(No Model.) 2 Sheets—Sheet 1.

H. WARDEN.

FEED WATER PURIFIER.

No. 450,437. Patented Apr. 14, 1891.

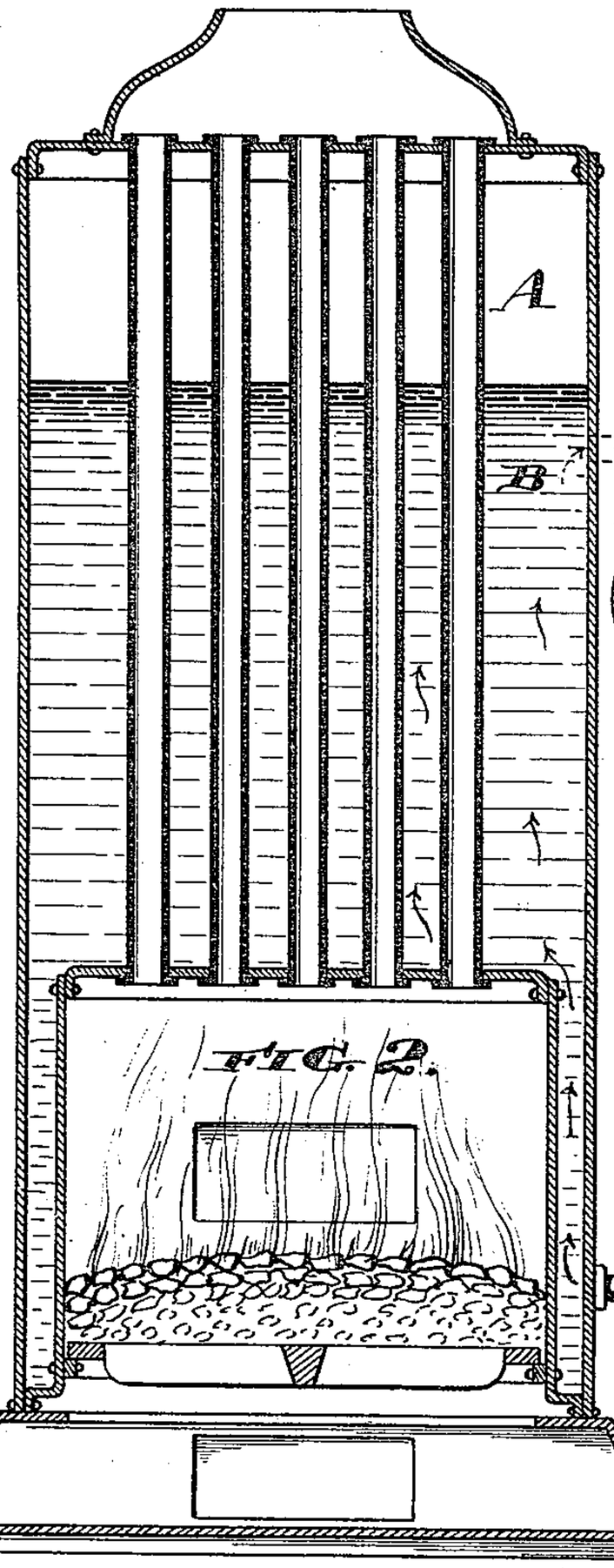


FIG. 2.

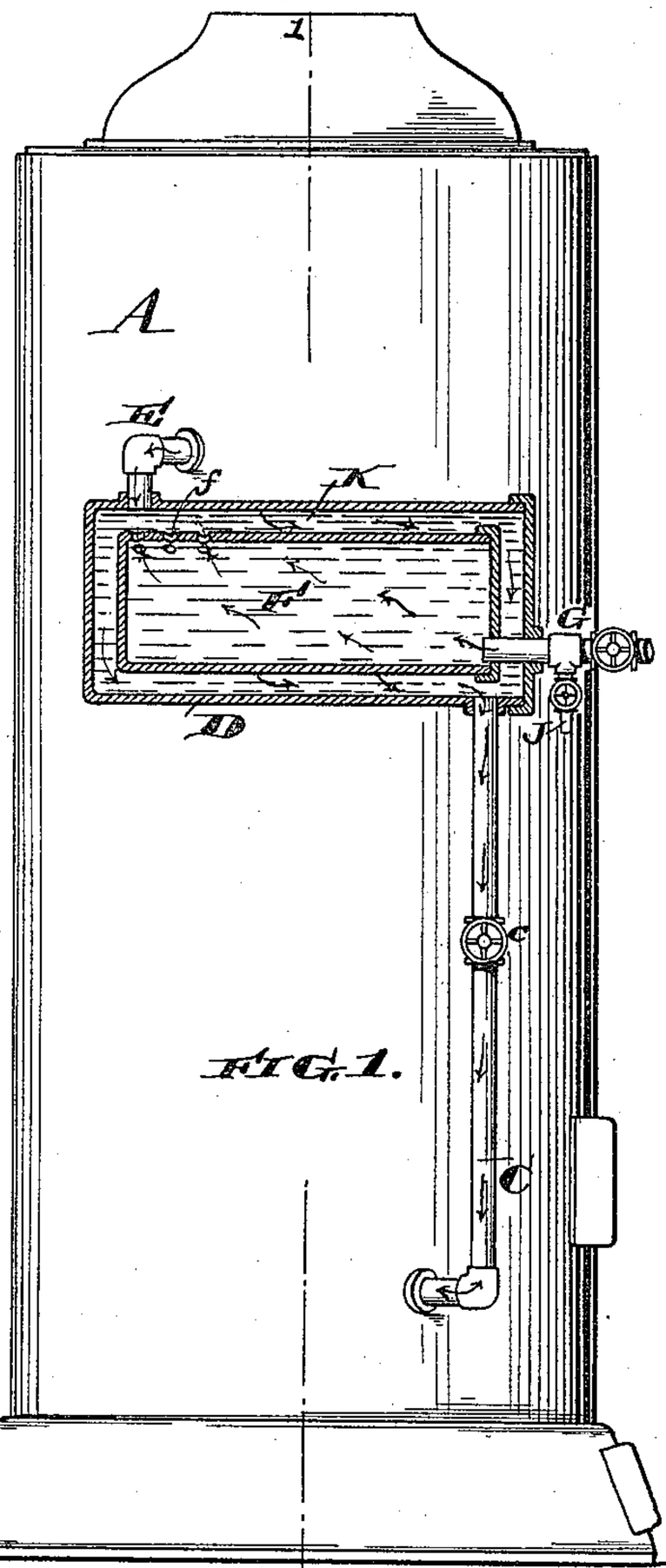
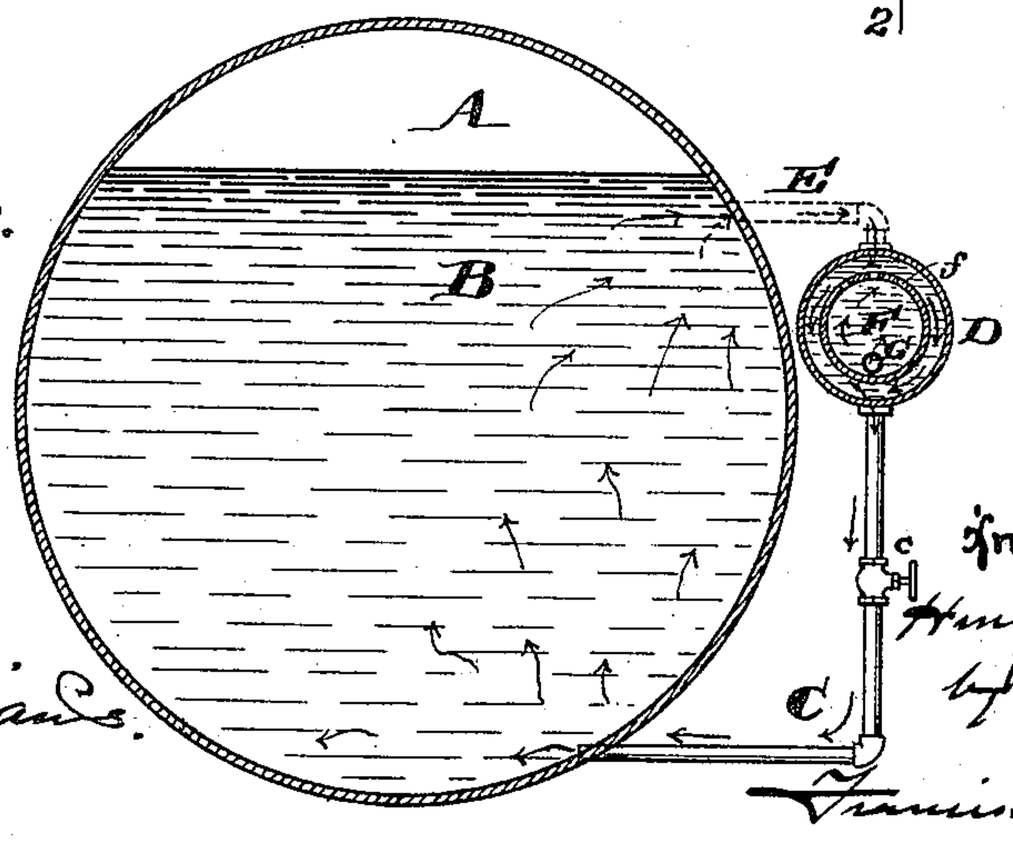


FIG. 1.

FIG. 3.



Witnesses:
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Francis T. Chambers

(No Model.) 2 Sheets—Sheet 2.

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FEED WATER PURIFIER.

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FIG. 4.

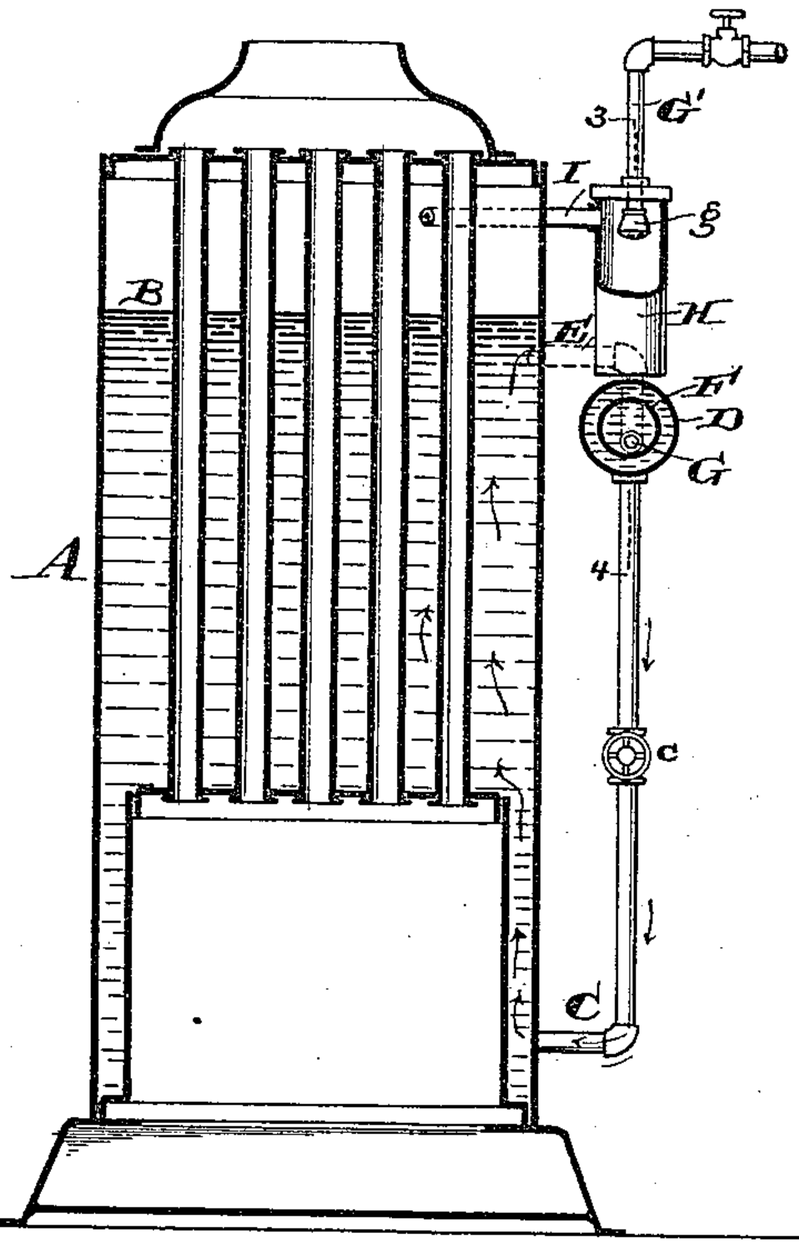


FIG. 6.

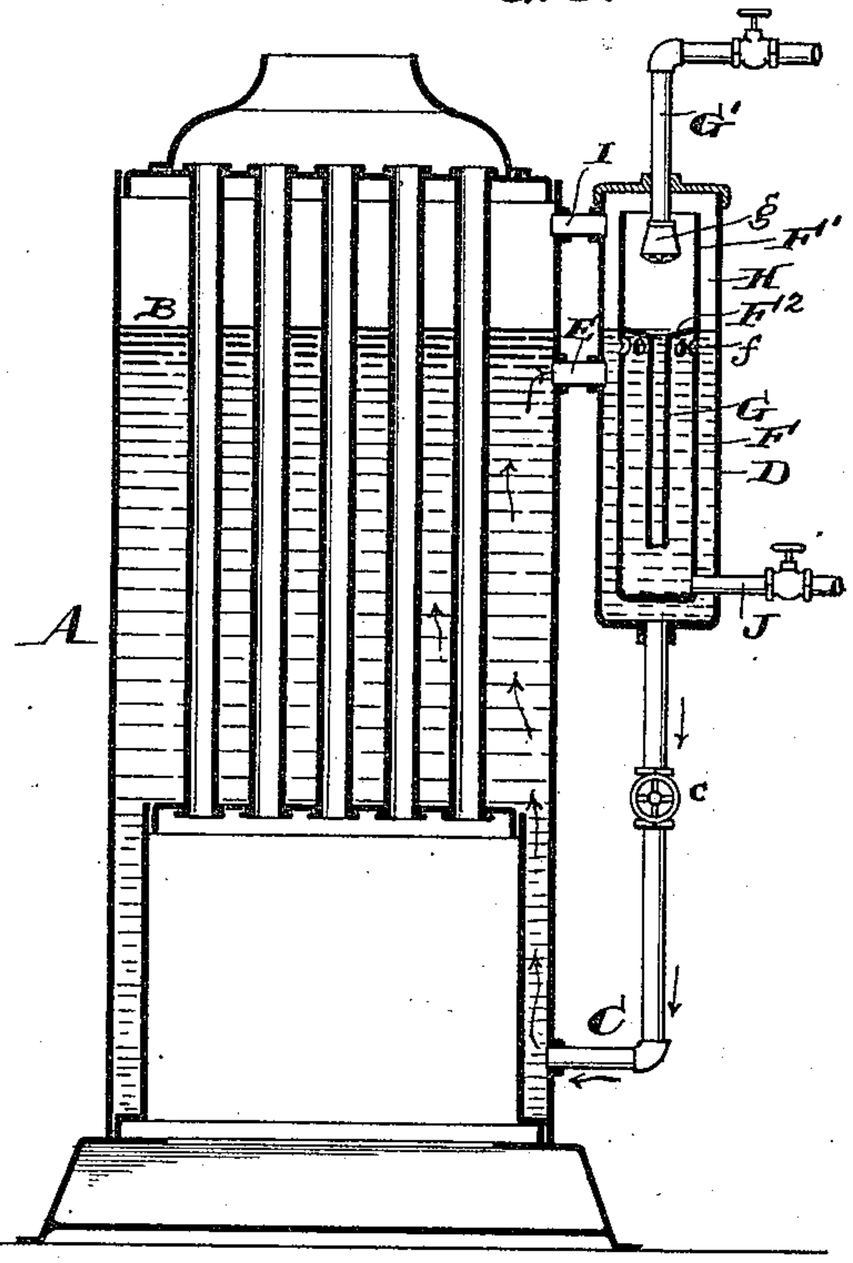
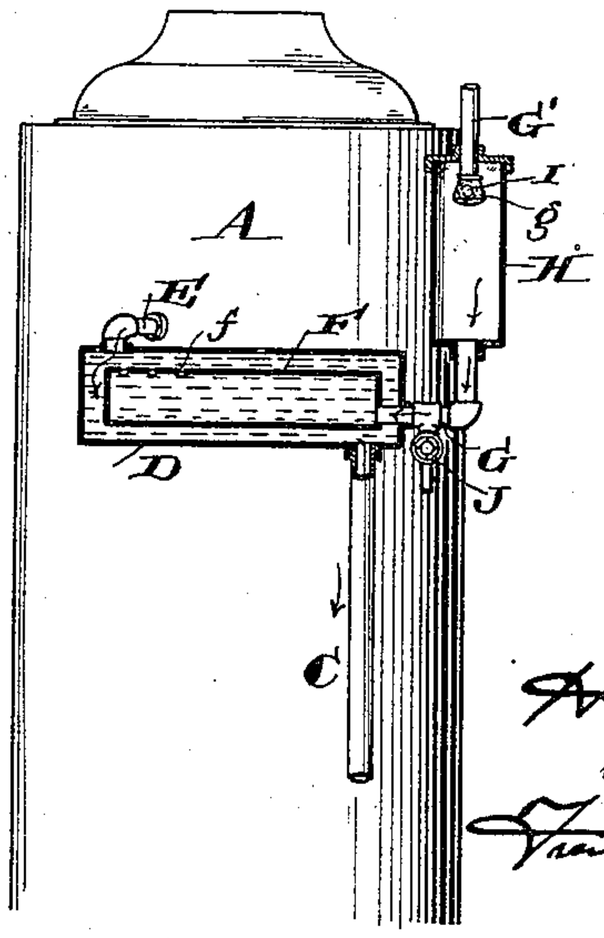


FIG. 5.



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UNITED STATES PATENT OFFICE.

HENRY WARDEN, OF PHILADELPHIA, PENNSYLVANIA.

FEED-WATER PURIFIER.

SPECIFICATION forming part of Letters Patent No. 450,437, dated April 14, 1891.

Application filed January 21, 1891. Serial No. 378,524. (No model.)

To all whom it may concern:

Be it known that I, HENRY WARDEN, of the city and county of Philadelphia, State of Pennsylvania, have invented a certain new and useful Improved Feed-Water Purifier and Heater, of which the following is a true and exact description, reference being had to the accompanying drawings, which form a part of this specification.

My invention relates to the construction of an improved device for heating and purifying the feed-water of a boiler, and has for its object to provide a purifier independent of and external to the boiler, but so connected with it as to draw its heat from a column of water constantly passing from and to the boiler, and preferably from the top of the boiler around the purifier and back to the bottom of the boiler, the purifier being so arranged that the water in it is not disturbed by the moving column, but is after purification fed gradually into it, and thus to the boiler.

The nature of my invention will be best understood as described in connection with the drawings, in which it is illustrated, and in which—

Figure 1 is a view of a boiler provided with my improved purifier, the purifier being shown in longitudinal section. Fig. 2 is a cross-sectional view taken through the boiler and purifier shown in Fig. 1 and upon the line 1 2 of said figure. Fig. 3 shows my improved purifier connected with a horizontal boiler. Fig. 4 is a vertical cross-section taken through the boiler and purifier, showing also, partly in section, a spray-water heater connected with the purifier. Fig. 5 is a cross-sectional view of the spray heater and purifier, taken on the line 3 4 of Fig. 4; and Fig. 6 illustrates in vertical section another modification of the combined spray heater and purifier.

A is the boiler, B indicating the water therein.

C is a pipe leading from the lower part of the boiler to the bottom of a casing or vessel D, from the top of which a pipe E leads back to the upper part of the boiler, but below the water-line.

Supported in the casing D, so as to leave a clear space around it, is another casing or vessel F, opening into casing D by perforations *f f*, &c., at its top, and into the bottom of the casing or vessel F a water-supply pipe G is led.

The above-described device constitutes my main invention in, I believe, its best form. It will be seen at once that the pipes C and E and the vessel or casing D will be always full of a solid column of water, which is heavier than the corresponding column of water and steam in the boiler, and will therefore descend, drawing fresh water from the boiler and keeping up a constant circulation, fresh and highly-heated water being drawn from the boiler as the heavy column descends by its greater weight. It is obviously possible to move the column of water by force as well as by gravity, and it will be understood that I do not limit myself exclusively to a descending water-column. A constant current of water is forced by means of an injector or pump (not shown) through the supply-pipe G to the bottom of the casing or vessel F, which is thus filled with water which is constantly drawing heat from the column descending in the casing D, and the upper and hottest portion of which is constantly passing out through the perforations *f* and mingling with the descending column passing through the casing D and the pipe C. The heating of the water in the casing F has the usual effect of causing it to precipitate the mud with which it is contaminated or the salts held in suspension in it, and these impurities accumulate at the bottom of the casing F, from which they are blown out at convenient intervals, a blow-off pipe being provided for this purpose—as, for instance, pipe J.

I prefer in many instances to use in combination with my purifier a spray-heater—for instance, as is indicated in Figs. 4, 5, and 6. In the construction shown in Figs. 4 and 5 a casing H connects with the supply-pipe G, and by means of a pipe I with the steam space of the boiler, the casing H being in part at least above the water-level, and into the top of the casing a pipe G′, having a rose *g* at its end, is introduced. The injector or pump forces the water through pipe G′ and sprays it into the chamber H, the

spraying falling through the steam with which the said chamber is filled and taking up heat therefrom, and the heated water accumulating in the bottom of the casing H flows through pipe G into the purifier-casing F, depositing its impurities therein and escaping therefrom into the casing B, as already described.

In Fig. 6 of the drawings a slight modification of the foregoing device is shown, the spray-chamber H being formed of an upwardly-extending portion of the casing D, which casing, in addition to the pipes C and E, connecting it with the water-space of the boiler, has also a pipe I, connecting it with the steam-space. The purifier-casing F extends up into the steam-space H, its upper portion being open, a diaphragm F^2 extending across the casing F, as shown. The supply-pipe G leads through its diaphragm to the bottom of the casing, and openings *f f*, &c., are formed through the casing F below the diaphragm. The operation of the device constructed in this way is obviously identical with that illustrated in Figs. 4 and 5.

Having now described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. The described device for heating a feed-water purifier and supplying the boiler with purified and heated water, consisting of a conduit, as C D E, through which water is caused to pass from and to the boiler, in combination with a casing, as F, situated in said conduit and communicating therewith through an opening or openings, as *f f*, and a supply-pipe, as G, leading into the casing F.

2. A feed-water purifier consisting of a casing D, having connections, as C E, adapted to connect it with a boiler below its water-line, in combination with an interior casing F, having an opening or openings, as *f f*, &c., at its top, and a supply-pipe, as G, leading into it, all substantially as and for the purpose specified.

3. The combination, with a boiler, of an exterior casing, as D, a pipe C, leading from the bottom of said casing to the lower part of the boiler, a pipe E, leading from the top of said casing to the upper part of the boiler, but below its water-line, a casing F, situated in casing D and having an opening or openings, as *f f*, &c., at its top, and a water-supply pipe leading into casing F, all substantially as and for the purpose specified.

4. A feed-water purifier consisting of a casing, as D, having openings at bottom and top adapted to connect it with a boiler, as specified, in combination with an interior casing, as F, having openings at its top leading into the casing D, a casing or chamber H, adapted to connect with the steam-space of the boiler, a spray-supply pipe G′, leading into casing H, and a pipe G, leading from casing H to the bottom of casing F, all substantially as and for the purpose specified.

HENRY WARDEN.

Witnesses:
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