

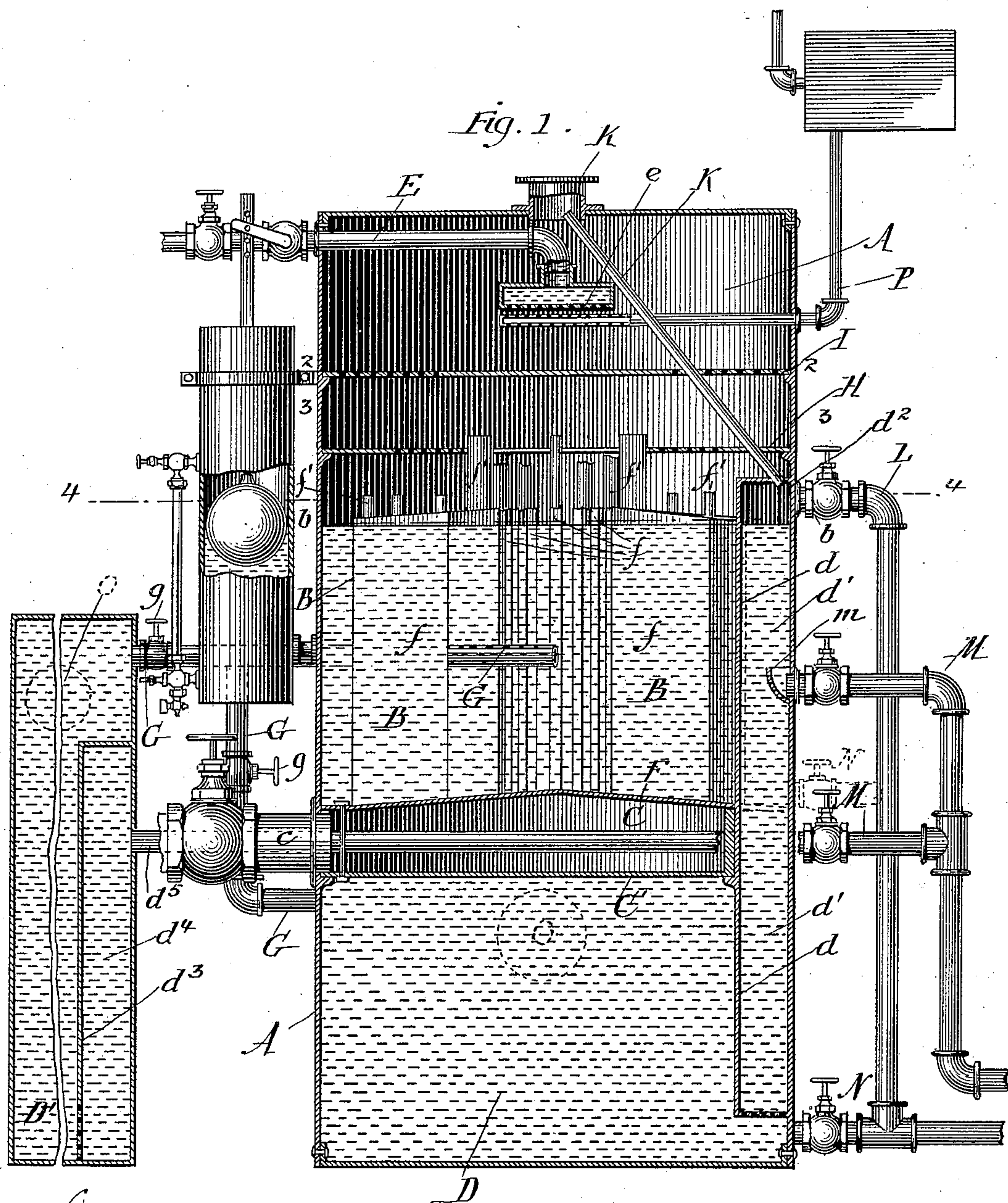
(No Model.)

2 Sheets—Sheet 1.

C. E. FERREIRA.  
FEED WATER HEATER.

No. 405,154.

Patented June 11, 1889.



Witnesses:  
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Fred Gerlach.

Inventor:  
Charles E. Ferreira  
By Banning & Banning & Rayson.  
Attorneys.

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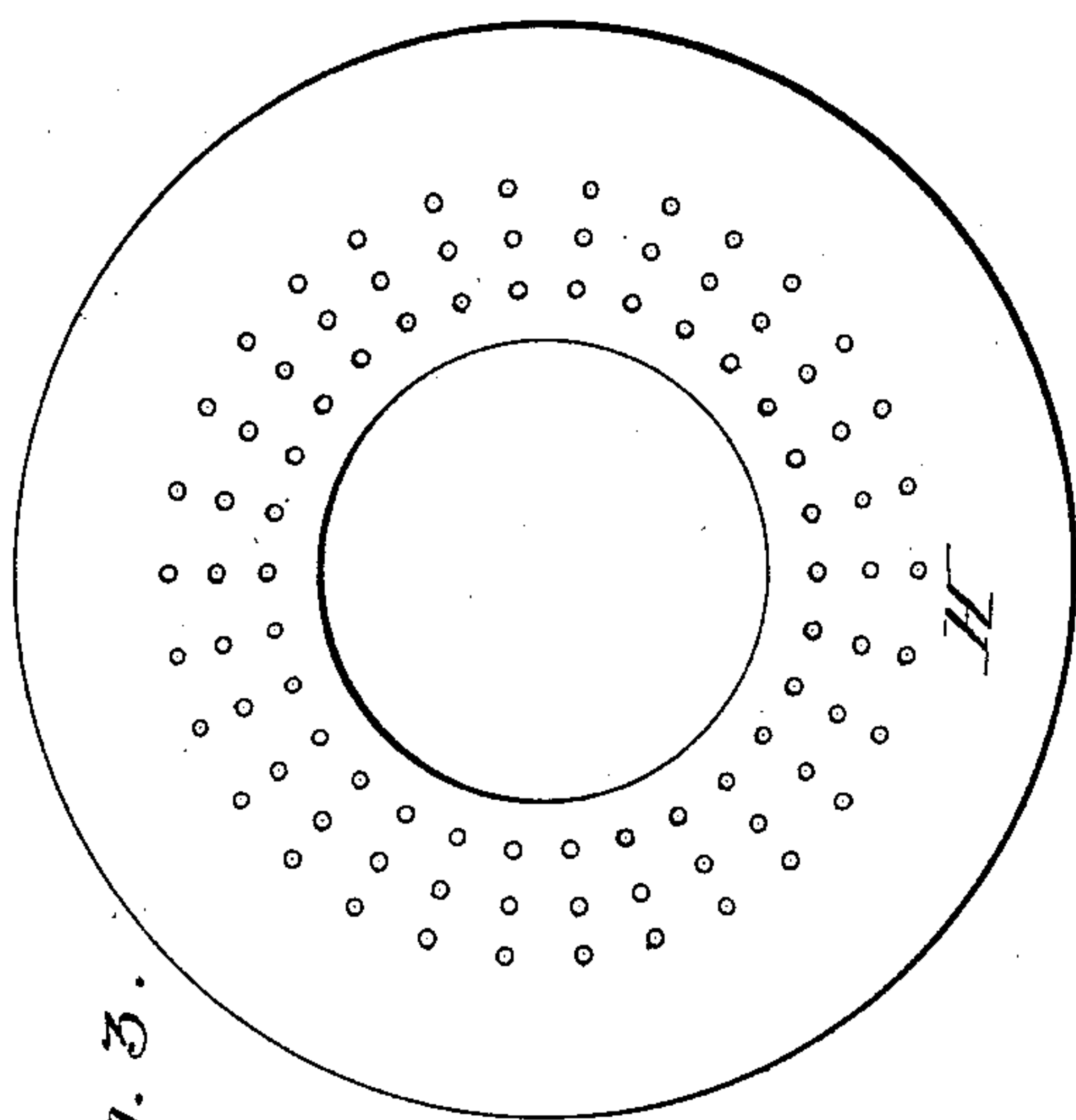


Fig. 3.

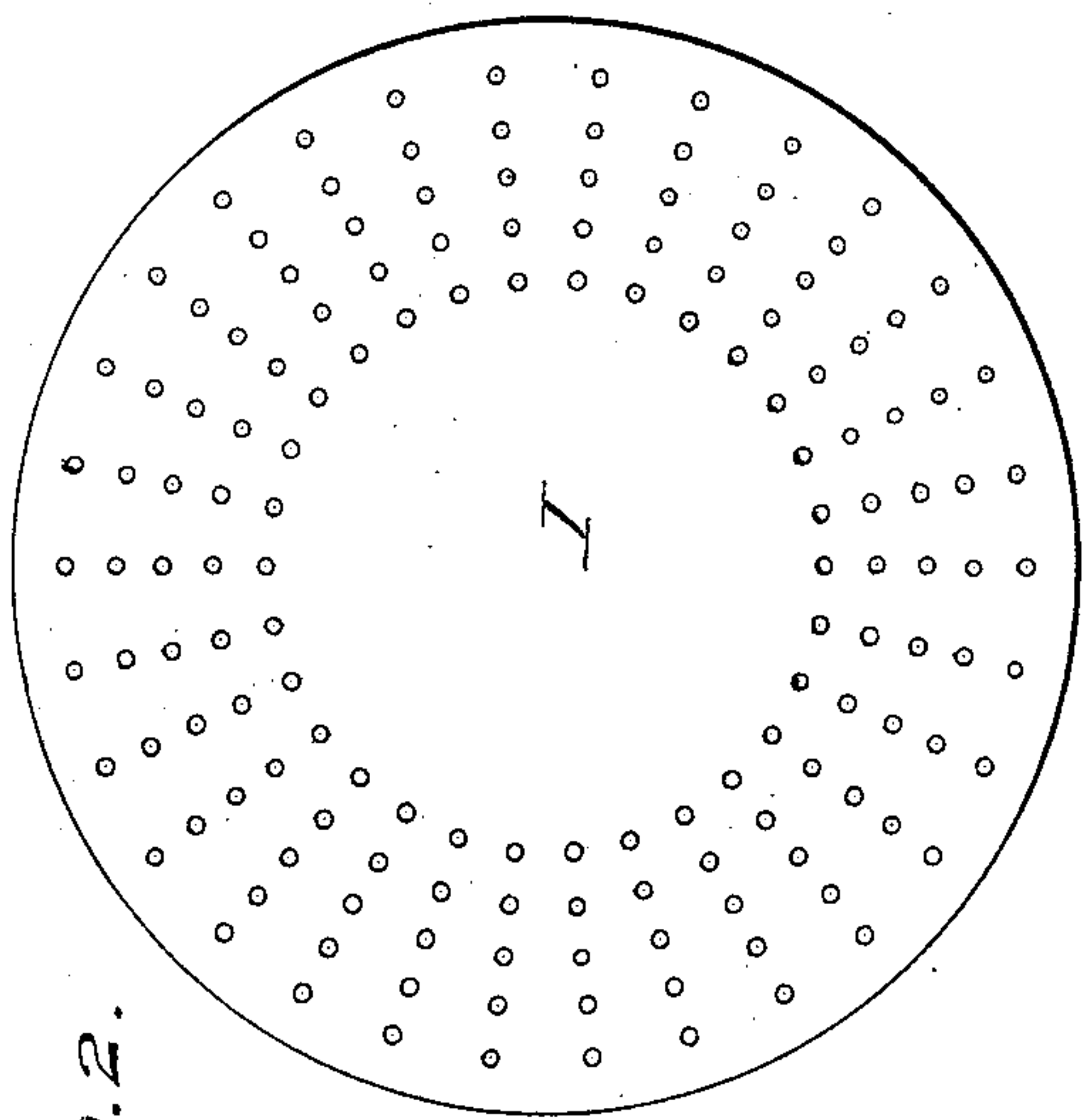


Fig. 2.

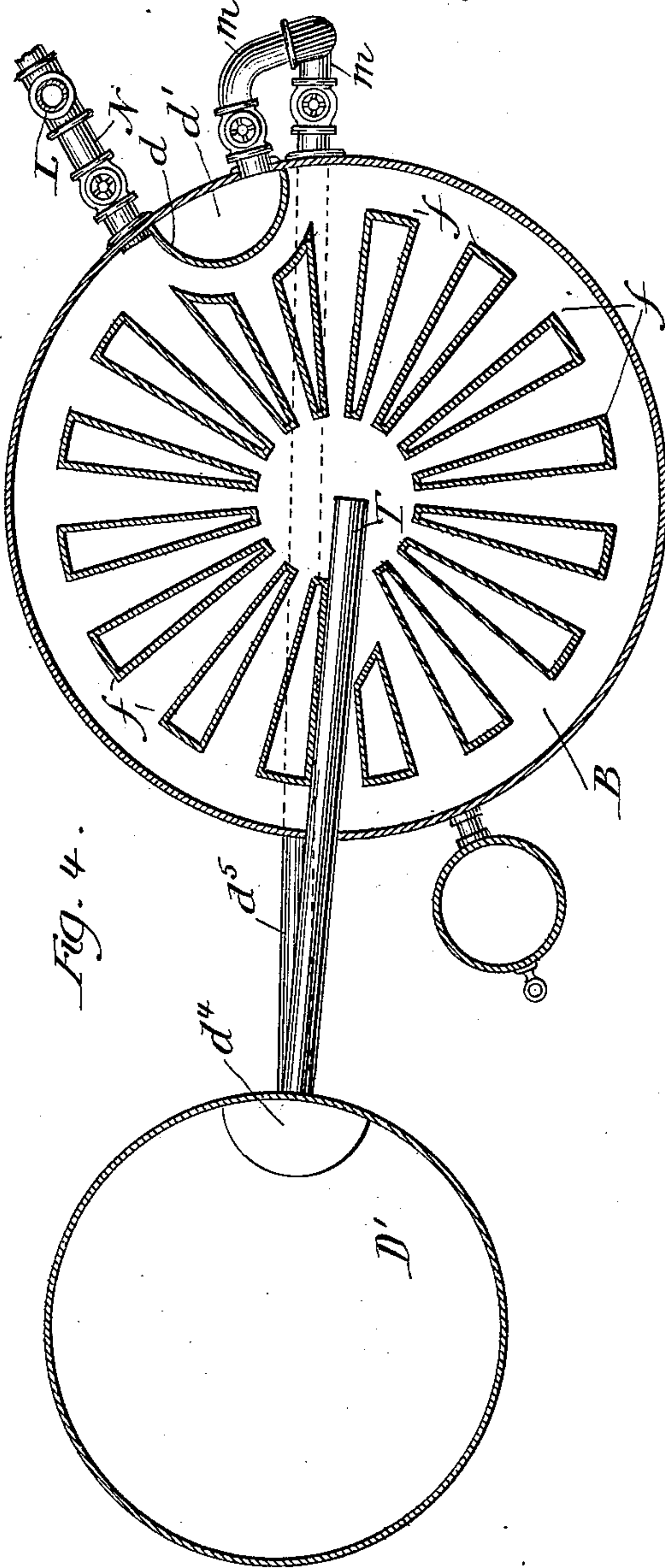


Fig. 4.

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# UNITED STATES PATENT OFFICE.

CHARLES E. FERREIRA, OF MORGAN PARK, ILLINOIS.

## FEED-WATER HEATER.

SPECIFICATION forming part of Letters Patent No. 405,154, dated June 11, 1889.

Application filed February 23, 1889. Serial No. 300,909. (No model.)

*To all whom it may concern:*

Be it known that I, CHARLES E. FERREIRA, a citizen of the United States, residing at Morgan Park, in the county of Cook and State of Illinois, have invented a new and useful Improvement in Feed-Water Heaters and Purifiers, of which the following is a specification.

The object of my invention, which is an improvement upon the one described in my application filed January 15, 1889, Serial No. 296,446, is to provide for heating and purifying water, particularly water intended for use in steam-boilers; and the invention consists in the features and combinations hereinafter described and claimed.

In the accompanying drawings, Figure 1 is a vertical section of my improved water heater and purifier; Fig. 2, a horizontal section taken in line 2 2 of Fig. 1; Fig. 3, a horizontal section taken in line 3 3 of Fig. 1, and Fig. 4 a horizontal section taken in line 4 4 of Fig. 1.

A is the shell or sides of the heater; B, a water-chamber, and *b* a line indicating the highest water-level therein; C, a steam-chamber, and *c* an inlet for introducing exhaust-steam; D, a settling-chamber, and *d* a vertical partition in the water and settling chambers, perforated at or near its bottom; *d'*, space separated by such partition, and *d''* a relief-chamber for vapor at the upper end thereof; D', a settling-chamber placed at the side, to be sometimes used instead of chamber D; *d'''*, a vertical partition in said side chamber, perforated at or near its bottom; *d''''*, space separated by such partition, and *d'''''* a pipe connecting the side settling-chamber with the pump; E, an inlet-pipe for introducing water into the heater, and *e* the inner perforated end thereof; F, the cover of the steam-chamber, separating it from the water-chamber; *f*, hollow chambers extending upwardly therefrom and communicating at their lower ends with the steam-chamber, and *f'* nozzles therein; G, pipes for conducting the heated water to the settling-chamber, and *g* valves therein; H, a diaphragm above the water-chamber, open at its center, perforated around its center, and solid in its outer circle; I, a diaphragm still higher up, solid in its central part and perforated around its center; K, relief-pipes for the escape of surplus steam and vapor; L, an outflow-pipe; M, suction-pipes for the feed-

pump, and *m* a cap or apron in front thereof; N, drain-valves; O, man-holes for cleaning out the chambers, and P an inlet-pipe for introducing condensed steam from a trap or traps when desired.

In constructing my improved feed-water heater and purifier I make a metallic shell of any size desired, according to the capacity of the boiler or boilers with which it is to be used. Inside this shell I form chambers for water and steam by means of suitable partitions, these chambers of course being sufficiently tight to hold the water and steam respectively and to prevent their mingling together except as desired.

I introduce the water into the water-chamber by pumping, or in any other convenient way, through a pipe entering the shell, preferably from the side and as near the top as possible. This pipe terminates in a sprinkler inside, preferably enlarged, so as to distribute the water in a spray or shower. The inflow of water may be regulated by suitable valves or in any other convenient way; but I prefer to use an ordinary float and butterfly valve for this purpose.

The steam-chamber is below the water-chamber, and its cover, which separates it from the water-chamber, is so formed as to provide for a sufficient heating-surface inside the water without the use of separate steam-pipes. This heating-surface is obtained by casting the cover of the steam-chamber in such a way that it will have upwardly-projecting chambers, each communicating with the main steam-chamber, so that steam will at once pass into and fill the same, and thus heat the body of water into which they extend. Although I speak of them in the singular, particularly in the claims, it will be understood that there may be as many of these hollow chambers as desired—one or many—and they may be of any size or shape and made to extend upwardly to any extent desired; but I prefer to make them somewhat V-shaped and to have a sufficient number to give a large amount of heating-surface inside the water. I also prefer to have them extend up to a point slightly above the water-level, and their upper ends provided with two nozzles, one at a point near the inner edge of the hollow casting and another at a point near its outer edge; but in



some cases it may be advisable to have them terminate just above, or even below, the water-surface, or, no matter where they terminate, to omit the nozzles or make them in any other form or position desired.

A short distance above the highest water-level I place a diaphragm, open in its central part, perforated around its center, and solid in its outer circle. The solid part of this diaphragm extending over the openings of the hollow chambers, when they are made in my preferred form, causes the steam escaping therefrom to be deflected toward the center, so as to pass up through the perforations, and particularly through the central opening. At a convenient distance above this diaphragm I place another diaphragm solid in its central part and perforated in its outer circle. The solid part of this second diaphragm, being in the center, is directly under the water-sprinkler and over the inner nozzles of the hollow chambers and the open central part of the lower diaphragm. The water coming down from the sprinkler falls onto the solid part of the upper diaphragm, which is of course heated by the steam coming up from below, and thus begins to be heated as soon as it is introduced into the water-chamber. Indeed, the steam coming up through the perforations in the outer circle of the upper diaphragm fills the entire upper chamber and heats the water-inlet pipe, sprinkler, &c., so that the water is brought into contact with heating influences even before it strikes the upper diaphragm. From the center of this diaphragm the water spreads to its sides and passes down through its outer perforations, falling onto the outer or solid portion of the lower diaphragm. It then passes through the perforations and open center of the lower diaphragm down into the water-chamber proper, where it is brought into contact with the hollow heating-chambers above described.

After the water is heated sufficiently in the water-chamber, it is drawn off into a settling-chamber. I prefer to draw it from a point substantially in the center of the body of the water heated, and to conduct it by a pipe extending horizontally to a point outside the chamber, and thence to the settling-chamber, from which it is intended to be drawn for use. As shown, the pipe for drawing off the water extends outwardly to a point near the float-casing, then downwardly to a point below the steam-chamber, and then inwardly to the settling-chamber. When it is desired to use the settling-chamber at the side instead of the one under the steam-chamber, the vertical portion of the pipe is closed by a valve, and the horizontal portion communicating with the side chamber, which was previously closed, opened by a valve. In this case, also, the upper valve of the suction-pump is closed and the lower valve opened, so that the water may flow from the side chamber into the suction.

Above the point from which the water is to

be drawn for use, especially when the settling-chamber is placed below the steam-chamber, I prefer to have a vapor-chamber and an outlet-pipe for vapor leading therefrom. As shown, this vapor-chamber is formed at the top of the space separated by the vertical partition; and it consists, simply, of the open space above the water in the portion thus partitioned off, and its outlet-pipe communicates with the relief-pipe for surplus steam. As will be seen, it is entirely separated from the steam-dome and the main water-chamber. I also prefer to have a suitable cap or apron in front of the suction of the pump, which, as shown, extends inwardly and upwardly. The boiling water breaking over this cap or apron, its bubbles of steam or vapor are thrown or passed up to the relief-chamber instead of being drawn into the pump, and from the relief-chamber they are readily drawn off by the draft created by the escape of surplus steam. This cap in front of the suction, with the vapor-chamber and outlet, enables the water to be pumped out for use at a very high temperature. As already suggested, I also prefer to have the pipe for drawing off the water from the water-chamber extend horizontally instead of vertically, so that, the water being drawn out sidewise from a point between its surface and bottom, impurities cannot fall or be drawn into the outlet-pipe.

The construction and operation of various other parts will be readily understood from the drawings and from the description contained in my application above referred to, the broad claims of which cover several of the features or forms now shown. I have here simply intended to describe particularly the parts which I consider to be an improvement on my former construction.

It will be understood that changes may be made in various parts, or equivalents substituted therefor, without departing from the spirit of my invention.

I do not herein claim the process of heating and of purifying water above described, the same being the subject of another application, No. 301,133.

I claim—

1. In a feed-water heater, the combination of a water-chamber provided with a water-inlet, a steam-chamber under the water-chamber, provided with a steam-inlet, a hollow chamber communicating with the steam-chamber and integral with its top, extending upwardly in the water-chamber for heating the water, and an outlet for drawing off the water, substantially as described.

2. In a feed-water heater, the combination of a water-chamber provided with a water-inlet, a steam-chamber under the water-chamber, provided with a steam-inlet, a hollow chamber communicating with the steam-chamber formed integral with its top, extending upwardly to a point above the water-level, and having a nozzle at its upper extremity for the escape of steam and an outlet



for drawing off the water, substantially as described.

3. In a feed-water heater, the combination of a water-chamber provided with a water-inlet, a steam-chamber under the water-chamber, provided with a steam-inlet, a hollow chamber communicating with the steam-chamber and extending upwardly in the water-chamber for heating the water, a settling-chamber, a pipe communicating between the water-chamber and settling-chamber away from the steam-chamber and from a point above to a point below and under the same, and an outlet for drawing off the water, substantially as described.

4. In a feed-water heater, the combination of a water-chamber provided with a water-inlet, a steam-chamber under the water-chamber, provided with a steam-inlet, a hollow chamber communicating with the steam-chamber and extending upwardly in the water-chamber for heating the water, a settling-chamber at the side of the shell, a pipe communicating between the water-chamber and settling-chamber, and an outlet for drawing off the water, substantially as described.

5. In a feed-water heater, the combination of a water-chamber provided with a water-inlet, a steam-chamber provided with a steam-inlet, a hollow chamber communicating with the steam-chamber integral with its top, extending upwardly to a point above the water-level, and having a nozzle at its upper extremity for the escape of steam, a perforated diaphragm above the water-level and nozzle of the hollow chamber, and an outlet for drawing off the water, substantially as described.

6. In a feed-water heater, the combination of a water-chamber provided with a water-inlet, a steam-chamber provided with a steam-inlet, means for conducting steam through the water-chamber and permitting it to escape above the water-level, a horizontal diaphragm H above the water-level, open in its center, a horizontal diaphragm I above the diaphragm H, closed in its center, and an outlet for drawing off the water, substantially as described.

7. In a feed-water heater, the combination of a water-chamber provided with a water-in-

let, a steam-chamber provided with a steam-inlet, means for conducting steam through the water-chamber and permitting it to escape above the water-level, a horizontal diaphragm H above the water-level, open in its center, perforated around its center, and solid in its outer part, a horizontal diaphragm I above the diaphragm H, closed in its center and perforated in its outer part, and an outlet for drawing off the water, substantially as described.

8. In a feed-water heater, a horizontal diaphragm above the water-level, open in its center, perforated around its center, and solid in its outer part, substantially as described.

9. In a feed-water heater, a vapor-chamber above the water-level separated from the steam-dome and an outlet therefrom, substantially as described.

10. In a feed-water heater, a cap or apron in front of the water-outlet extending inwardly and upwardly, over which the water flows in its outward passage, substantially as described.

11. In a feed-water heater, the combination of a cap or apron in front of the water-outlet extending inwardly and upwardly, a vapor-chamber above the water-level separated from the steam-dome, and an outlet from the vapor-chamber, substantially as described.

12. In combination with the water-chamber of a feed-water heater, a pipe for drawing off water extending into the water-chamber horizontally to a central point laterally between the surface and bottom of the water and substantially below the surface, whereby the water may flow from such points sidewise, substantially as described.

13. In combination with a feed-water heater, a trap for catching water formed by condensation of steam, and a pipe connecting the trap with the steam-dome of the heater, perforated at its end inside the dome under the sprinkler, whereby water formed by condensation of steam may be conducted into the heater for feed purposes, substantially as described.

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