

(No Model.)

2 Sheets—Sheet 1.

F. J. FURMAN.  
HOT WATER HEATER.

No. 452,637.

Patented May 19, 1891.

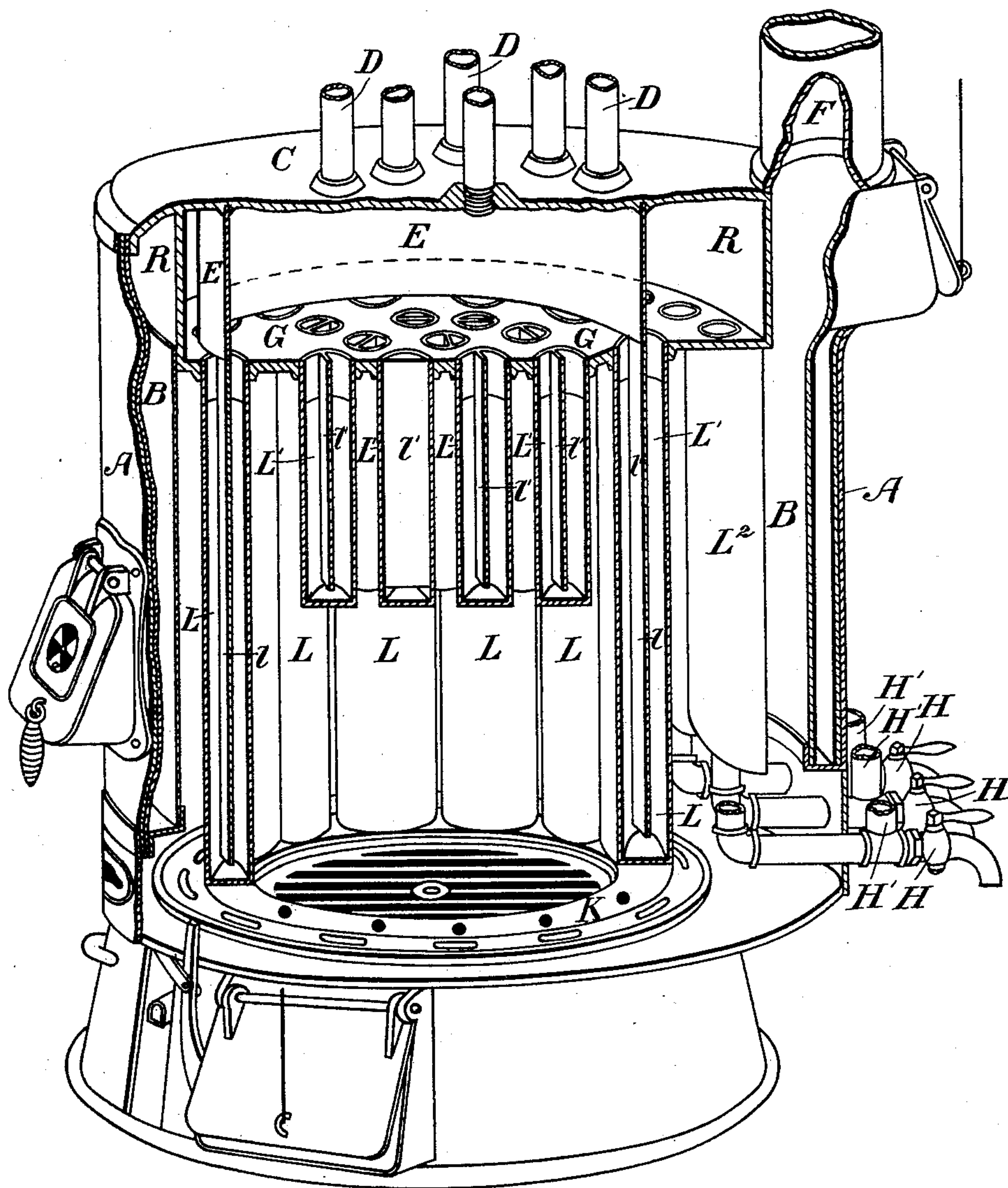


Fig. 1.

Witnesses  
Albert E. Leach  
E. N. Culman

Inventor  
Frederick Furman by  
J. B. Dows  
att.

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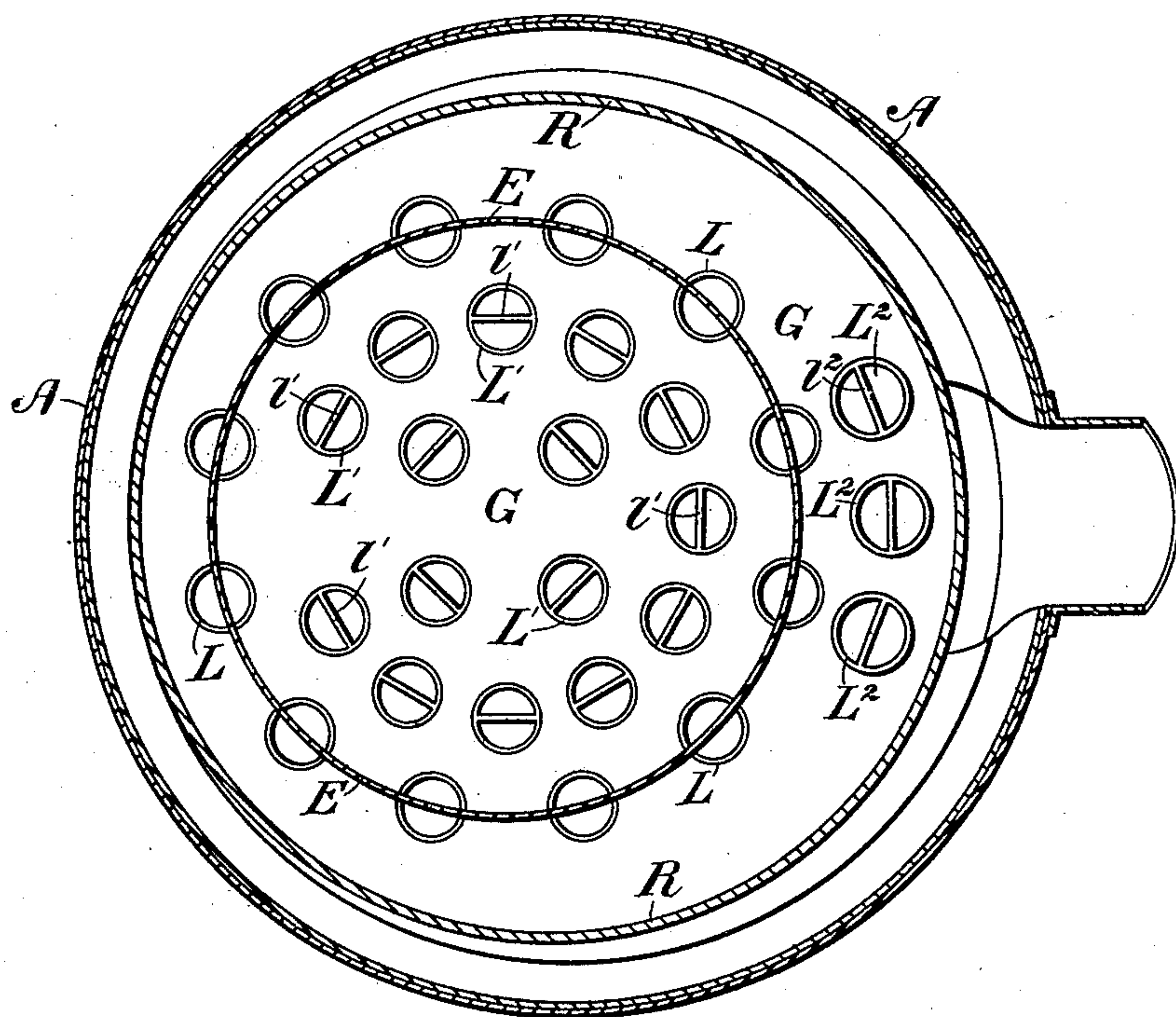


Fig. 2.

*Witnesses*

Albert E. Leach  
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*Inventor*

Frederic J. Furman by  
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att'y.



# UNITED STATES PATENT OFFICE.

FREDRIC J. FURMAN, OF GENEVA, NEW YORK, ASSIGNOR TO THE HEREN-  
DEEN MANUFACTURING COMPANY, OF SAME PLACE.

## HOT-WATER HEATER.

SPECIFICATION forming part of Letters Patent No. 452,637, dated May 19, 1891.

Application filed January 5, 1891. Serial No. 376,728. (No model.)

*To all whom it may concern:*

Be it known that I, FREDRIC J. FURMAN, a citizen of the United States, residing at Geneva, in the county of Ontario and State of New York, have invented certain new and useful Improvements in Hot-Water Heaters, of which the following is a full specification.

My invention consists of certain improvements in hot-water heaters, my object being to so construct the heater that the water circulation is in vertical lines throughout, it being well understood that horizontal circulation is forced and unnatural. The water-spaces are so arranged that the hot water rises and the cool water descends in vertical passage-ways, and that the products of combustion strike against the water-surfaces at right angles. The construction is, moreover, such that all friction and interior resistance are reduced to a minimum, thus promoting rapidity of movement of the water leaving the boiler.

Figure 1 of the drawings is a perspective view of one form of my improved heater with parts broken away to show the interior construction. Fig. 2 is a transverse sectional view taken near the top of the dome.

The general construction of the lower part of my hot-water heater, so far as the fire-pot and adjacent parts are concerned, is similar in many respects to the steam-heater shown and described in United States Letters Patent No. 421,261, issued to me February 11, 1890, to which reference is hereby made.

A is the outer jacket, and B the lining, of the heater.

G is the bottom plate of the dome, and K the base-ring of the fire-pot, beneath which is the grate and ash-pit of any approved construction.

R is the outer wall of the dome, and C the top thereof.

The fire-pot is surrounded by the circulatory water-tubes L, which are preferably elliptical in cross-section from their base to a point near the top, being provided with cylindrical necks at the top which screw into the plate G. These tubes rest directly upon the base-ring K, and have spaces between them through which pass the gases and pro-

ducts of combustion from the fire. The tubes are, moreover, provided with diaphragms *l*, preferably made integral with the tubes, extending up and down lengthwise through the center and reaching from the open top of the tube to within a short distance from the closed bottom. The arrangement is such that the tubes L form a circle around the fire-pot, being disposed broadside toward the fire with the diaphragms *l* (which pass through the greater diameter or major axis of each elliptical tube) lying practically in a circle. This arrangement is obviously most economical, since the water is very readily heated, being exposed in thin sheets to the fire confined within the circle of the tubes. The circulation of the water in the tubes is in the direction of the arrows shown therein, being downward in each tube on the side of the diaphragm opposite to the fire and upward on the side of the diaphragm next the fire.

I employ in addition to the long tubes L, which pass completely through from top to bottom, a series of short drop-tubes L', similar in shape to the long tubes, being elliptical and provided with circular necks which screw into the bottom plate G of the dome. These tubes overhang the fire, being, like the long tubes L, open at the top and closed at the bottom, and like them are provided also with diaphragms *l'*, reaching from the top to a short distance from the bottom to direct the circulation of the water within them.

At the rear of the heater are three larger elliptical tubes L<sup>2</sup>, placed end to end. These screw into the plate G and are open at the top. They, however, terminate at the bottom before reaching the level of the base-ring, affording space beneath them for the products of combustion to pass in the direction of the arrow, up the rear end thereof and out through the chimney-flue F. These rear tubes are provided with blow-off cocks H, through which sediment is removed. The sediment collects in that portion of a circulatory system where the circulation is most sluggish, so that following this rule no sediment will be found in the tubes L, which immediately surround the fire, for there the circulation is most vigorous, while in the back tubes L<sup>2</sup>,



which are farthest distant from the fire, the sediment will be deposited, since here the water is more quiet.

E is a circular wall or diaphragm lying vertically in the dome of the heater between the bottom plate G and the top C of the dome. The lower edge of the wall is on a line with the centers of the openings, into which screw the necks of the outer circle of tubes L. In this way the diaphragm in the tube is practically extended and becomes a part of this division of the dome. By this means the interior of the dome, where the hottest water is sent out through the flow-pipes of the radiating system, has no direct communication with the outer or cooler portion of the dome, being connected therewith indirectly through the tubes L, half of which lie within and half of which without the division E.

The return-water enters the heater through the branch pipes H', communicating with the bottoms of the rear tubes L<sup>2</sup>. This water, entering the lower ends of the three rear tubes L<sup>2</sup>, passes up through them into that part of the dome outside of the division E but within the outer wall R of the dome, where it flows around and drops down in the outside half of each tube L and there comes, already partly heated, into immediate contact with the fire as it rises in the inner half of the tubes L. From the inner half of these tubes the water passes up into the interior of the division E in the dome and circulates in the drop-tubes L<sup>2</sup>. The water passes out into the radiating system through the flow-pipes D, communicating with the interior of the dome. Thus all the water adjacent to the fire rises straight up vertically into the inner part of the dome, whence it literally shoots out into the flow-pipes. By this construction the circulation is wholly vertical, and there is consequently but little friction and great rapidity of circulation, which causes the water to leave the heater with considerable momentum. As all the principal heating-surfaces are vertical, they are perpetually clean, and therefore in condition to freely and rapidly extract the heat from the fire.

While I have described and shown my invention in the form of a circular heater, I do not by any means confine myself to this form. I may, for example, employ a rectangular fire-pot, in which case the circulatory tubes surrounding it would form the four sides of a rectangle instead of lying in a circle. In this case, also, the division corresponding to the

circular diaphragm E, between the inner or hotter portion of the dome and the outer or cooler, would conform in shape to that of the fire-pot, passing along and forming an extension of the diaphragms in the circulatory tubes.

The products of combustion pass out from the fire-pot between the tubes L in a lateral direction, as indicated by the arrows. They then pass under the back tubes L<sup>2</sup> and up the rear of the same on their way to the chimney-flue F.

I claim—

1. A hot-water heater having a series of circulatory tubes open at the top and closed at the bottom, secured to the bottom of the dome, and provided with central diaphragms extending from the top nearly to the bottom of said tubes, in combination with a division reaching from top to bottom of said dome in line with and forming an extension of the diaphragms of said tubes, substantially as and for the purposes described.

2. A hot-water heater having a series of circulatory tubes L, open at the top and closed at the bottom, arranged in a circle, secured to the bottom of the dome, and provided with central diaphragms extending from the open top nearly to the bottom of said tubes, in combination with a circular division E, reaching from top to bottom of the said dome in line with and forming an extension of the diaphragms of said tubes, whereby communication between the inside and outside of said division is had only through the length of the said circulatory tubes, substantially as and for the purposes described.

3. A hot-water heater having a series of circulatory tubes surrounding the fire-pot and secured to the bottom plate of the dome, said tubes being open at the top and closed at the bottom and provided with diaphragms reaching from the top nearly to the bottom thereof, in combination with a division reaching from top to bottom of the dome in line with and forming an extension of the diaphragms of said tubes, and an additional series of drop-tubes depending from the bottom of the dome within said division, substantially as and for the purposes described.

In witness whereof I have hereunto set my hand.

FREDRIC J. FURMAN.

Witnesses:

G. W. NICHOLAS,  
EDGAR PARKER.