

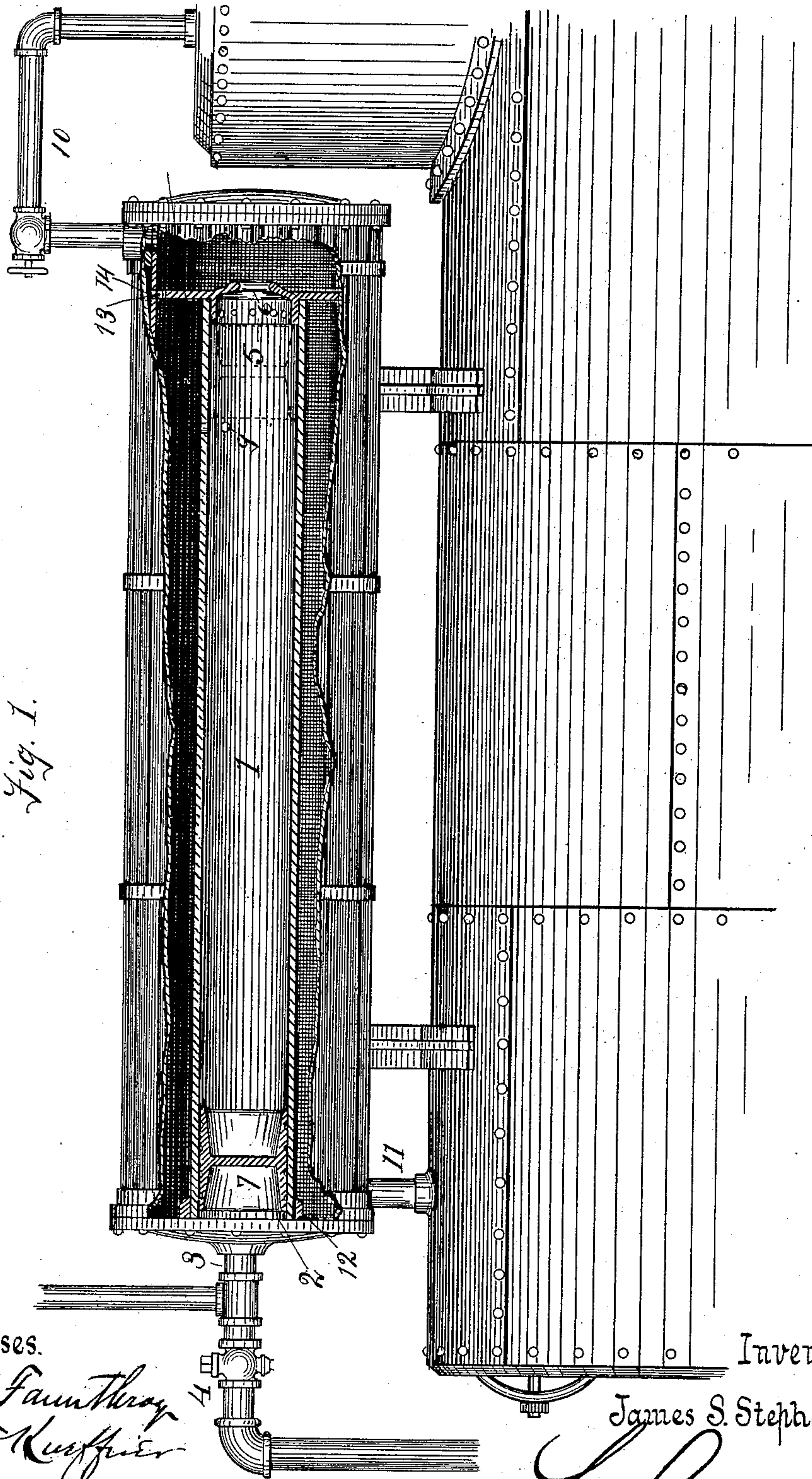
(No Model.)

2 Sheets—Sheet 1.

J. S. STEPHENS.
FEED WATER HEATER AND PURIFIER.

No. 407,378.

Patented July 23, 1889.



Witnesses.
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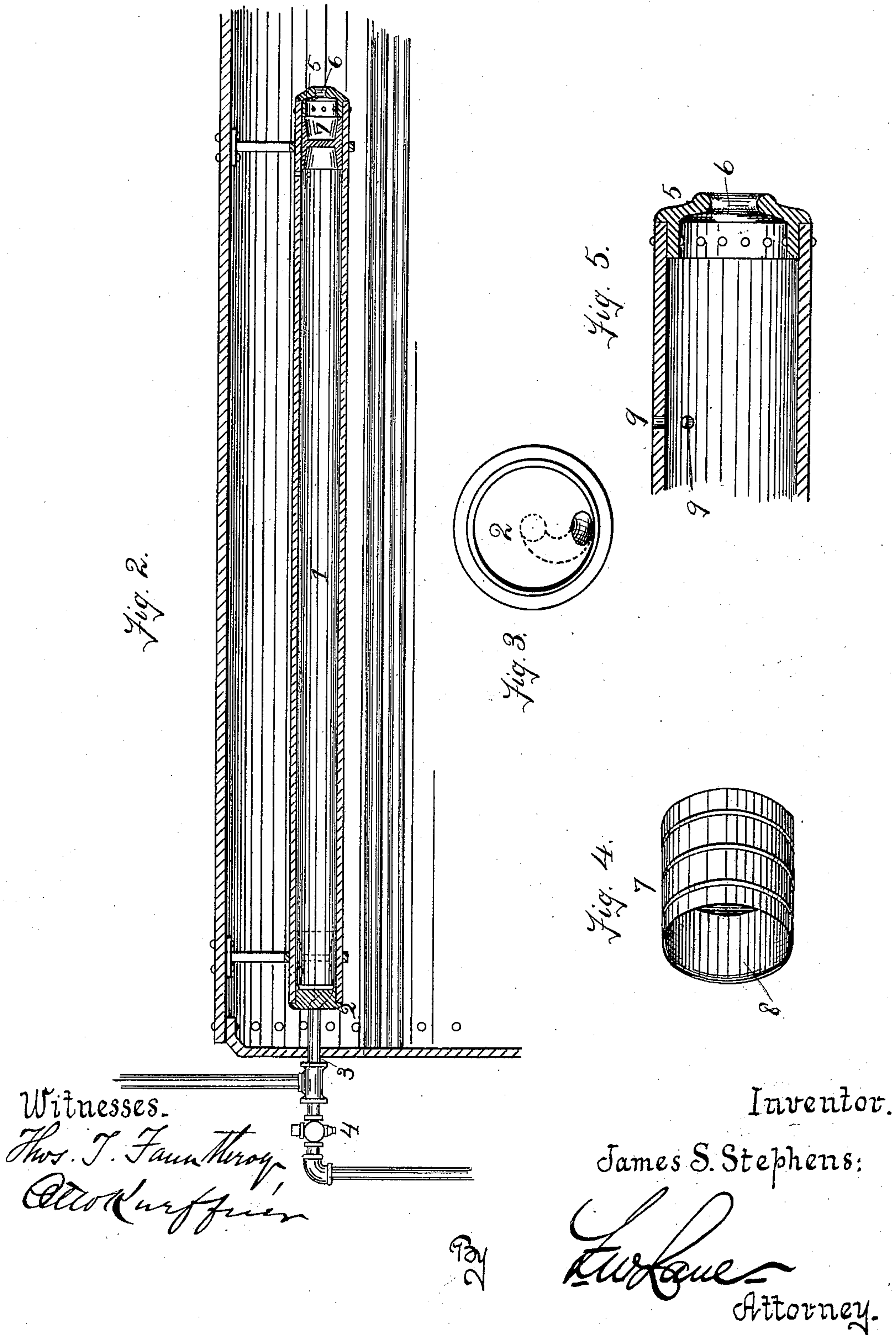
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UNITED STATES PATENT OFFICE.

JAMES S. STEPHENS, OF ST. PAUL, MINNESOTA.

FEED-WATER HEATER AND PURIFIER.

SPECIFICATION forming part of Letters Patent No. 407,378, dated July 23, 1889.

Application filed March 23, 1889. Serial No. 304,470. (No model.)

To all whom it may concern:

Be it known that I, JAMES S. STEPHENS, a citizen of the United States, residing at St. Paul, in the county of Ramsey and State of Minnesota, have invented certain new and useful Improvements in Feed-Water Heaters and Purifiers; and I do declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the letters and figures of reference marked thereon, which form a part of this specification.

This invention relates to appliances for heating and purifying feed-water for steam-boilers; and it consists in the means employed for utilizing the differential pressure of the feed-water and steam to operate a piston for clearing the heating-chamber of impurities deposited by the water, and by the same means to cause the piston to operate as a check-valve between the chamber and the boiler, according as the blow-off valve is opened or closed.

The object of the invention is to provide means for removing such impurities from the chamber without the necessity of removing the latter and without loss of steam, as is occasioned by blowing out the chamber, and at the same time to construct an appliance which shall be inexpensive and easily and efficiently operated.

The invention is illustrated in the accompanying drawings, in which—

Figure 1 is a side view, partly in section, showing the heater as inclosed in a separate shell and mounted above the boiler; Fig. 2, a similar view showing the chamber as suspended within the boiler; Fig. 3, a detail of the outer end cap of the heating-chamber, showing the form of the water-inlet to give a spiral movement to the water in its passage through the heating-chamber; Fig. 4, a perspective view of the piston; and Fig. 5, a partial view, in section, of the inner end of the heating-chamber.

The apparatus consists of a heating-chamber 1, preferably of tubular form, and usually of a length a little less than that of the boiler. The outer end of the chamber is fitted with a cap 2, to which is attached the pipe 3, com-

municating with the feed-water supply and also with the blow-off valve 4, and the inner end is provided with a cap 5, having a central opening 6 of about one-half the area of a cross-section of the chamber. This opening 6 affords communication between the interior of the chamber and the boiler, or an outer chamber inclosed by a separate shell in communication with the boiler. In the interior of the chamber is fitted a piston 7, ordinarily of a length about equal to its diameter, and preferably hollowed out at each end, as shown in the drawings at 8. Near the inner end of the chamber, at a distance therefrom a little greater than the length of the piston, are several perforations 9 9, whose combined area is about equal to or slightly less than that of a cross-section of the supply-pipe. The location of these perforations is such that when the piston is at its farthest limit in that direction the perforations will be just at the edge of the piston, though left entirely open for the passage of the heated water from the chamber.

The passage within the cap 2, through which the feed-water is admitted, is of a curved form and enters the interior of the chamber near one side thereof at an angle to the direction of its length, in order to give the water a spiral movement in its passage through the heating-chamber for the purpose of more thoroughly heating the same.

The action of the apparatus is as follows: Water being admitted to the chamber at the outer end, the piston is forced gradually by the excess of the pressure of the feed-water over the steam-pressure to the inner end of the chamber, thus allowing the water to escape through the perforations 9 9, after having passed in a spiral course through the whole length of the chamber, into the boiler, or into the outer chamber and thence into the boiler. During its passage the water becomes heated to the temperature of the steam in the boiler, and at the same time its impurities are deposited upon the bottom of the chamber. The piston is retained at the inner end of the chamber and the ports left open by the pressure of the feed-water. When it becomes necessary to clean out the chamber, the blow-off valve is opened, when the press-

ure of the steam upon the piston so far exceeds that of the feed-water that the piston is forced back to the inner end of the chamber, carrying with it all the impurities that
 5 have been deposited in the chamber. With the first forward movement of the piston the ports 9 9 are closed, thus cutting off all communication between the chamber and the boiler. The full pressure of steam is thus exerted upon the piston and the escape of steam
 10 prevented, the piston thus operating automatically as a check-valve. The feed-water may or may not be shut off when the blow-off valve is opened, though in case of heavy deposits the water assists in its removal. When
 15 the blow-off valve is closed, the feed-water pressure gradually returns the piston to its former position at the inner end of the chamber, thus opening the ports 9 9.

20 The apparatus may be located, as shown in Fig. 1, above the boiler, inclosed in a separate shell, and having pipe 10 to admit live steam from the boiler, and water-pipe 11 for the passage of water from the heater to the
 25 interior of the boiler. In this construction the heater may be supported by flanges 12 13, extending outwardly from the caps 2 and 5, and of the same diameter as the interior of the shell, the flange 13 at the inner end having passages 14 formed therein for the free
 30 circulation of steam around the outside of the chamber. A more economical method is, however, to arrange the heater, as shown in Fig. 2, in the upper part of the interior of the
 35 boiler, in which case the shell of the boiler answers all the purposes of the outer shell shown in Fig. 1, and the operation is in all respects the same.

By the use of this invention the heater is
 40 thoroughly cleaned of all impurities without removing it from its position and with no waste of steam or hot water, except what is contained in the heating-chamber, by the simple operation of opening the blow-off valve,
 45 all other movements being entirely automatic.

I claim as my invention—

1. In a feed-water heater and purifier, a heating-chamber having steam communication with the boiler at one extremity and the
 50 other end connected with the feed and blow-off pipes, ports connecting the upper part of the interior of said chamber with the interior of the boiler, and a piston fitting said chamber and adapted to be moved in opposite directions by the pressure of the feed-water and steam, respectively, according to the excess of pressure, substantially as and for the purpose herein specified.

2. In a feed-water heater and purifier, a
 60 chamber having at one end feed-water and

blow-off connections and at the other live-steam inlet and water-outlet ports, and a sliding piston adapted to close said steam-inlet and open said water-outlet by excess of feed-water pressure and to open said steam-inlet and
 65 close said water-outlet by excess of steam-pressure, substantially as and for the purpose herein specified.

3. In a feed-water heater and purifier, a chamber having steam communication with
 70 the boiler at one end and feed-water and blow-off pipes at the other extremity, a piston within said chamber, and ports in the upper part of the chamber at a distance from said steam-inlet a little greater than the length of
 75 the piston, substantially as described, whereby excess of feed-water pressure forces the piston beyond said ports to afford escape for the water, and excess of steam-pressure caused by opening the blow-off valve forces the piston
 80 to the opposite end of the chamber, closing said ports, as and for the purpose set forth.

4. In a feed-water heater and purifier, a heating-chamber having at one extremity feed and blow-off connections and at the other
 85 live-steam inlet and water-outlet, and a cap forming the end of said chamber, to which the feed-pipe is attached, the said cap having a passage therethrough at an angle to the length of the chamber, substantially as specified,
 90 whereby a spiral direction is given to the course of the water through the chamber.

5. In a feed-water heater and purifier, a heating-chamber having in one end thereof an opening of less area than the cross-section of
 95 the chamber and the opposite end connected with the feed and blow-off pipes, a sliding piston fitting the interior of said chamber, the said chamber having perforations in its upper part at a distance from the inner end of
 100 the same a little greater than the length of said piston, and the whole located in the upper part of a boiler or in a suitable shell communicating therewith, substantially as and for the purpose herein set forth.

6. In a feed-water heater and purifier, a clearing-piston adapted to force out deposits in the heating-chamber, operated directly in either direction by the pressure of steam or feed-water, the movement of said piston being
 110 controlled by the variation in pressure caused by opening or closing the blow-off valve, substantially as and for the purpose herein set forth.

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

JAMES S. STEPHENS.

Witnesses:

WALTER HOLCOMB,
 F. W. LANE.