(No Model.) 2 Sheets—Sheet 1.

W. H. CAMPBELL.

WATER HEATER.

No. 411,951. Patented Oct. 1, 1889.

Fig. 1.

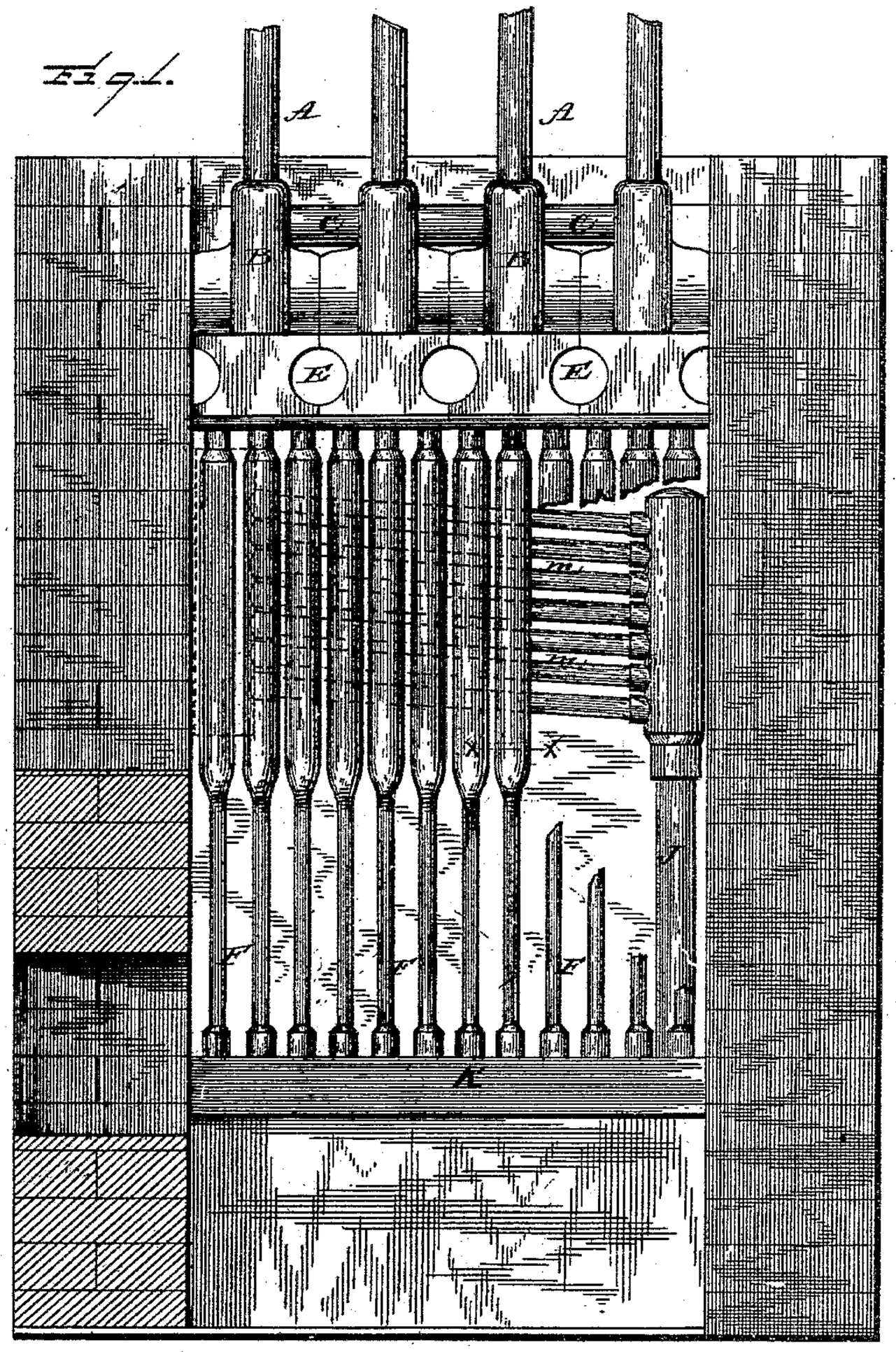

Fig. 2.

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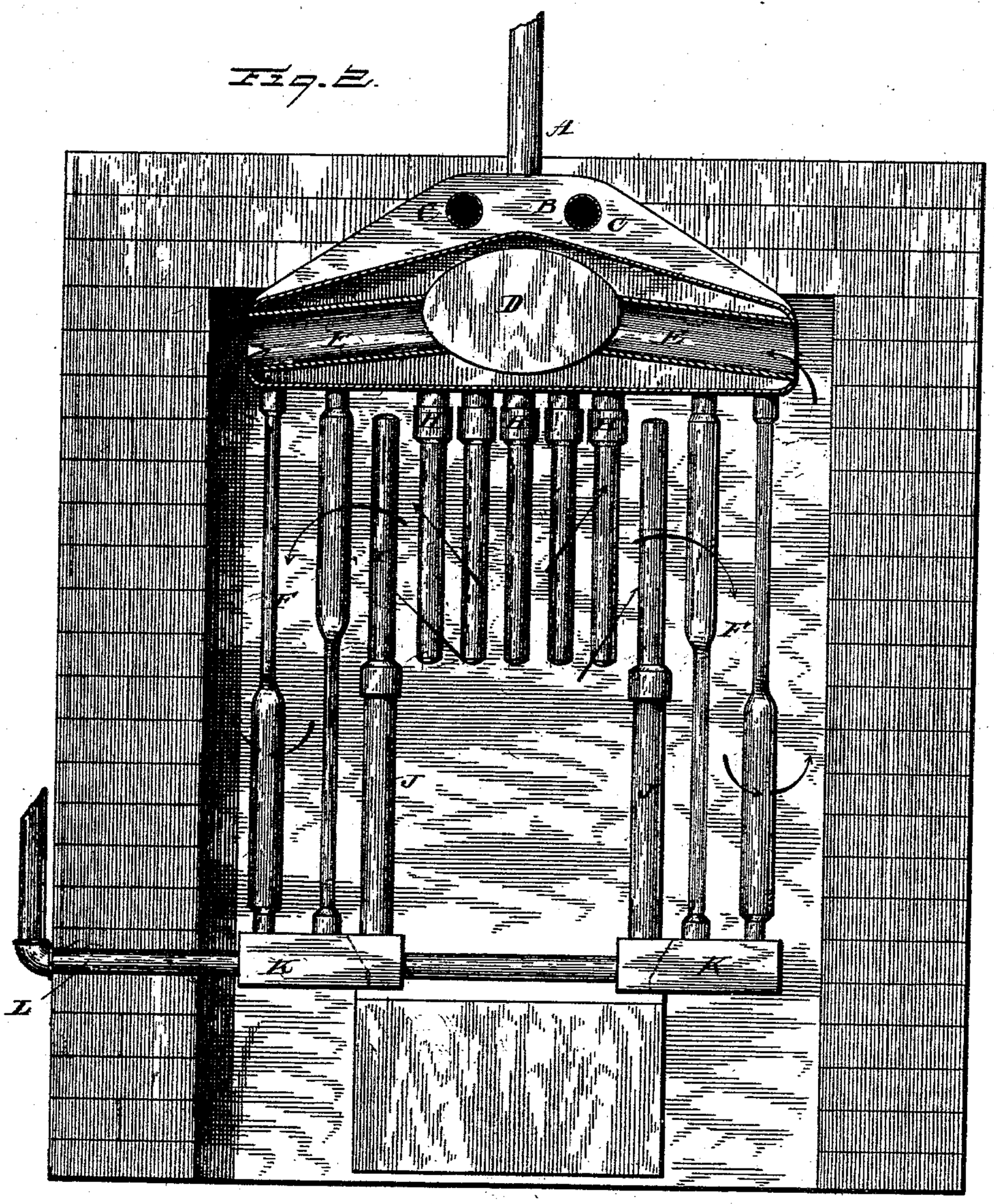

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UNITED STATES PATENT OFFICE.

WILLIAM H. CAMPBELL, OF ALPENA, MICHIGAN.

WATER-HEATER.

SPECIFICATION forming part of Letters Patent No. 411,951, dated October 1, 1889.

Application filed March 26, 1889. Serial No. 304,818. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM H. CAMPBELL, a citizen of the United States, residing at Alpena, in the county of Alpena, State of Michigan, have invented certain new and useful Improvements in Water-Heaters, of which the following is a specification, reference being had therein to the accompanying drawings.

The object of my invention is the production of a hot-water heater for use either as a boiler or for steam or water heating systems, which shall be so constructed as to avoid all downward currents in all parts of the boiler and to heat the greatest quantity of water in the least possible time. To this end I have constructed my device as described in the following specification, and with the novel features set forth particularly in the claims at the end of the same.

In the drawings, Figure 1 is a side elevation of my water-heater, showing a portion of the outer system of water-pipes broken away to exhibit the manifold system contained within the same. Fig. 2 is an end elevation of my device, showing the depending manifold system and two of the manifold supply-pipes, which are reversed for more evenly distributing the supply of water in the top of the heater. Fig. 3 is a cross-section on the line *x x* of Fig. 1, looking downward.

The construction of my heater is according to a double system, according to the degree of heat to which the various parts of the fire-box are subjected, and according to the direction which it is desired to give the draft. The whole is constructed in sections, and to this extent resembles a sectional boiler of the ordinary construction, where, as in some of the other features of construction, my device may be classed under water-tube boilers proper.

As shown in Fig. 1, the sections are joined above the pipes by longitudinal pipes C, running above the whole of the boiler and entering the cross-chambers B. Each section, as shown, is provided with a number of outer pipes F—in this instance three in number for each section.

The form of the top of my boiler-sections is best shown in Fig. 2, where it may be seen that there extends along the whole length of the boiler and between the sections a main hot-air flue D, communicating with the fire-box by the side flues E, which are shown also in Fig. 1. Around three sides of the bottom of the fire-box there extends a base-chamber K, and in front (on the left of Fig. 1) this base is supplemented by a pipe, as shown in Fig. 2. At one side of the furnace the water enters at the pipe L, and therefore all the currents of the water will be upward, as will be further explained in detail.

On the two sides of the boiler, as shown in the drawings, the outer pipes F extend directly from the base to the top of the heater or header. These pipes are shaped as shown, being flattened considerably, with the longer diameter of the same extending at right angles throughout the extent of one portion of the length of the pipes to the direction of the same in the remainder of the length. As shown in Fig. 1, these longer axes are so placed that the upper portion of the furnace is entirely closed in by the pipes, save for slight spaces between the same, while the lower portion of the furnace is left open to allow of the passage of the draft. By this means the hot gases are forced to take the direction shown by the arrows in Fig. 2.

H and H′ are two series of manifolds, those marked H being at the back of the furnace, and those marked H′ being at the front of the same. The manifolds H′ depend from the lower surface of the header, and do not communicate directly with the base of the boiler. The manifolds H are supported by the supply-pipes J. These supply-pipes communicate directly with the base at the back of the furnace, and therethrough the water is allowed to rise into the manifolds H, and thence through the sloping pipes *m* to the front manifolds H′. Here the water is again turned and directed into the base of the main chamber or header, as shown in Fig. 2.

Although there are only two of the supply-pipes and manifolds H shown in Fig. 2, it is to be understood that they extend all the way across the furnace and communicate with the manifolds H′ by a separate series of pipes *m* for each pair of manifolds.

The pipes A at the top of the boiler are for the purpose of carrying off the steam or hot water which is supplied by the boiler. All

the vertical pipes are flattened, as those marked F, and this flattening everywhere takes place in two directions, preferably at right angles. The object of this flattening is to reduce the area of cross-section of the heating-pipes without decreasing the heating-surface, and thus secure the quickest possible heating of the water in the same. This also increases the velocity of flow of the water in the pipes, as the convective currents are of course proportional to the temperature of the water.

It will be seen that the arrangement of the double system is for the purpose of introducing the appropriate style of boiler-pipe in the proper place, and according to the degree of heat of the gases to which it is to be subjected at any position. As the hot air and gas enter the furnace from the grate they first rise and meets the longitudinal pipes *m*, connecting the manifolds. These are cylindrical, as in ordinary boilers, and, as the gases are hottest here, their form does not so much interfere with the transfer of heat to the water. Thence the gases pass to the back of the furnace and against the direction of the travel of the water until they are opposed by the pipes H and the wall of the furnace. Here they are deflected, and being unable to escape, except in very small quantities between the spaces intermediate the flattened pipes F, they descend and are allowed to pass between these parts of these pipes, which are appropriately flattened for this passage. After passing out of this inclosure the gases pass upward and into the flues E, where they pass through the water and enter the main flue D, thus forming during this portion of their passage a fire-flue boiler.

The construction of the sections with cross-chambers B strengthens them against all strains, and the few joints rendered necessary are a preventive of much leakage.

I do not wish to limit myself to the exact construction shown and described, as there are many details which might be varied by the exercise of mechanical skill without departing from the spirit of my invention. For instance, although I prefer to flatten the pipes as heretofore shown and described, the ordinary cylindrical pipes may be substituted where desired.

What I claim is—

1. In a boiler, a section composed of a header having fire-flues therein and depending pipes communicating with said header at the lower surface thereof and having indirect communication with the base of the boiler, substantially as described.

2. In a boiler, the combination, with the sections, the cross-chamber, and the pipes, of the longitudinal pipes C, joining the sections above the pipes and entering the cross-chamber, substantially as described.

3. In a boiler, the combination, with the fire-box, of a main hot-air flue D, and the side flues E, affording communication between the fire-box and the flue D, substantially as described.

4. In a boiler, a base, a water-supply for the same, supply-pipes J, extending upward from the same, and a top having depending manifold pipes H′, in combination with sloping pipes connecting said supply-pipes with said manifold pipes, and vertical pipes connecting said base with said top, substantially as described.

5. In a boiler, a fire-box surrounded with tubes for water, flattened above so as to inclose said fire-box and flattened below in the opposite direction, substantially as described.

6. In combination with the fire-box of a boiler, a base, a water-supply for the same, vertical tubes at the opposite ends, sloping pipes connecting the same, and one of said end rows communicating with a top water-chamber, and vertical pipes at the sides of said fire-box, said tubes flattened above to inclose said box and below in a direction at right angles to the flattening of the upper part, substantially as described.

In testimony whereof I affix my signature in presence of two witnesses.

WILLIAM H. CAMPBELL.

Witnesses:

JAMES F. NICHOLSON,

CHARLES B. CAMPBELL.