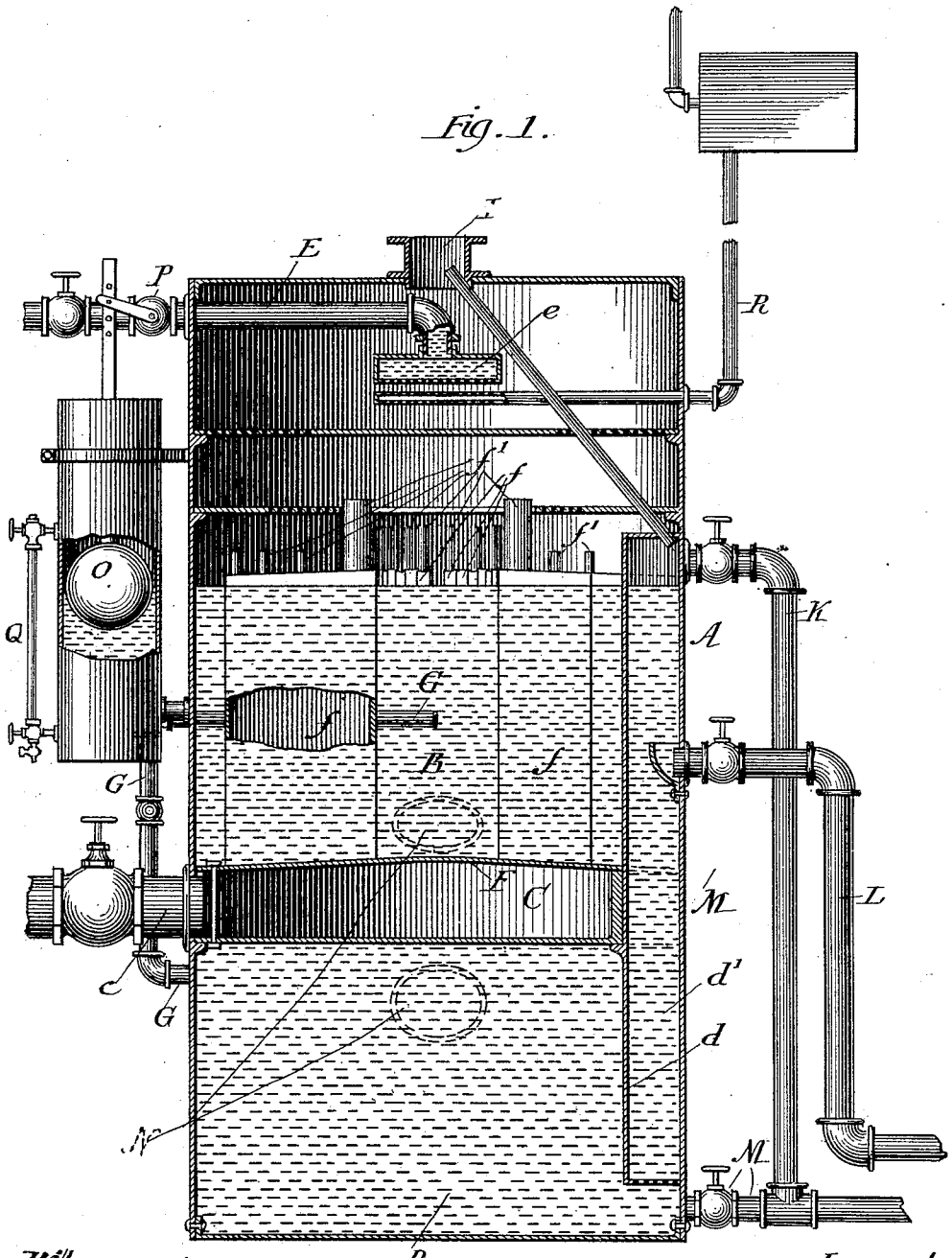
(No Model.) 2 Sheets—Sheet 1.

C. E. FERREIRA.

PROCESS OF HEATING AND PURIFYING WATER.

No. 434,592. Patented Aug. 19, 1890.

Fig. 1.



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(No Model.) 2 Sheets—Sheet 2.

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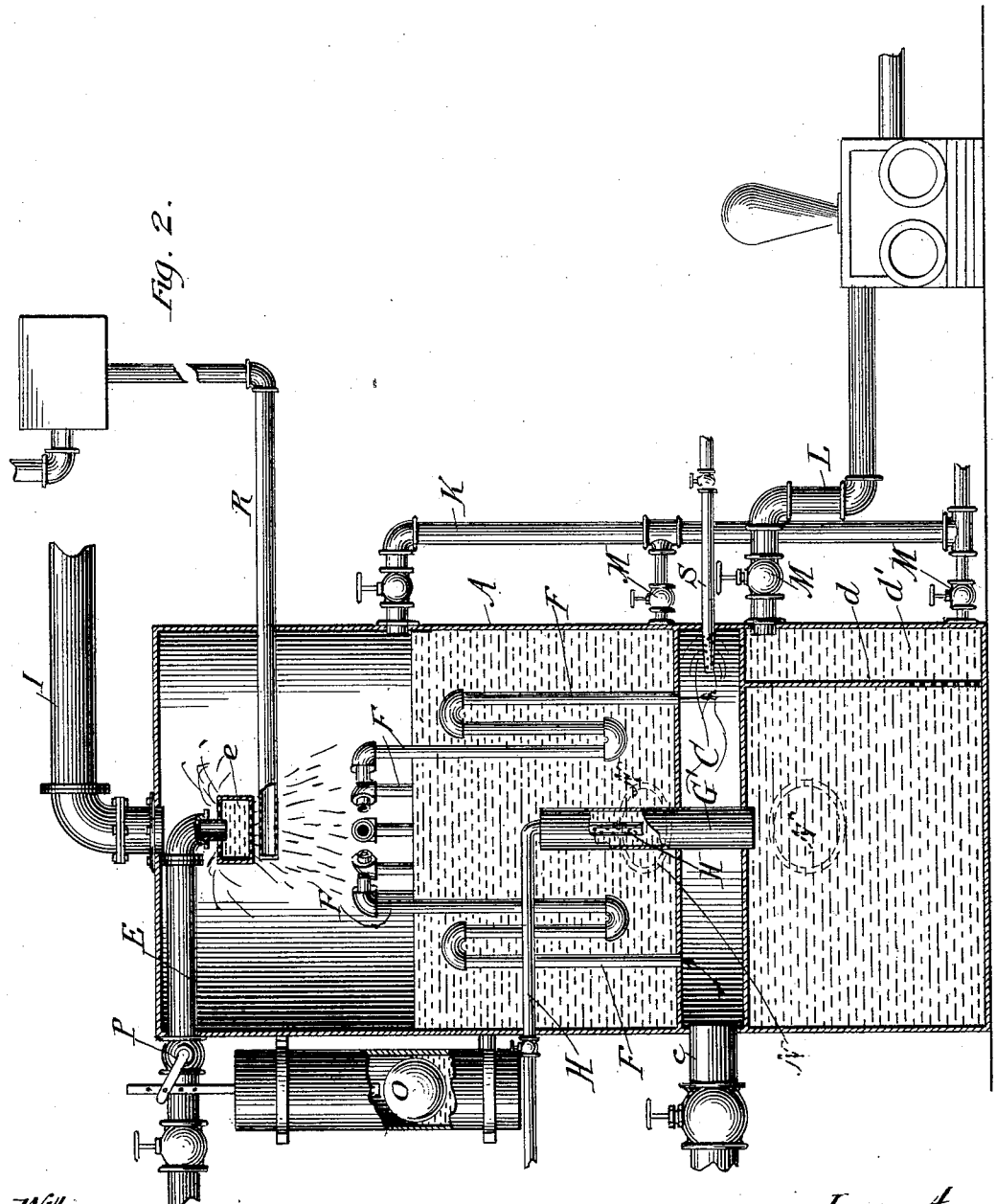
Fig. 2.



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Inventor:
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UNITED STATES PATENT OFFICE.

CHARLES E. FERREIRA, OF MORGAN PARK, ILLINOIS.

PROCESS OF HEATING AND PURIFYING WATER.

SPECIFICATION forming part of Letters Patent No. 434,592, dated August 19, 1890.

Application filed February 25, 1889. Serial No. 301,133. (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 Process of Heating and Purifying Water, of which the following is a specification.

The object of my invention is to provide for heating and purifying water, particularly water intended for use in steam-boilers, and its principal features are subjecting water to the action of both exhaust-steam and live steam in the same vessel, introducing steam into the outflowing water to superheat it, and drawing the water off from a point between its surface and bottom, so as to avoid carrying out floating and heavy impurities, as hereinafter described and claimed.

In the accompanying drawings I have shown two forms of apparatus by means of which my process may be carried out; but I do not intend to limit myself to either of these forms, inasmuch as they are merely intended as illustrations, and other forms may be employed that are capable of accomplishing the purpose of my invention.

The drawings, Figures 1 and 2, represent vertical central sections of two feed-water heaters. They are in all substantial respects the same. They are both provided with water-chambers, steam-chambers, and settling-chambers inclosed in a shell or case. In one the steam is allowed to pass from the steam-chamber upward through the water-chamber through chambers shaped like a segment of a circle, and in the other the steam passes up through pipes bent in the form of the letter S. Furthermore, the former style of heater is provided with two perforated diaphragms, as shown, above the water-level. In the first form the water passes from the water-chamber into the settling-chamber by means of a horizontal pipe. In the other it is drawn off through a vertical pipe. These are, however, mere changes in the mode of constructing the apparatus, the process being the same in either case.

In the drawings, A is the shell or sides of the heater; B, a water-chamber; C, a steam-chamber, and *c* an inlet for introducing exhaust-steam; D, a settling-chamber; *d*, a vertical partition in the settling-chamber, perforated at or near its bottom, and *d'* space separated by such partition; E, an inlet-pipe for introducing water into the heater, and *e* the inner perforated end thereof. In Fig. 1, F is 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. In Fig. 2, F is a pipe communicating with the steam-chamber for conducting steam into the water-chamber and through the water, and *f* the nozzle thereof; G, one form of pipe for conducting the heated water to the settling-chamber, and G' another form of pipe for the same purpose; H, a pipe for introducing live steam into the pipe leading from the water-chamber to the settling-chamber; I, a relief-pipe for the escape of surplus steam; K, an overflow-pipe; L, the suction-pipe of the feed-pump; M, drain-valves, and N man-holes for cleaning out the chambers; O, a float in a side chamber to open or close a valve P in the water-inlet pipe; Q, a gage or indicator to show the water-level in the water-chamber; R, an inlet-pipe for introducing condensed steam from a trap or traps, when desired, and S an inlet-pipe for introducing live steam into the steam-chamber when exhaust-steam is not to be used.

As now generally heated for feed purposes, water cannot be economically brought to the high temperature necessary to precipitate the impurities or scale-forming matter to the extent necessary to fully purify it. My process is intended to overcome this objection to a greater or less extent and to secure other advantages not obtained by present methods of heating water for feed purposes.

In constructing the apparatus shown for carrying out my process, 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, pref-

erably 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 water in the chamber may be heated in any convenient way; but I prefer to heat it by hollow chambers or pipes extending upwardly from the steam-chamber, as shown in the drawings. In the first way the 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. There may be as many of these hollow chambers as desired, 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 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. In the second way the heating-surface is obtained by having a pipe communicating with the steam-chamber pass up into the water-chamber and body of water to be heated. This pipe may pass up and down or make turns, and the steam passing through it will of course heat the body of water surrounding or in contact with it. There may be only one of these pipes or as many as desired. I prefer to use several, (as many as possible,) so as to have numerous inlets for the steam and to secure the greatest amount of heating-surface in the water. I also prefer to have the upper end of each of these pipes provided with a horizontal nozzle.

A diaphragm, open in its central part, perforated around its center, and solid in its outer circle, may be placed a short distance above the highest water-level. The solid part of this diaphragm causes the escaping steam to be deflected toward the center, so as to pass up through the perforations, and particularly through the central opening. Another diaphragm, solid in its central part and perforated in its outer circle, may be placed a convenient distance above the first one. The solid part of this second diaphragm, being in the center, is directly under the water-sprinkler and over 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 in the water-chamber. Indeed, the steam, coming up through the outer perforations 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 portions 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 chambers or pipes above described.

After the water is heated in the water-chamber it is drawn off into a settling-chamber, preferably from a point substantially in the center of the body of water. It may be so drawn by a vertical pipe extending directly through the steam-chamber or by a pipe extending into the water-chamber horizontally and passing down and around the steam-chamber to the point of its connection with the settling-chamber. A pipe for the introduction of live steam may enter or be connected with this water-outlet pipe at any convenient point. I prefer to have the end of this steam-pipe run into the water-pipe a short distance and to have its end closed by plugging or otherwise and its sides within the water-pipe perforated to distribute the steam laterally. By means of this pipe live steam may be introduced into a comparatively small quantity of outflowing water, so as to commingle therewith, and thus superheat it or greatly increase its temperature. In this way the water can be heated to any temperature required before or as it enters the settling-chamber, and the temperature being sufficiently high of course the impurities of scale-forming matter are immediately precipitated in the settling-chamber. I prefer and consider it important to have the live steam thus introduced at a temperature sufficiently high to cause the impurities or scale-forming matter to be rapidly and fully precipitated. As already stated, I also prefer to have the end of the pipe for the outflow of water at a point about half-way between the surface and bottom of the water, or at least at a point substantially below the surface, so as to draw off the water without scum, oil, or other floating matter and with as little as possible of the heavier impurities. As will be seen, then, impurities which can be precipitated at about 214° Fahrenheit are thus caused to remain in the water-chamber, and other impurities requiring a higher temperature to precipitate them are precipitated by the live steam in the water-outlet and arrested in the settling-chamber.

The sediment or impurities in the water and settling chambers may be removed or washed out from time to time, as necessary, by opening the drain-valves from the chambers and through the man-hole in each of said chambers.

Some of the advantages of my invention are

that it provides for heating and purifying water by the use of both live steam and exhaust-steam in the same vessel; that it also provides for drawing off the heated water without taking any of the floating impurities or many of the precipitated impurities; and that it also provides for introducing live steam directly into the outflowing water, so as to superheat it or greatly increase its temperature, and thus cause the remaining impurities, which require a higher degree of heat, to be precipitated in the settling-chamber; but it will of course be understood that I do not intend to limit myself to the accomplishing of all these results together, my process covering any or all, as circumstances seem to require. Nor do I intend to limit myself to other special steps or features described as incidental to the carrying out of my process.

I do not herein claim the means above described for carrying out my process, the same being the subject of other applications, Serial Nos. 296,446 and 300,909.

I am aware of the Doyle patent of March 24, 1885; but its process differs from mine in that it does not introduce live steam and exhaust-steam into the same vessel so that they come in contact and mingle with the same body of water, the live steam entering the inner chamber and the exhaust-steam the outer one, and in that the exhaust-steam, not coming into the water, is in no way condensed by it, and hence has no effect beyond that due to its simple heat in softening hard water introduced into the heater. In the Doyle patent referred to the live steam is also introduced at the top of the water, not into the outlet-pipe, to superheat it as it flows out.

I claim—

1. The process of heating and purifying water, which consists in subjecting it to the direct action of both exhaust-steam and live steam in the same vessel, whereby the water is heated and its impurities precipitated in such vessel, substantially as described.

2. The process of heating and purifying water, which consists in subjecting it to the direct action of exhaust-steam to heat it in a body and then to the action of live steam introduced into the outlet-pipe to superheat it as it flows out, substantially as described.

3. The process of heating and purifying water, which consists in subjecting it to the direct action of exhaust-steam to heat it in a body, drawing the water off from a point between its surface and bottom to avoid carrying out floating and heavy impurities, and subjecting the outflowing water to the action of live steam introduced into the same to superheat it, substantially as described.

4. The process of heating and purifying water, which consists in heating it upon its introduction into the heater and afterward subjecting it to the indirect action of exhaust-steam to heat it in a body and then to the direct action of live steam introduced into the outlet-pipe to superheat it as it flows out, substantially as described.

5. The process of heating and purifying water, which consists in heating it by direct exhaust-steam upon its introduction into the heater and afterward subjecting it to the indirect action of exhaust-steam to heat it in a body, drawing the water off from a point between its surface and the bottom to avoid carrying out floating and heavy impurities, and finally subjecting the outflowing water to the action of live steam introduced into the same to superheat it, substantially as described.

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