(No Model.) 2 Sheets—Sheet 1.

J. J. HOPPES.

FEED WATER HEATER AND PURIFIER.

No. 369,712. Patented Sept. 13, 1887.

Fig. 1

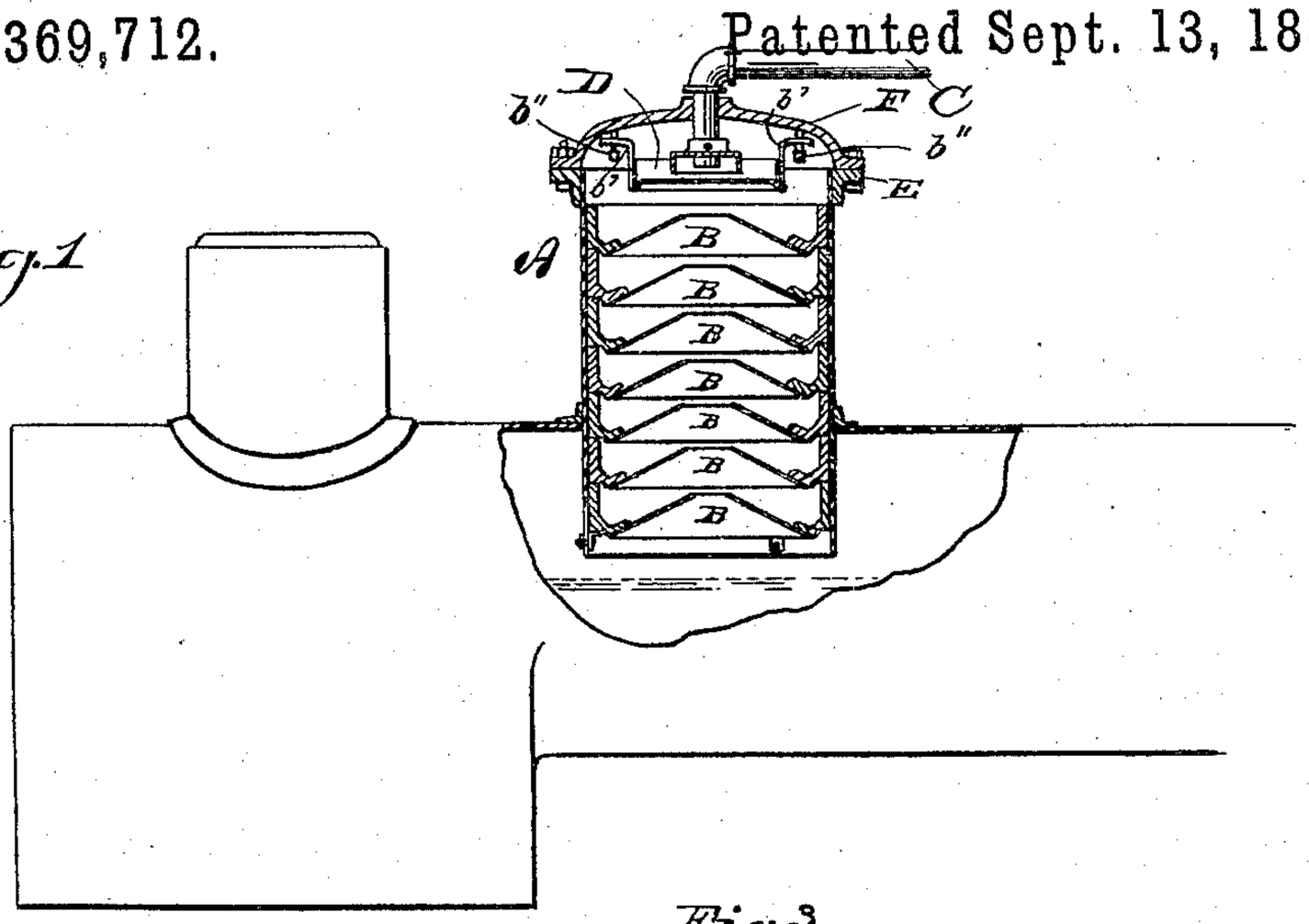


Fig. 3

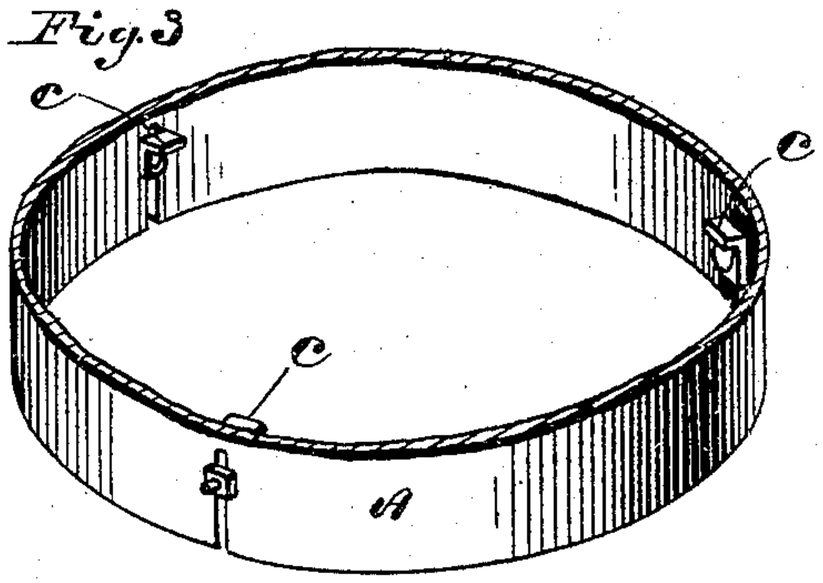
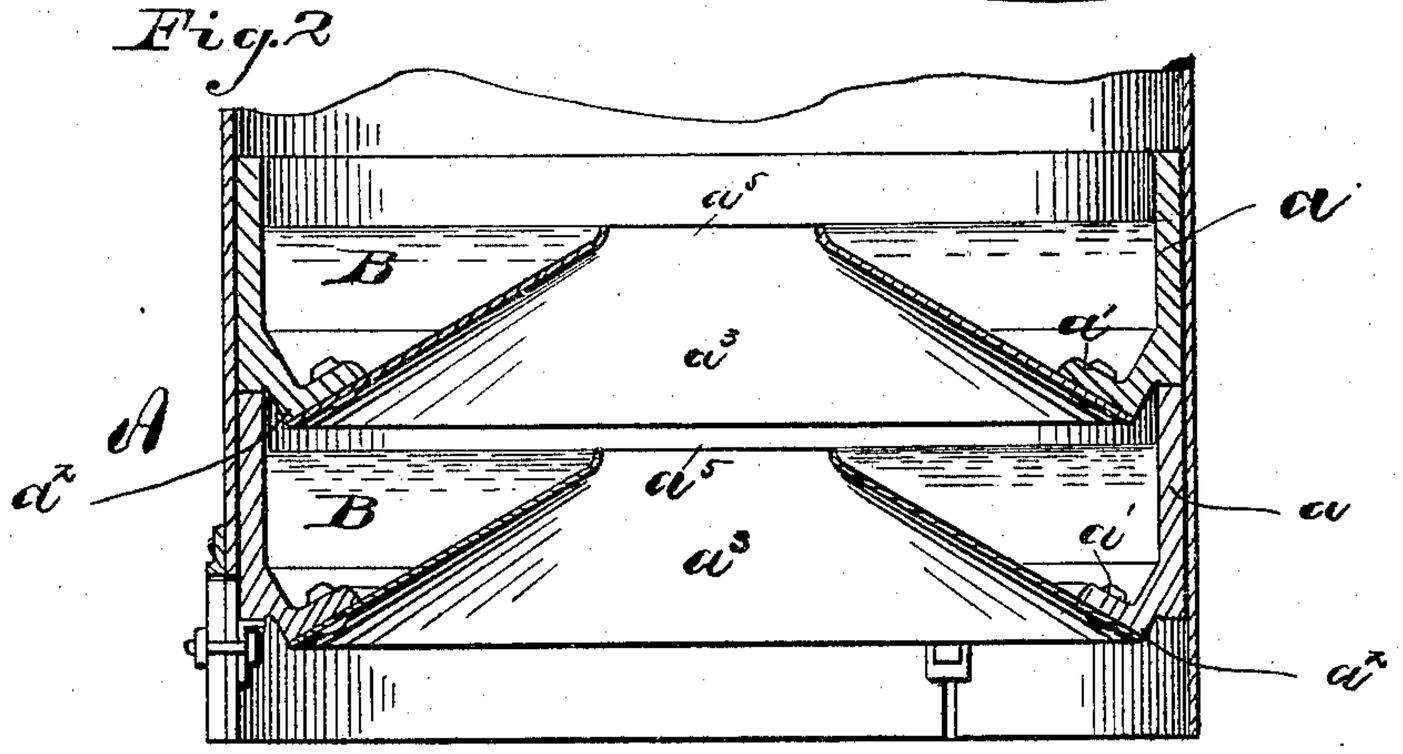


Fig. 2



Witnesses

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(No Model.) 2 Sheets—Sheet 2.

J. J. HOPPES.

FEED WATER HEATER AND PURIFIER.

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Fig. 8

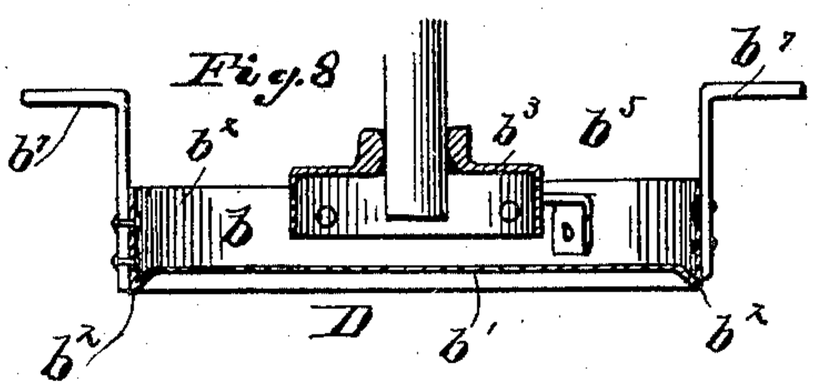
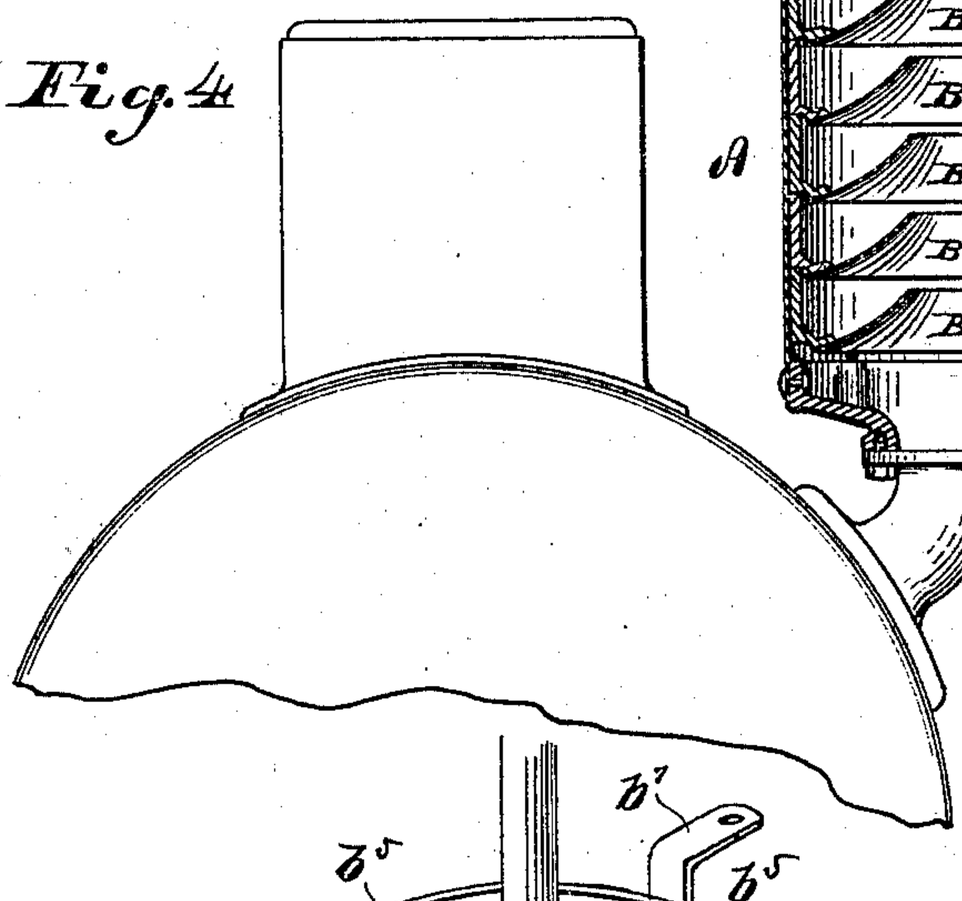


Fig. 4



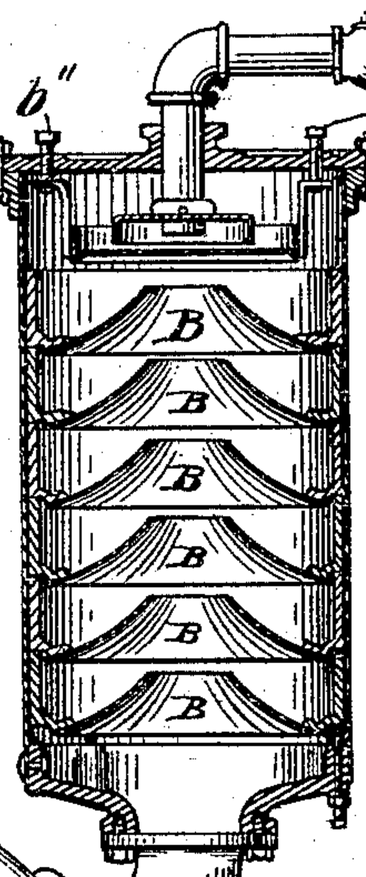


Fig. 11

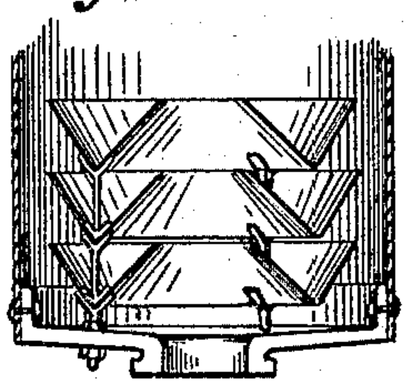


Fig. 6

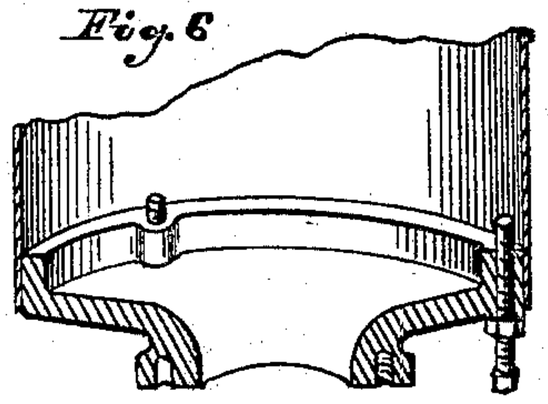


Fig. 7

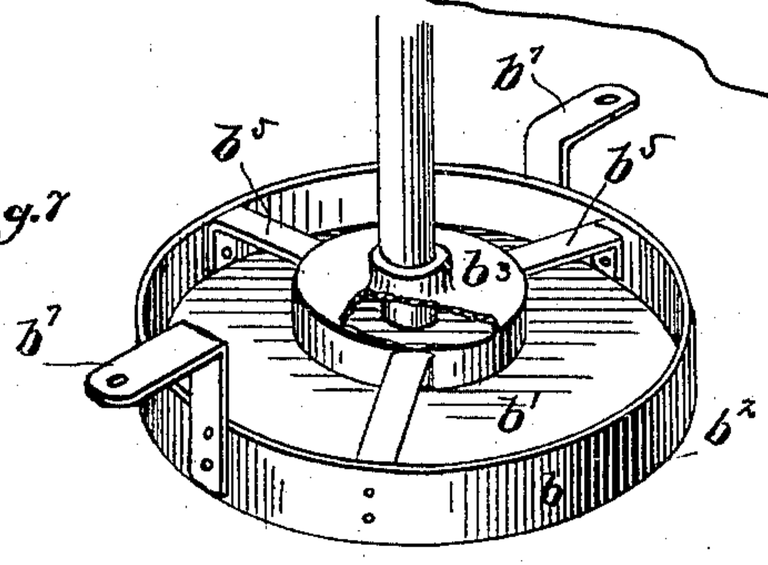


Fig. 10

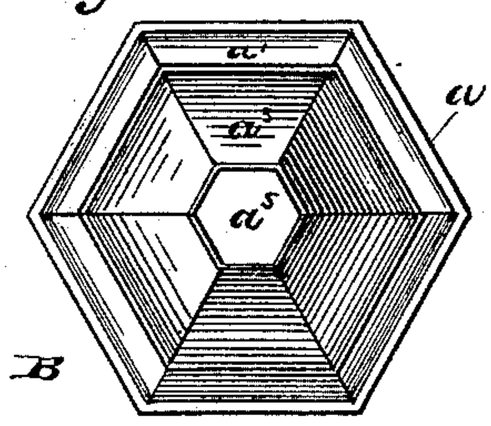


Fig. 5

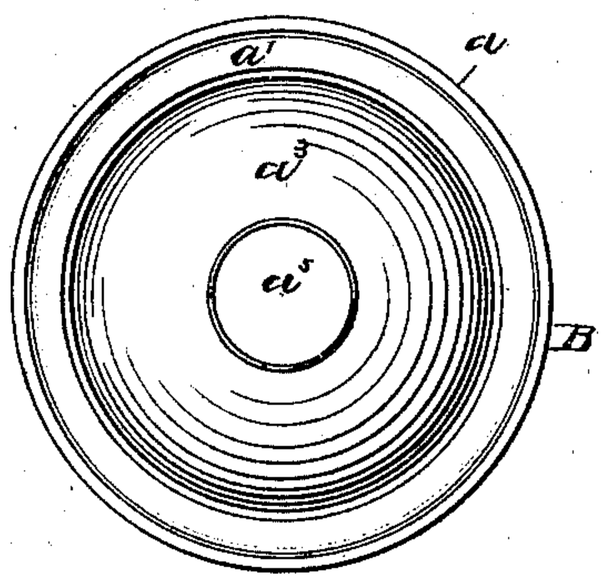
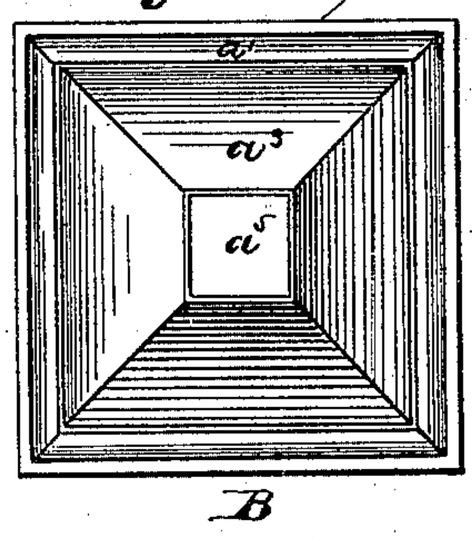


Fig. 9



Witnesses
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Inventor
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UNITED STATES PATENT OFFICE.

JOHN J. HOPPES, OF SPRINGFIELD, OHIO.

FEED-WATER HEATER AND PURIFIER.

SPECIFICATION forming part of Letters Patent No. 369,712, dated September 13, 1887.

Application filed December 16, 1886. Ser'al No. 221,796. (No model.)

To all whom it may concern:

Be it known that I, JOHN J. HOPPES, a citizen of the United States, residing at Springfield, in the county of Clark and State of Ohio, have invented certain new and useful Improvements in Feed-Water Heaters and Purifiers, of which the following is a specification.

My invention relates to feed-water heaters for steam-boilers, and it particularly relates to that class of heaters which are adapted to extract the lime and other impurities from the water as well as heat it to a high temperature before it is admitted to the boiler.

My invention consists, first, in a plate or pan having an opening therein the sides of which are inclined outwardly and so constructed that the water will flow through said opening and follow the under surface of said pan or plate and be subjected to the heat of the steam, and thus become thoroughly heated and deposit the incrustating substance therein contained.

My invention further consists in arranging the plates or pans in a series one above the other in an outer casing and providing means for adjusting said pans to a horizontal position, so that the water will flow evenly over the edges of the openings therein.

My invention further consists in a feed or overflow box of novel construction, through which the water is fed to the pans or plates.

My invention further consists in various constructions and combinations of parts, hereinafter described and claimed.

In the accompanying drawings, which form a part of this specification, Figure 1 is a side elevation view, partly in section, of a steam-boiler to which one of my improved heaters is attached, the heater being shown in section. Fig. 2 is a partial sectional elevation view of the heater, showing the arrangement of the plates and pans therein. Fig. 3 is a perspective view of a portion of the lower end of the outer casing of the heater, showing the means for adjusting the plates or pans to a horizontal position in the said casing. Fig. 4 is a sectional elevation view of a heater, showing a slight modification of the construction and of the method of attaching the same to a boiler. Fig. 5 is a plan view of one of the pans or plates. Fig. 6 is a perspective view, partly in section, showing the manner of adjusting the pans. Figs. 7 and 8 are detailed views of the feed or overflow box. Figs. 9, 10, and 11 are views showing modifications in the construction of the parts, to be hereinafter referred to.

Like parts are indicated by similar letters of reference throughout the several views.

In the said drawings, A represents the outer casing of the heater, which is preferably made of a plain cylindrical form placed in an upright position.

B represents the pans or plates therein, which are preferably placed horizontally in the said outer casing and arranged in series one above the other. Each of the pans B consists, preferably, of an outer ring, *a*, having a trough-shaped flange, *a'*, which extends slightly below the bottom thereof at an angle thereto, and then turns upwardly and inwardly, forming a corner, a^2, slightly below and within the inner side of the said ring.

Secured to the flange *a'* and projecting upwardly into the ring *a* is a cone shaped bottom, a^3, preferably made of sheet-steel and provided at the top with an opening, a^5. The sides of the respective pans formed by the rings *a* extend above the openings in the cone-shaped bottoms a^3, and are so constructed that the bottom of one ring is adapted to rest on the top of the ring below, with the angular flange which forms the lower edge of the bottom of each ring projected into the ring below.

The water is admitted to the heater in such a manner that it flows into the upper pan. When the water in the pan rises to the top of the cone-shaped bottom, it flows over the sides of the opening therein and follows the under surface of said bottom to the lower projecting edge thereof. It drops into the next succeeding pan, and so on through the series. Steam is admitted to the heater in any desired manner, and comes in contact with the water flowing down on the under surface of the pans, and thus thoroughly heats the same, causing it to deposit the incrustating substances therein on the under side of the cone-shaped bottoms of the pans.

I preferably connect the heater directly to the boiler, so that the steam-pressure and temperature will be the same therein as in the boiler, thus subjecting the water to the same

conditions as it would be subjected to in the boiler proper. I preferably accomplish this by forming the heater in the top of the boiler, as shown in Fig. 1, or connecting it directly to the same above the water-line, as shown in Fig. 4. By this means the full pressure and temperature of the boiler are obtained and only one connection is necessary—namely, the pipe which conveys the water thereto.

The water is supplied to the heater by an inlet-pipe, C, from the feeding-pumps or any other convenient source of supply. The feeding-pipe C preferably passes through the top of the heater into an overflow-box or feed-box, D. This feed-box D, I construct as follows:

The main part of the feed-box consists of a circular pan, b, the sides of which are projected downwardly below the bottom b' to form a flange or ledge, b^2, around the lower edge thereof. Surrounding the inlet-pipe and concentric with the outer pan, b, is a smaller pan, b^3, which is connected at suitable intervals by strips b^5 to the larger pan, b. This smaller pan, b^3, is placed in the larger pan in an inverted position, so that the sides thereof project downwardly into the pan b.

The inlet-pipe C passes through the top of the inverted pan b^3 and projects therein, so that its lower end stands below the upper edges of the sides of the outer pan, b, but above the lower edges of the sides of the inverted pan b^3. By this means it will be seen that the end of the inlet-pipe always stands below the water-line in the overflow-box, while the sides of the inner pan, b^3, projecting below the end of said pipe, form a brake between the said pipe and the point at which the water is discharged from said pan. By this means the boiling and bubbling over the edges of the feed-box, caused by its discharge from the inlet-pipe, are prevented, the water being discharged over the sides of the pan b in a thin even sheet.

Means are provided for adjusting the overflow-box so that it will always maintain a horizontal position, and thus cause the water to flow evenly over the sides thereof. This I preferably accomplish by providing at either side of the pan extending arms b^7, adapted to project upwardly and be engaged by adjusting-screws b^{11} in the top of the casing A, the opening in the top of the inverted pan being adapted to fit loosely over the end of the inlet-pipe.

If desired, the overflow or feeding box may be pivoted to the lower end of the inlet-pipe and provided at either side with adjusting-screws adapted to bear against the top of the casing, by means of which the pan may be readily adjusted, or any other suitable means may be employed for this purpose. The overflow or feeding box projects beyond the opening a^5 in the upper pan, so that the water flows from the said feeding-box into the upper pan near the outer edge thereof, the projecting ledges on the bottom of the overflow-box being adapted to cause the water to drop directly down from the overflowing sides of the said box, and thus prevent its running along the under side of the said box and dropping into the opening in the upper pan. The opening a^5 being considerably above the lower edge of the bottom of the pan, the pan remains at all times nearly full of water, thus giving the free solids therein opportunity to settle. When the pan fills up to the upper edges of the cone-shaped bottom, the water flows over the edges of the opening therein and along the under surface of the said bottom until it drops into the next successive pan. The top of the cone-shaped bottom being much smaller in diameter than the lower portion thereof, it will be seen that as the water flows over the edges of said opening and follows the under surface of the cone-shaped bottom it will be spread out over a much greater surface, and thus reduced to a much thinner sheet, as it approaches the lower edge of the said bottom. By this means a very thin even sheet of water will be formed flowing down the lower portion of the said cone-shaped bottom, which, coming in direct contact with the steam in the said heater, will cause it to part with all its incrustating substances and deposit them on the under side of the pans.

In order that the water will flow over the edges of the opening in the respective pans in a uniform sheet, I provide means for leveling up the pans, so that they may always occupy a horizontal position in the heater. This I accomplish by providing at the bottom of the heater three or more adjustable supports, c, on which the lower pan is adapted to rest. In Figs. 1 to 3, inclusive, these supports are shown in the form of brackets, secured to the outer casing, a, by small bolts which pass through slotted openings in the said casing. In Figs. 4 and 6 I have shown the supports in the form of set-screws which pass vertically through the bottom of the outer casing and form supports on which the lower pan at its outer edge is adapted to rest. It will be seen that by the means thus described the lower pan may be readily adjusted to a horizontal position, after which the upper pans are placed thereon, and, being of uniform size, will also occupy a horizontal position. A simple means for adjusting the lower pan is to fill the pan with water and move the adjustable supports until the water stands at an equal height around the edge of said pan.

I preferably make the outer casing, A, of a straight cylindrical shape of boiler-iron, the upper end of which is provided with an annular ring or flange, E, secured thereto, to which is attached a removable head, F. The outer ring or sides, a, of the pans are made of a suitable size to slip loosely into the outer casing, and may be removed therefrom for cleaning or other purposes by removing the cover F.

It is obvious that the pans, instead of being round, could be made of any desired form—square or hexagonal, as indicated in Figs. 9 and 10, or of any other desired shape. In-

stead of having the outer edge straight and projected above the opening in the bottom of said pans, the pans could be made, as shown in Fig. 11, with the sides thereof inclined in either direction, so that the water would flow over the outer edges, as well as over the edges of the opening therein, following the under surface of the pan in both cases.

The heater thus described I preferably use as a live-steam heater—that is, one which is connected directly to the boiler. It is evident, however, that the constructions herein set forth may be used in an exhaust-steam heater or any other form of heater now in use.

If desired, the heater may be placed separate and apart from the boiler, and separate connections be provided for steam and water, in which case, if desired, a filter may be added through which the water is adapted to pass after coursing through the respective pans. Various other modifications may be employed, which will readily suggest themselves to a mechanic. I do not therefore confine myself to the constructions herein set forth; but

I claim, broadly, as my invention—

1. In a feed-water heater, a pan having an upwardly-projecting conical bottom provided with an opening therein so formed that the water will flow through said opening and outwardly along the under surface of said cone-shaped bottom, substantially as set forth.

2. In a feed-water heater, the combination, with an outer casing, of a series of pans placed one above the other, each of said pans being provided with an upwardly-extending cone-shaped bottom provided with an opening in the top thereof so formed that the water from the said pans will pass through the said opening and flow outwardly along the under side of said cone-shaped bottom and be discharged in the next successive pan, substantially as set forth.

3. The combination, in a feed-water heater, of a pan or pans each of which is provided with an opening therein, having inclined sides, and means for adjusting said pan or pans to a horizontal position, substantially as set forth.

4. In a feed-water heater, an overflow or feeding box, an inlet-pipe which is adapted to project below the water-line thereof, and downwardly-projecting flanges extending below the bottom of said inlet-pipe between the said pipe and overflow-edges of said box, substantially as and for the purpose set forth.

5. The combination, in a feed-water heater, with the inlet-pipe, of an overflow or feeding box into which the said inlet-pipe is adapted to discharge, and means for adjusting said box to a horizontal position in the said heater, substantially as specified.

6. The combination, in a feed-water heater, with the inlet-pipe, of the outer pan, the sides of which are provided with projecting ledges below the bottom thereof, and an inverted pan secured near the center of said outer pan around the inlet-pipe, the lower end of said pipe being adapted to project below the overflow-edges of the outer pan and stand above the edges of the inverted pan, substantially as and for the purpose set forth.

7. The combination, with a steam-boiler, of a feed-water heater connected directly to said boiler above the water-line thereof, said feed-water heater being provided with a series of removable overflow-pans having inclined bottoms with openings therein through which the water is adapted to flow, substantially as and for the purpose set forth.

8. The combination, in a feed-water heater, of a series of overflow-pans, each of which consists of an outer ring provided at the bottom with an inwardly-projecting flange at an angle thereto and a cone-shaped bottom secured to said flange and provided with an opening therein, substantially as and for the purpose set forth.

9. The combination, in a feed-water heater, of the overflow-pans provided with an opening therein having inclined sides, on the under side of which the water is adapted to flow after passing through said opening, and an overflow or feed box above the said pans, said feed-box being provided at the bottom with projecting ledges on either side of said opening, substantially as specified.

10. The combination, in a feed-water heater, with the pans having inclined bottoms with openings therein through which the water is adapted to flow, of an overflow or feeding box suspended from the top of said heater and provided at the bottom with downwardly-projecting ledges on either side of said openings, and means for adjusting said feeding-box to a horizontal position, substantially as set forth.

11. The combination, with a steam-boiler, of a feed-water heater open at its lower end and set directly into said boiler, said feed-water heater being provided with a series of pans having inclined bottoms with openings therein through which the water is adapted to flow, a supply-pipe adapted to discharge the water into the said pans, and adjustable supports for supporting said pans in said heater, substantially as and for the purpose set forth.

In testimony whereof I have hereunto set my hand this 10th day of December, A. D. 1886.

JOHN J. HOPPES.

Witnesses:
CHASE STEWART.
PAUL A. STALEY.