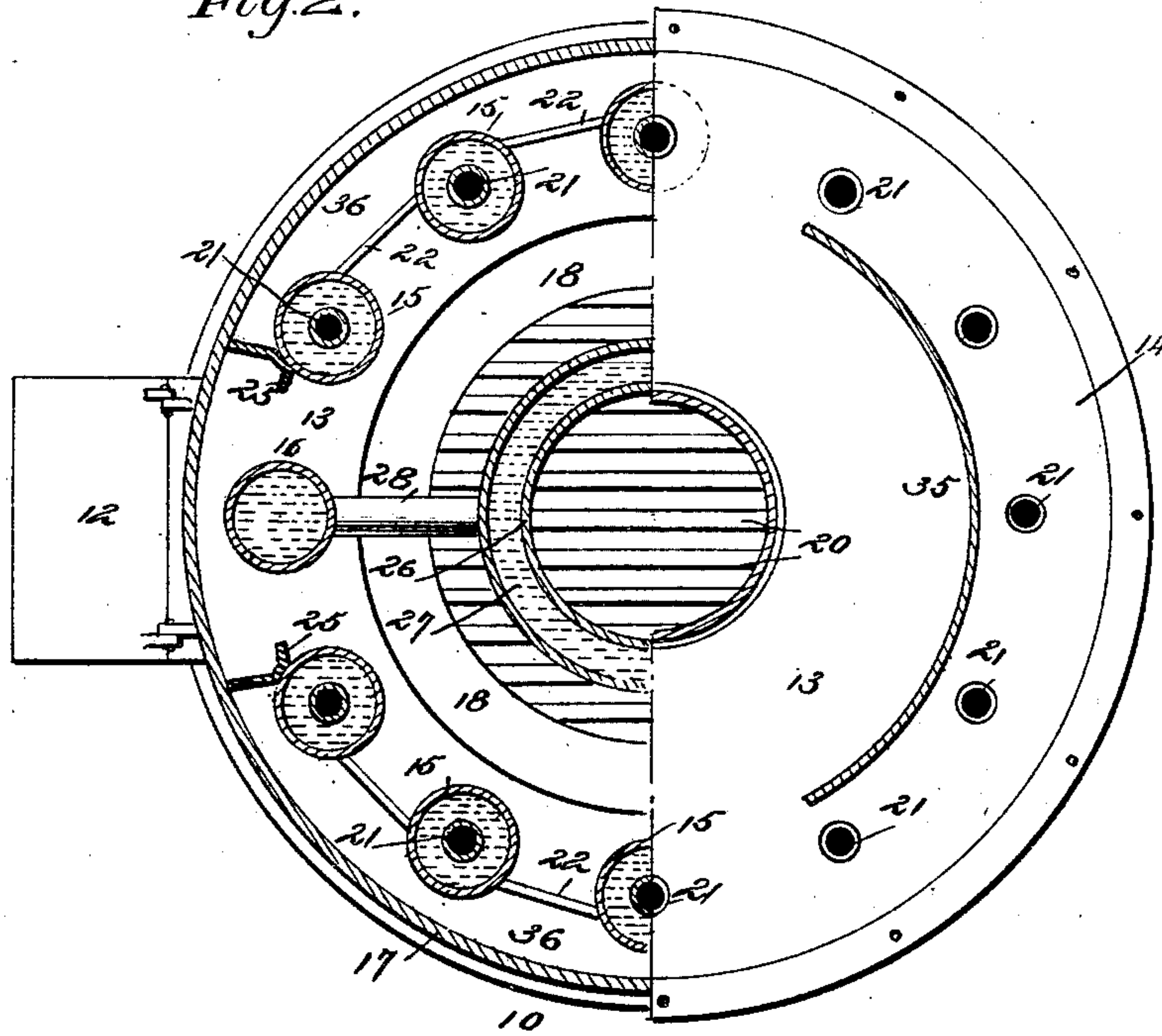
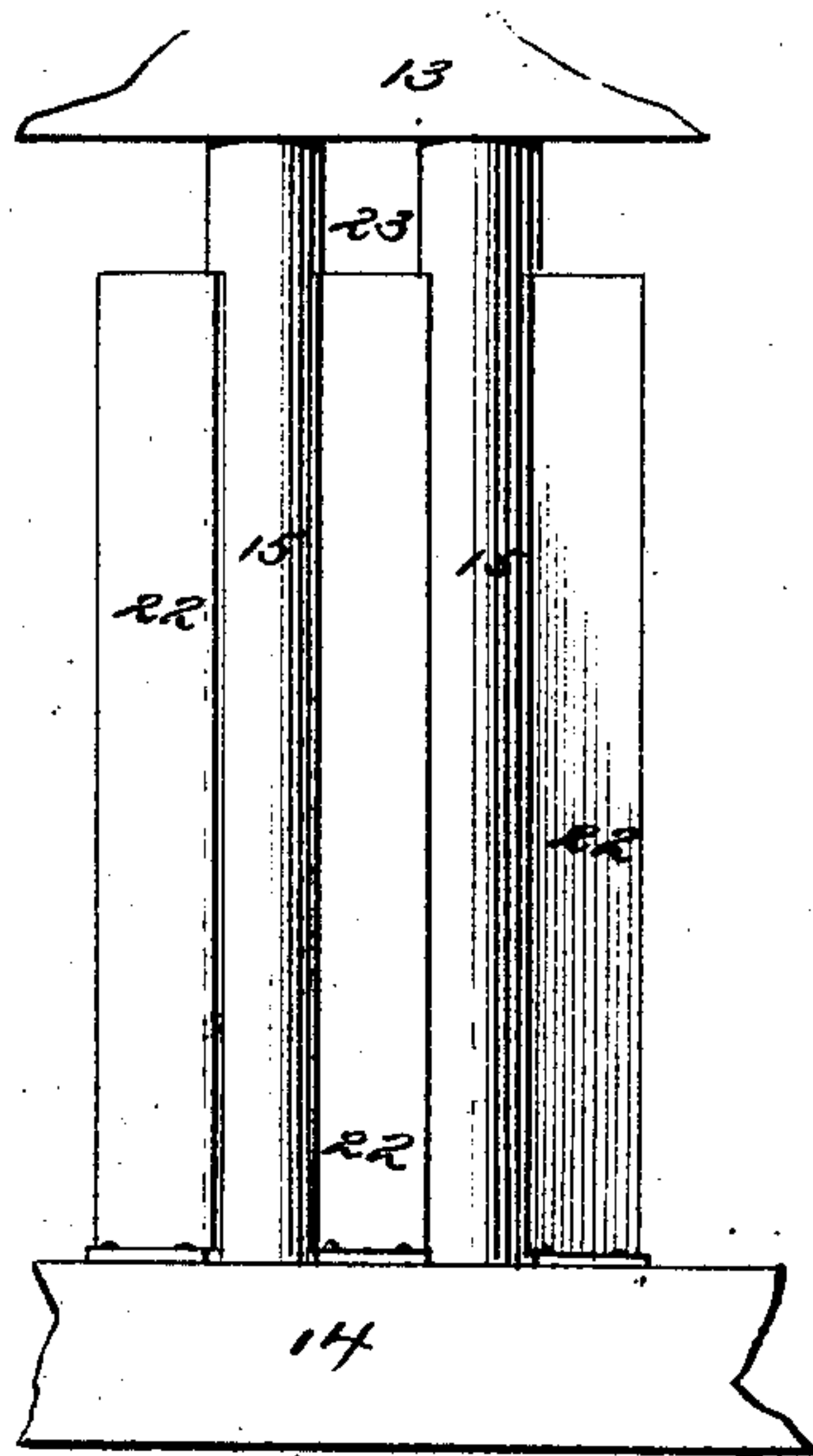


Fig. 3.



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# UNITED STATES PATENT OFFICE.

GEORGE F. SPENCER, OF THOMPSON, PENNSYLVANIA.

## BOILER.

SPECIFICATION forming part of Letters Patent No. 399,443, dated March 12, 1889.

Application filed June 12, 1888. Serial No. 276,790. (No model.)

*To all whom it may concern:*

Be it known that I, GEORGE F. SPENCER, of Thompson, in the county of Susquehanna and State of Pennsylvania, have invented a new and Improved Boiler, of which the following is a full, clear, and exact description.

My invention relates to an improvement in boilers, and has for its object to increase the area of the heating-surface and provide for the rapid circulation of the water and steam.

The invention also consists in providing a boiler economical in fuel and wherein provision will be made for the settlement of all waste in the base of the boiler, thereby effectually preventing incrustation of the tubes.

The invention consists in the construction and combination of the several parts, as will be hereinafter fully set forth, and pointed out in the claims.

Reference is to be had to the accompanying drawings, forming a part of this specification, in which similar figures of reference indicate corresponding parts in all the views.

Figure 1 is a central vertical section through the complete boiler. Fig. 2 is a transverse section on line *x x* of Fig. 1, and Fig. 3 is a detail elevation of the tubes.

In carrying out the invention the base 10 is provided with a central opening in the top, provided with an upwardly-extending flange, 11, to receive the body of the boiler, and with a draft-door, 12, which door is also utilized for removing the ashes. The body consists of a top and bottom, preferably cylindrical, heads 13 and 14, united by a series of spaced vertical water-tubes, 15, one of which tubes at the front is united with the upper head, 13, only, being made to extend vertically downward to within a short distance of the lower head, 14, the opening thus provided being adapted for the reception of fuel or for the manipulation of the fire through a fire-door produced in the boiler-casing 17, which casing will be hereinafter described.

Within the lower head, 14, a fire-pot, 18, is constructed, and the walls of said fire-pot are made to extend downward at suitable intervals, as shown at 19 in Fig. 1, for the reception of the grate 20. When the body of the boiler is placed upon the base, the grate 20 extends downward within the said base. The

space surrounding the fire-pot 18 in the lower head, 14, is adapted for the reception of water.

By reason of the flange 11, integral with the base, the lower face of the lower head, 14, is held at an elevation from the upper face of the said base, as best shown in Fig. 1. Within the several water-tubes 15, with the exception of the reduced water-tube 16, concentric fire-tubes 21 are supported, which latter tubes are expanded or otherwise secured in suitable apertures in the lower face of the lower head, 14, at one end, the other end being held preferably in similar manner in the upper face of the upper head, 13.

A wall is formed for the body of the boiler through the medium of a series of plates, 22, one of which plates is adapted to intervene each of the several water-tubes, being attached at their lower ends to the upper surface of the lower head, 14, and extending upward in connection with the said water-tubes, as aforesaid, within a short distance of the lower surface of the upper head, 13, whereby a series of spaces, 23, are obtained surrounding the body.

The plates 22 are omitted at the front of the boiler—that is to say, a plate is omitted between the short tube 16 and the tube at each side of the same. The tubes at each side of the short tube 16 are provided, however, with vertical plates 25, extending outward from the water-tubes at right angles thereto, the said plates 25 being adapted to extend to a contact with the inner face of the boiler-casing 17 and upward a distance equal to the height of the walling-plates 22.

In the upper head, 13, a central aperture is made, through which aperture a magazine, 26, is projected vertically downward over the fire-pot 18, which magazine is adapted to contain the fuel to be fed to the fire. The said magazine is provided, preferably, with a conical annular jacket, 27, as best shown in Fig. 1, the upper end of the jacket terminating with the lower wall of the upper head, 13, constituting an integral portion thereof, thus forming a conical-dropped crown-sheet of the boiler, avoiding the danger of explosion by low water.

The short water-tube 16, in which there is no concentric fire-tube, is connected with the



magazine-jacket through the medium of a horizontal pipe, 28, and the said water-jacket 27 is in turn united with the lower head, 14, by a series of upwardly-projecting tubes, 29. 5 The body, having been placed upon the base, is surrounded by the jacket 17, which jacket is provided with a dome-shaped top, 30, having attached thereto an offtake-flue, 31, and is provided with a central aperture, 32, which is 10 usually closed by a sliding cover, 33.

A detachable thimble, 34, having a flange at the upper end is passed downward through the central aperture in the top of the casing into the magazine, as best shown in Fig. 1, 15 whereby, when the lid 33 is thrown back, the coal or other fuel may be readily emptied into the said magazine.

Beneath the offtake-flue 31 a segmental flange, 35, is attached to the upper surface of 20 the upper head, 13, which flange extends upward to a contact with the inner surface of the said casing-top, inclosing a number of the fire-tube openings, as best shown in Fig. 2. The purpose of the flange is to distribute the 25 draft, so that an equal draft will be obtained for each of the fire-tubes. The casing 17 fits close to the upper head, 13, which is larger than the lower head, 14, and between the body of the casing and below the upper head a heating- 30 chamber, 36, is formed, which chamber extends beneath the lower head of the body. Thus in operation, a suitable amount of water having been introduced into the lower head in any approved manner, the water rises in the several 35 water-tubes around the fire-tubes, preferably within a short distance of the upper head, as illustrated by broken lines in Fig. 1. When the water is at this point, all the water-tubes are filled, likewise the magazine-jacket, as 40 said jacket, the water-tubes, and the heads are all connected, as has been hereinbefore stated. The fire having been built in the fire-pot, the products of combustion pass upward in contact with the inner side of the water- 45 tubes, around the connecting-pipes 28 and 29, and in contact with the outer surface of the water-jacket, over the top of the plates 22, through the spaces 23, down into the chamber 36, heating the outer side of water-tubes 15, 50 to a contact with the top, side, and bottom surfaces of the lower head. From thence the products of combustion pass upward through the several fire-tubes 21, over the upper surface of the upper head, and out through the 5 offtake-flue 31, as indicated in Fig. 1 by arrows.

It will be observed that the course pursued by the products of combustion in this construction of boiler is very circuitous, and that 60 the heat thereof is utilized to a maximum extent. In first building a fire a direct draft is desirable. To this end the lid 33 is opened, the magazine being free of fuel, the detachable thimble removed, and the lid replaced. 65 By this means the magazine is utilized as a flue, the products of combustion now being able to pass directly up the magazine and out

through the offtake-flue 31. The thimble is not replaced until the fire is well started. 70 When replaced, the circuit of the draft is changed. As each and every water-tube, likewise the magazine-jacket, is connected with the lower head, 14, of the body, any sediment in the tubes or magazine-jacket will naturally 75 fall downward and lodge in the said lower head, thereby preventing incrustation of the pipes.

For convenience, if desired, the lower head, 14, may be provided with a suitable man-hole for cleaning the same. When the boiler is to 80 be used in connection with an engine, that portion of the upper head within the circle of the fire-tubes is preferably raised much higher than illustrated to form a dome for the accumulating steam, and also to prevent foaming 85 or priming of the engine. When the upper head is thus constructed, the flues will be at all times submerged, whereby unequal expansion is avoided and an accumulation of sediment prevented upon the steam side of the 90 flues.

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

1. The combination, with a vertical boiler 95 and its fire-pot and a smoke-box above the boiler, of a jacketed fuel-magazine extending down through smoke-box and the top of the boiler into the combustion-chamber and having a movable or sliding direct-draft section 100 within the smoke-box, the space within the jacket communicating with the interior of the boiler, substantially as set forth.

2. The combination, with the vertical casing having a smoke-box in its top, a fire-pot, 105 and flues leading from the space above the fire-pot downward and then upward into the smoke-box, of a fuel-magazine leading down through the smoke-box into the combustion-chamber and provided with a removable section 110 within the smoke-box, whereby by removing said section a direct draft through the magazine from the fire-pot to the smoke-box will be formed, substantially as set forth.

3. The combination, with the vertical casing 115 having a smoke-box in its upper end; the boiler in-said casing consisting of upper and lower water-chambers, tubes connecting them, concentric fire-tubes passing through the water-tubes and both water-chambers, the 120 lower ends of the fire-tubes leading from a space within the casing below the lower water-chamber and their upper ends discharging into the smoke-box, and baffle-plates for causing the draft to pass from the upper part of 125 the combustion-chamber downward to the lower ends of the fire-tubes, of a jacketed magazine extending down through the smoke-box and upper water-chamber, with its jacketed space communicating with the interior of 130 the boiler and having a removable section within the smoke-box, by removing which a direct draft through the magazine will be formed, substantially as set forth.



4. In a boiler, the combination, with a lower water-chamber surrounding the fire-pot, an upper water-chamber, water-tubes connecting the upper and lower chambers, and fire-tubes  
5 passed through the water-tubes and water-chambers, of a fuel-magazine surrounded by a water-jacket connected with the lower water-chamber and baffle-plates partially closing the space intervening the several water-tubes,  
10 substantially as shown and described.

5. In a boiler, the combination, with a lower water-chamber surrounding the fire-pot, a base supporting said chamber, an upper water-chamber, water-tubes connecting the upper  
15 and lower chambers, fire-tubes passing through the water-tubes and said chambers, and baffle-plates partially closing the space intervening the water-tubes, of a fuel-magazine surrounded by a water-jacket connected with the  
20 lower water-chamber and a casing surrounding the chamber and water-tubes supported

upon the base, substantially as shown and described.

6. In a boiler, the combination, with a lower water-chamber surrounding the fire-pot, an  
25 upper water-chamber, water-tubes connecting the upper and lower chambers, fire-tubes passing through said chambers and water-tubes, and baffle-plates partially closing the space intervening the water-tubes, of a fuel-maga-  
30 zine surrounded by a water-jacket connected with the upper and lower water-chambers, a casing surrounding the water-receptacle provided with an offtake-flue, and a segmental  
35 deflecting-plate attached to the upper water-chamber beneath said flue, all combined to operate substantially as shown and described.

GEORGE F. SPENCER.

Witnesses:

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J. M. LAMONT.