

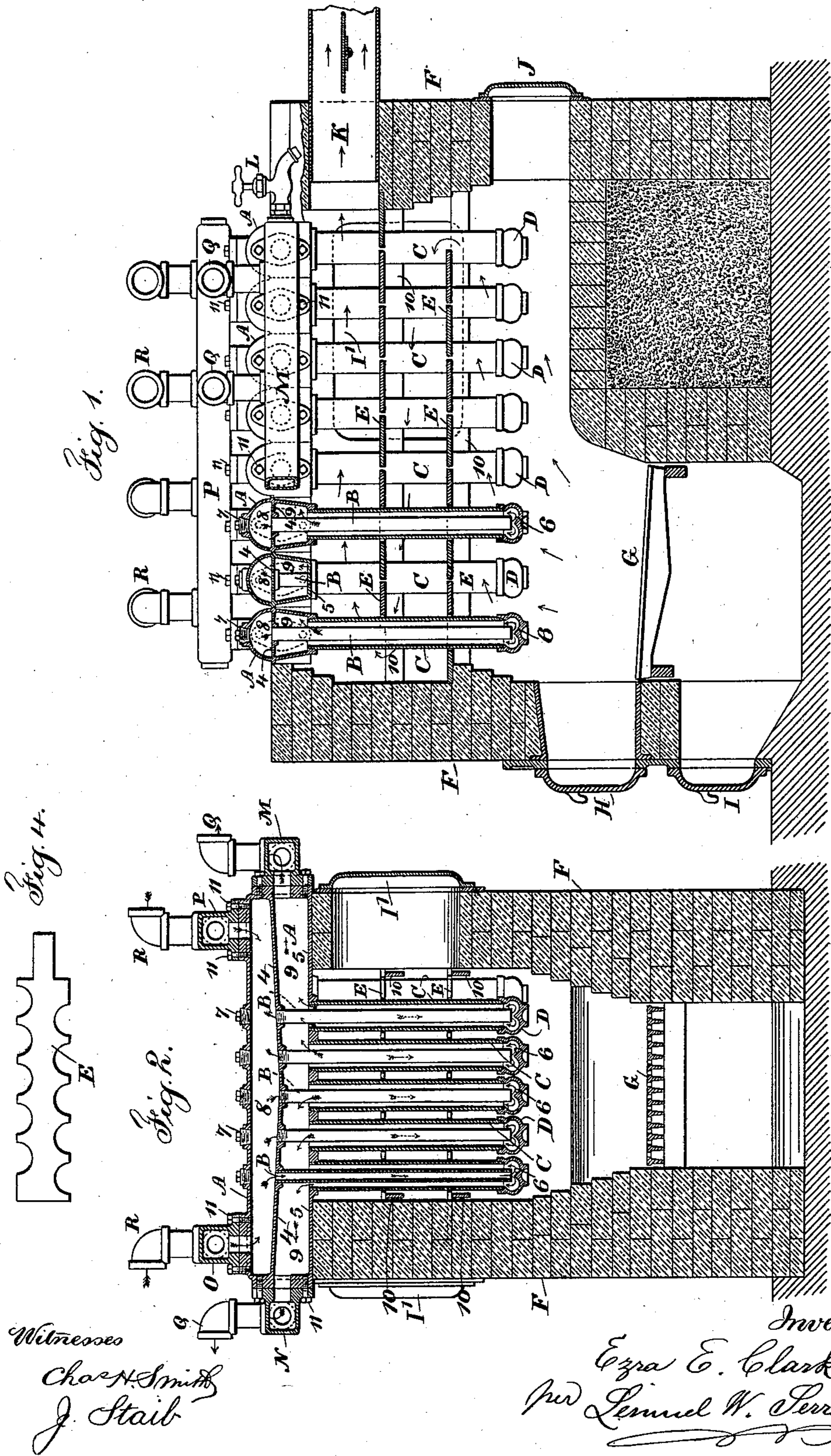
(No Model.)

2 Sheets—Sheet 1.

E. E. CLARK.
HOT WATER HEATING APPARATUS.

No. 557,189.

Patented Mar. 31, 1896.



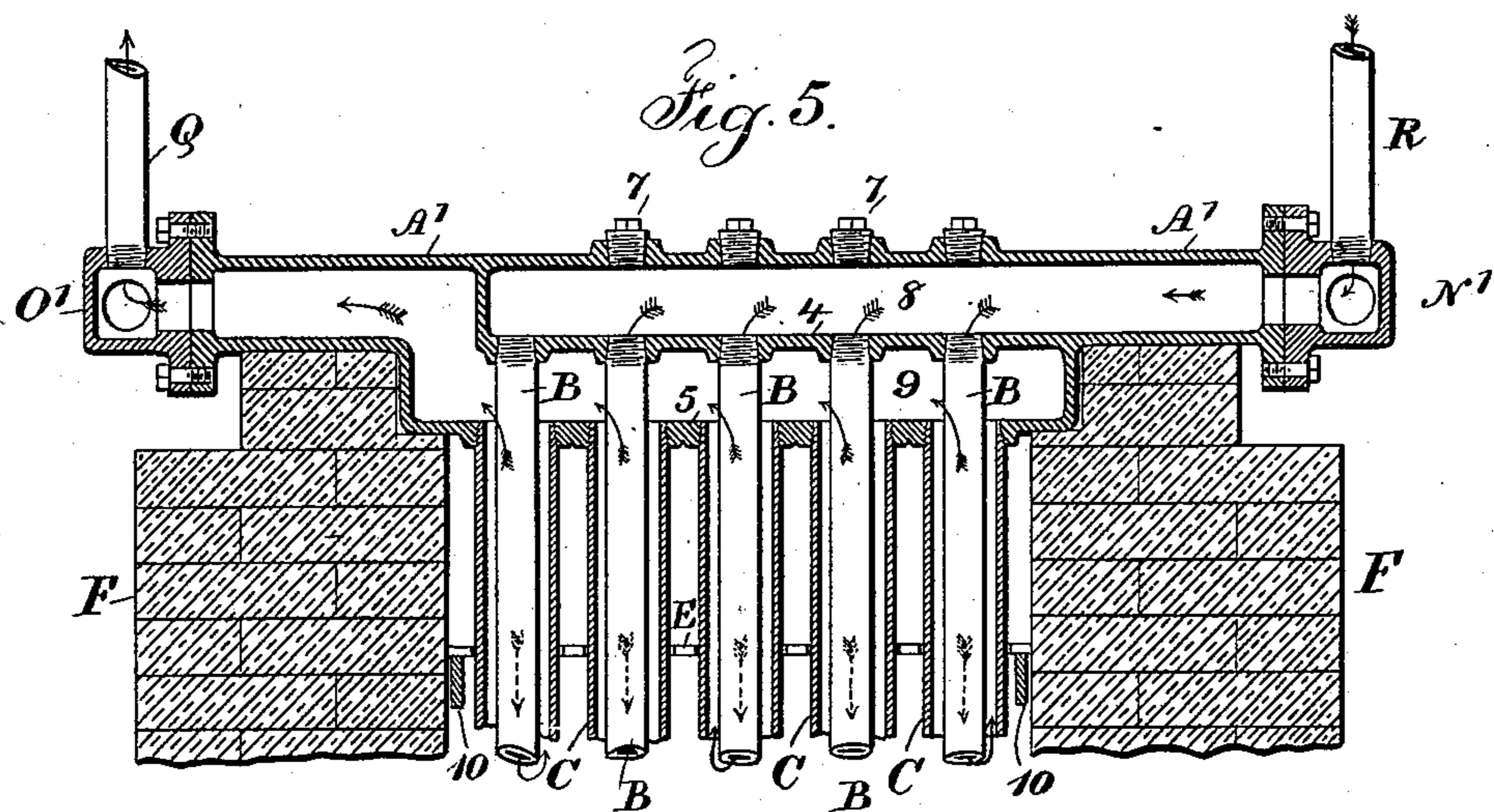
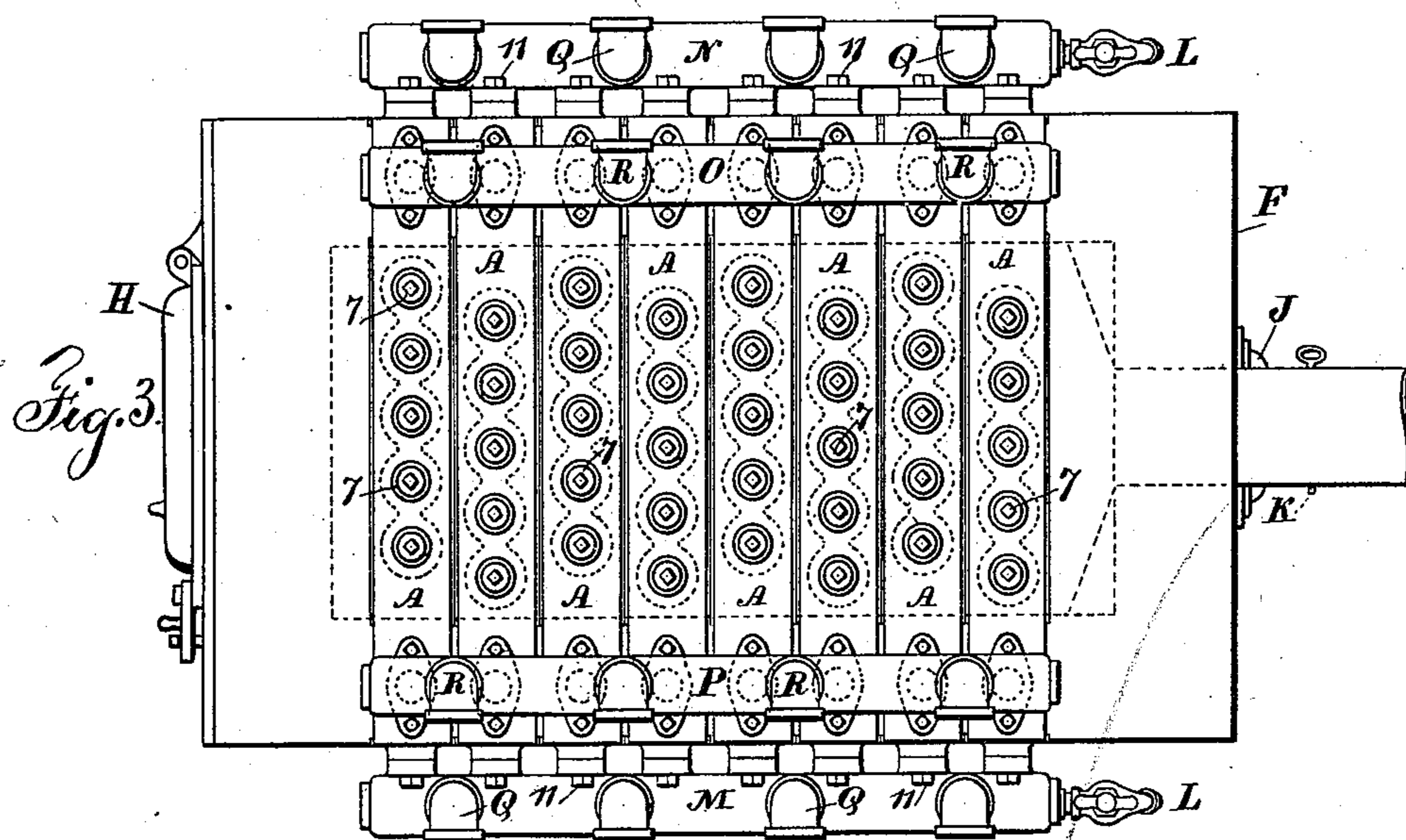
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HOT WATER HEATING APPARATUS.

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Witnesses

Charles Smith
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Inventor

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UNITED STATES PATENT OFFICE.

EZRA E. CLARK, OF NORTHAMPTON, MASSACHUSETTS.

HOT-WATER HEATING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 557,189, dated March 31, 1896.

Application filed April 20, 1895. Serial No. 546,465. (No model.)

To all whom it may concern:

Be it known that I, EZRA E. CLARK, a citizen of the United States, residing at Northampton, in the county of Hampshire and State of Massachusetts, have invented an Improvement in Hot-Water Heating Apparatus, of which the following is a specification.

The object of the present invention is to obtain an extended heating-surface for the fire and products of combustion to act upon and to render the heater very compact, easily repaired, and capable of extension to any desired extent, so that the apparatus may be adapted to different locations by increasing or lessening the number of sections brought together in the heater and a rapid and reliable circulation of the water is obtained in the apparatus. The boiler is composed of sections each of which is divided by a diaphragm, and there are pendent tubes, the outer ones of which are screwed into the bottom of the section, and the inner ones are passed through the outer ones and are screwed into the diaphragm, and caps are provided at the lower ends of the outer tubes peculiarly constructed for directing the water that passes down through the inner tube and ascends by the action of the heat in the outer tube and between the same and the inner tube, and there are headers connecting with the boiler-sections through which the water flows into the circulating system or radiators and returns to the boiler-sections above the diaphragms and descends through the inner tubes of the pairs of pendent tubes.

In the drawings, Figure 1 is a longitudinal elevation and partial section of the heating apparatus. Fig. 2 is a cross-section through one of the boiler-sections. Fig. 3 is a plan view. Fig. 4 shows one of the baffle-plates separately, and Fig. 5 is a section through a modified form of boiler-section.

The boiler-sections A are preferably of cast-iron, and they are hollow and divided by a horizontal or nearly horizontal diaphragm 4 into an upper water-chamber 8 and a lower water-chamber 9, and there are suitable bosses cast upon the lower side 5 of each boiler-section and upon the diaphragm 4, which bosses are drilled and tapped, the pipes

B being screwed into the diaphragm 4 and the outer pipes C being screwed into the lower side 5 of the boiler-section.

The lower ends of the pipes B are open and the bottom ends of the outer pipes C are closed by caps D that are preferably of cast-iron and made sufficiently heavy to withstand the direct action of the fire, and within each cap there is provided a central and conical projection 6, as shown, that aids in directing the circulation of the water as the water descends through the inner pipe B and ascends within the outer pipe C and between the same and the inner pipe, and these projections also lessen the risk of sediment accumulating at these the lowest points in the apparatus.

It is advantageous to provide in the top of each boiler-section screw-plugs 7 that are in line with the tubes B, so that access can be obtained to each pair of tubes for the removal of any obstruction or for the introduction of a hose or pipe through which water can be drawn up and discharged when the boiler and pipes have to be entirely emptied.

The boiler-sections are complete in themselves, each section being composed of the hollow upper portion A with the pairs of hanging pipes, preferably in line with each other, and it is advantageous to make the sections all alike, but to have the range of pipes nearer to one end of the section than the other, so that when the sections are placed together side by side and in reverse positions, as indicated in Fig. 3, the hanging pipes of one section will be staggered with the hanging pipes of the next section—that is, the pipes of one section are opposite the spaces between the pipes in the next section. In this arrangement the heat is caused to impinge against the tubes and produce the greatest heating effect.

Any suitable inclosing case can be made use of, either metal or other material. I have, however, shown an inclosing case F of brickwork, wherein there is provided a fire-chamber and grate-bars G, a fire-door at H, an ash-door at I, a back-flue door at J, and an escape-flue at K, provided with a damper. There are usually side doors I' to give access to the

baffle-plate and to the hanging pipes for cleaning their surfaces.

Where the escape-flue is at the front of the inclosing case, one row of baffle-plates may be made use of, but where the escape-flue is at the rear it is advantageous to make use of two rows of baffle-plates, as shown in Figs. 1 and 2. Each baffle-plate E is notched upon its opposite edges to correspond to the hanging tubes, and the baffle-plates are supported at their ends upon the bars 10 or ledges along on the inside of the inclosing case, and they may be provided with end projections to facilitate the handling of such plates when inserted or removed, and these baffle-plates can be easily taken out by tipping them up edgewise or replaced in the same manner.

The outflow and return pipes may be connected to the sections A in any suitable manner. In Figs. 1, 2, and 3 I have represented hollow connecting-headers N and M at the ends of the boiler-sections A and the headers O and P upon the top and at the ends of the boiler-sections, and it is advantageous to cast upon the sections the necessary hubs or flanges with the openings to the connecting-headers and to provide ears upon the headers for the bolts 11, by which the headers are connected to the respective sections, and the contiguous surfaces should be faced off and receive suitable packing material for making a tight joint.

When the headers are connected in the form shown in Figs. 1, 2, and 3, the outflow-pipes Q are connected with the headers M and N, and the return-pipes R are connected with the headers O and P, so that the return-water reaches the upper chambers 8 in the boiler-sections, passes down the inner pipes B and up around such pipes and within the outer pipes C into the lower chambers 9, and from thence by the outflow-pipes Q through the ranges of heating-pipes or radiators for giving off the heat. It is advantageous to provide draw-off cocks or valves L upon the headers M N for letting out the water from the ranges of heating-pipes or radiators.

When the boiler-sections A' are made in the form shown in Fig. 5, the return-pipes R and the connecting-header N' are applied at one end of the range of sections and the outflow-pipe Q and the header O' are applied at the other end of the range of sections. The upper chamber in each section extends only to one end, and the lower chamber in each section rises as it extends to the other end of such section, the mode of operation in both cases remaining the same.

It is advantageous to proportion the hanging tubes B and C in such a manner that the area between the outer and inner tube will exceed the area of the inner tube, so that the water circulating upwardly will not be moving as fast as the water circulating downwardly, and hence there will be more time for the absorption of the heat, and in conse-

quence of the diaphragms separating the sections into upper and lower water-chambers a circulation of water is compelled throughout the whole of the apparatus by the circulation of the water through the hanging tubes that connect such chambers, and the rapidity of the circulation will be in proportion to the difference in the temperature of the water in outer tubes and the water in inner tubes.

The upper and lower water-chambers and the diaphragm may be of any desired configuration, the hanging tubes being constructed as aforesaid and arranged in a row or rows, as desired.

The connections between the upper ends of the tubes and the bottom of the vessel and the diaphragm, respectively, may be of any desired character.

I claim as my invention—

1. The combination in a water-heating apparatus, of a range of hollow boiler-sections each divided into two separate water-chambers by a diaphragm, inner tubes screwed into openings in the diaphragm, outer tubes screwed into openings in the bottoms of the sections and caps screwed upon the lower ends of the outer hanging tubes, each cap having a hollow interior central projection passing upwardly toward the lower end of the inner tube for directing the circulating water, substantially as set forth.

2. The combination in a water-heating apparatus, of boiler-sections each cast hollow and divided by a diaphragm into upper and lower chambers, inner pipes screwed into openings in the diaphragms and outer pipes screwed into openings in the bottoms of the sections, cast-metal caps screwed upon the lower ends of the outer tubes and headers and connecting-flanges having openings and secured to the ends of the boiler-sections, substantially as set forth.

3. The combination in a water-heating apparatus, of boiler-sections each cast hollow and divided by a diaphragm into upper and lower chambers, inner pipes screwed into openings in the diaphragms and outer pipes screwed into openings in the bottoms of the sections, cast-metal caps screwed upon the lower ends of the outer tubes and headers and connecting-flanges having openings and secured to the ends of the boiler-sections, and removable plugs screwed into the top of each section and in line with the inner tubes, substantially as set forth.

4. The combination in a water-heating apparatus, of a range of hollow boiler-sections each containing a diaphragm, inner tubes secured into openings in the diaphragm, outer tubes secured into openings in the bottoms of the sections, and caps secured upon the lower ends of the outer hanging tubes, an inclosing case and baffle-plates introduced between the tubes for directing the products of combustion, substantially as set forth.

5. The combination in a water-heating ap-

paratus, of a water-holding vessel with a diaphragm dividing the same into upper and lower chambers, circulating-pipes connected with such chambers, hanging tubes open at
5 both ends and secured into openings in the diaphragm, and surrounding tubes closed at their lower ends and secured at their upper

ends into openings in the bottom of the vessel, substantially as set forth.

Signed by me this 13th day of April, 1895. 10
EZRA E. CLARK.

Witnesses:

WILLIAM G. MOTT,
S. T. HAVILAND.