

No. 661,934.

Patented Nov. 13, 1900.

A. G. HOHENSTEIN.

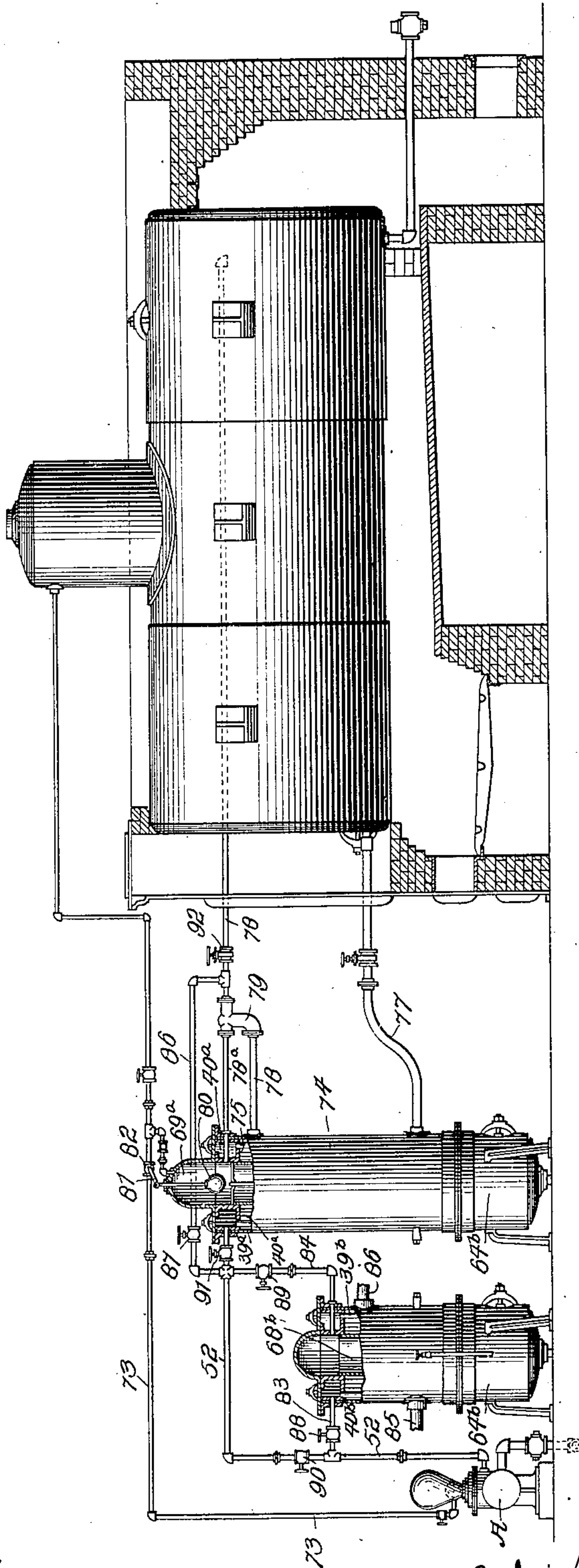
WATER HEATER, PURIFIER, AND SEPARATOR.

(Application filed July 30, 1900.)

(No Model.)

2 Sheets—Sheet 1.

FIG. 1.



WITNESSES:

*Herbert Bradley*  
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INVENTOR

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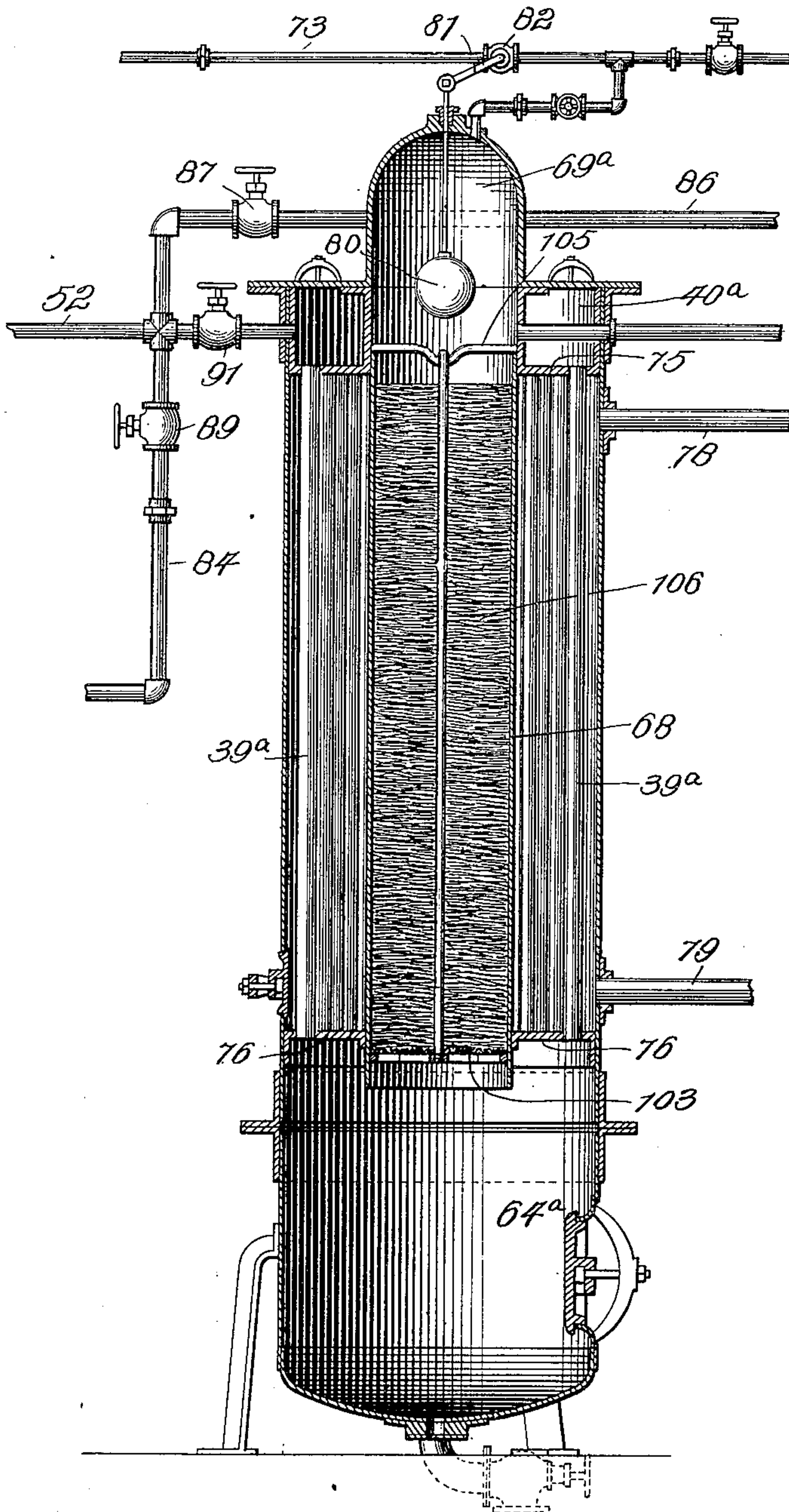
A. G. HOHENSTEIN.  
WATER HEATER, PURIFIER, AND SEPARATOR.

(Application filed July 30, 1900.)

(No Model.)

2 Sheets—Sheet 2.

FIG. 2.



WITNESSES:

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INVENTOR

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# UNITED STATES PATENT OFFICE.

ARCHIE G. HOHENSTEIN, OF NEW HAVEN, CONNECTICUT.

## WATER HEATER, PURIFIER, AND SEPARATOR.

SPECIFICATION forming part of Letters Patent No. 661,934, dated November 13, 1900.

Application filed July 30, 1900. Serial No. 25,266. (No model.)

*To all whom it may concern:*

Be it known that I, ARCHIE G. HOHENSTEIN, a citizen of the United States, residing at New Haven, in the county of New Haven and State

of Connecticut, have invented or discovered certain new and useful Improvements in Water Heaters, Purifiers, and Separators, of which improvements the following is a specification.

In an application, Serial No. 25,265, filed July 30, 1900, I have described and claimed certain improvements in heaters for boilers, said improvements having for their object not only the heating of the water, but also the precipitation and removal of carbonates, sulphates, &c., and the separation of air and gases from the water prior to the entrance of the water into the circulation in the boiler.

The invention described herein relates to certain specific improvements in heaters for the purposes specified; and the invention also has for its object the utilization of the movement of the feed-water toward and into the boiler for the production of an active circulation through the boiler and also the circulation of water at boiler temperature through the heater for raising the feed-water to a temperature at which a precipitation of the sulphids, carbonates, &c., will be effected.

The invention is hereinafter more fully described and claimed.

In the accompanying drawings, forming a part of this specification, Figure 1 is a view, partly in elevation and partly in section, showing my improvements applied to a boiler; and Fig. 2 is a sectional elevation, on an enlarged scale, of the heater.

My improved heater may be applied to any form of boiler, either of the horizontal tubular type or of the flue-boiler type, and consists of an external shell 74, provided with annular tube sheets or heads 75 and 76, in which are secured in any suitable manner the vertical tubes 39<sup>a</sup>. Through these tube-sheets passes the rising tube 68<sup>a</sup>, which communicates at its lower end with a settling chamber or reservoir 64<sup>a</sup> and with a drum or steam-space 69<sup>a</sup> at its upper end. The lower portion of the space between the tube sheets or heads 75 and 76 is connected by a pipe 77 with the boiler, and a return connection from the heater to the boiler is formed by a pipe

78 and an injector 79, interposed at a suitable point in the pipe between the heater and the boiler or steam-generator. Feed-water is forced by a pump A or by other suitable means through pipe 52 into an annular chamber 40<sup>a</sup> at the upper ends of the tubes 39<sup>a</sup>. In operating this device the water enters into the chamber 40<sup>a</sup>, passes down through the tubes 39<sup>a</sup> into the settling-chamber 64<sup>a</sup> at the lower end of the heater, and then flows up through the rising tube or separating-chamber 68<sup>a</sup>, and thence by the pipe 78<sup>a</sup> and injector 79 into the boiler. During this circuit the feed-water is brought up to the same temperature as the water in the boiler or to a sufficiently high temperature to effect a separation of the carbonates, sulphates, &c., by the water drawn from the boiler through the pipe 77 into the shell 74, where it circulates around tubes 39<sup>a</sup> and returns to the boiler through the pipe 78 and injector 79, commingling with the feed-water in the injector. The movement of the water from the boiler through the heater and back to the boiler is effected by the feed-water operating through the injector 79. Hence in case a small amount of water is being forced by the pump into the boiler the injector will draw a less amount of heated water from the boiler; but if the pump is working rapidly the feed-water jet in the injector will have a higher speed, and therefore draw a proportionately greater amount of water from the boiler to heat the feed-water.

Ordinarily sufficient steam or gases will be obtained from the separating chamber or chambers of the heater and separator to operate the pump A, to which the separating-chamber is connected by a pipe 73. In order to maintain the water in the boiler and heater at as constant a level as possible, a float 80 is arranged in the rising tube of the heater, as shown in the drawings. The stem of this float passes out through a stuffing-box and is connected to an arm 81, attached to the stem of a controlling-valve 82 in the steam-supply pipe 73. The float may be arranged in the boiler having its stem connected to a valve arranged in a pipe extending from the steam-drum of the boiler to the pump, as shown and described in the application, Serial No. 25,265, heretofore referred to.



The water in the heater should be maintained at a level somewhat above the point of connection of the pipe 78<sup>a</sup> with the heater, so that a solid column of water will be constantly supplied to the pipe 78<sup>a</sup> for replenishing the boiler. As the feed-water passes up through the rising tube the solids separated by the heat are precipitated and settle down into the collecting-chamber 64<sup>a</sup>, which, it will be observed, is entirely outside of the circulating system of the boiler. During this upward movement of the feed-water through the rising tube any gases or air contained in the feed-water will free themselves from the water and collect, with any steam generated in the heater, in the space 69<sup>a</sup> above the water-level in the rising tube and can be utilized in operating the feed-pump A or for any other purpose.

It is frequently desirable to utilize the exhaust-steam from auxiliary devices or engines having a free exhaust to preheat the water before it enters the main heater, separator, and purifier. To this end an exhaust-heater of any suitable form or construction, but preferably one similar in construction to the heater heretofore described, is interposed between the feed-pump and the main heater and purifier. The delivery side of the pump A is connected by a branch 83 from the pipe 52 to the annular chamber 40<sup>b</sup> of the auxiliary heater, so that the water will flow into said chamber, thence down through the tubes 39<sup>b</sup> to the chamber 64<sup>b</sup> at the lower end of the heater, and thence up through the rising tube 68<sup>b</sup>, from which it passes by the pipe 84 to the pipe 52 and the chamber 40<sup>a</sup> of the main heater. Exhaust-steam is conducted by the pipe 85 into the space of the heater through which the tubes 39<sup>b</sup> pass and escapes from said space by the pipe 86. During its passage through this exhaust-heater the water will be heated nearly to boiling temperature.

As shown in Fig. 1, the feed-water pipes have suitable valves so arranged that the feed-water may be caused to pass through both heaters or through either one of the heaters or directly to the boiler itself. To this end a by-pass pipe 86, provided with a valve 87, is connected to the pipes 52 and 78, as shown, and valves 88, 89, 90, and 91 are arranged in the branch 83 and the pipes 84 and 52, respectively, as shown. The by-pass 86 is connected to the pipe 78 just outside of the regulating-valve 92. By closing the valves 87 and 90 and opening the valves 88, 89, and 91 the feed-water will pass from the pump through both heaters and thence to the boiler. If it be desired to cut out the auxiliary heater, the valves 88 and 89 are closed and the valves 90 and 91 opened, so that the water will now pass by the pipe 52 to the main heater and purifier. If it is desired to cut out the main heater and purifier and to utilize the auxiliary heater, the valves 88, 89, and 87 will be opened and valves 90 and 91 closed, or if it

be desired to feed direct to the boiler from the pump the valves 88, 89, and 91 will be closed and the valves 90 and 87 opened.

If desired, a filtering material, preferably excelsior or other material which will not be injured by the hot water or steam, may be placed in the rising tube or tubes 68 for the purpose of preventing the passage of any solid matter to the boiler. This material is supported in position by a disk 103, formed of wire-netting or perforated metal which is held in position by any suitable means—as, for example, by a bar 105, passed through an eye at the end of the rod 106, connected to the disk 103, the ends of said bar resting on shoulders which may be formed by the upper end of the rising tube, as shown in Fig. 2.

As hereinbefore stated, the rate of flow of feed-water to the boiler is controlled by the rise and fall of water in the boiler operating through the float and the valve in the steam-pipe leading to the pump. The rate of flow of feed-water through the injector controls the flow of water from the boiler through the heater and back to boiler. Hence as the pipes 77 and 78, connecting the boiler and heater, are so arranged that water is drawn from one point of boiler—*e. g.*, the front end—and discharged, with the feed-water, into the boiler at another—*e. g.*, the rear end thereof—a circulation from the rear to the front end will be established. It is preferred that the water should be drawn from and discharged into the boiler at different levels—as, for example, in the arrangement shown the water is drawn from a point near the bottom of the boiler and discharged into the boiler at a point near the water-level. By this arrangement of outlet and inlet a movement of the water from end to end and from top to bottom, or vice versa, is obtained.

As the rate of flow from the boiler through the heater and back is controlled by and is proportional to the rate of flow of feed-water to the boiler, it is evident that the rapidity of circulation of water in the boiler is directly proportional to the amount of water fed to the boiler.

I claim herein as my invention—

1. The combination of a boiler, a feed-water heater, a connection between the boiler and heater to permit of the flow of water from the boiler, an injector having its nozzle connected to the feed-water portion of the heater and its feed-inlet connected to the heating portion of the heater, and its outlet connected to the boiler, and means for feeding water to the heater whereby a circulation of boiler-water through the heater is effected by the feed-water, substantially as set forth.

2. The combination of a boiler, a feed-water heater, in and out connections between the boiler and heater, an injector having its nozzle connected to the feed-water portion of the heater and its feeding portion forming a part of the connection between the boiler and



heater, means for feeding water to the heater, and means operative on changes of water-level in the heater or boiler for controlling the means for feeding water to the heater, 5 substantially as set forth.

3. The combination of a boiler, means for feeding water to the boiler, means operative on a change of water-level in the boiler for controlling the rate of feed of water to the 10 boiler, and means controlled by the feed-water for producing a circulation of the water in the boiler, substantially as set forth.

4. A feed-water heater having in combination a receiving-chamber, a settling-chamber, 15 an intermediate heating-chamber, tubes extending from the receiving-chamber through heating-chamber into the settling-chamber and a rising tube connected to the settling-chamber and extending above the normal wa-

ter-level in the receiving-chamber, substantially as set forth. 20

5. A feed-water heater having in combination a receiving-chamber, a heating-chamber arranged below the receiving-chamber, tubes extending from the receiving-chamber 25 through the heating-chamber, a settling-chamber connected to the discharge ends of the tubes, a rising tube connected to the settling-chamber and extending through the heating-chamber to a point above the receiving-chamber, substantially as set forth. 30

In testimony whereof I have hereunto set my hand.

ARCHIE G. HOHENSTEIN.

Witnesses:

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F. E. GAITHER.