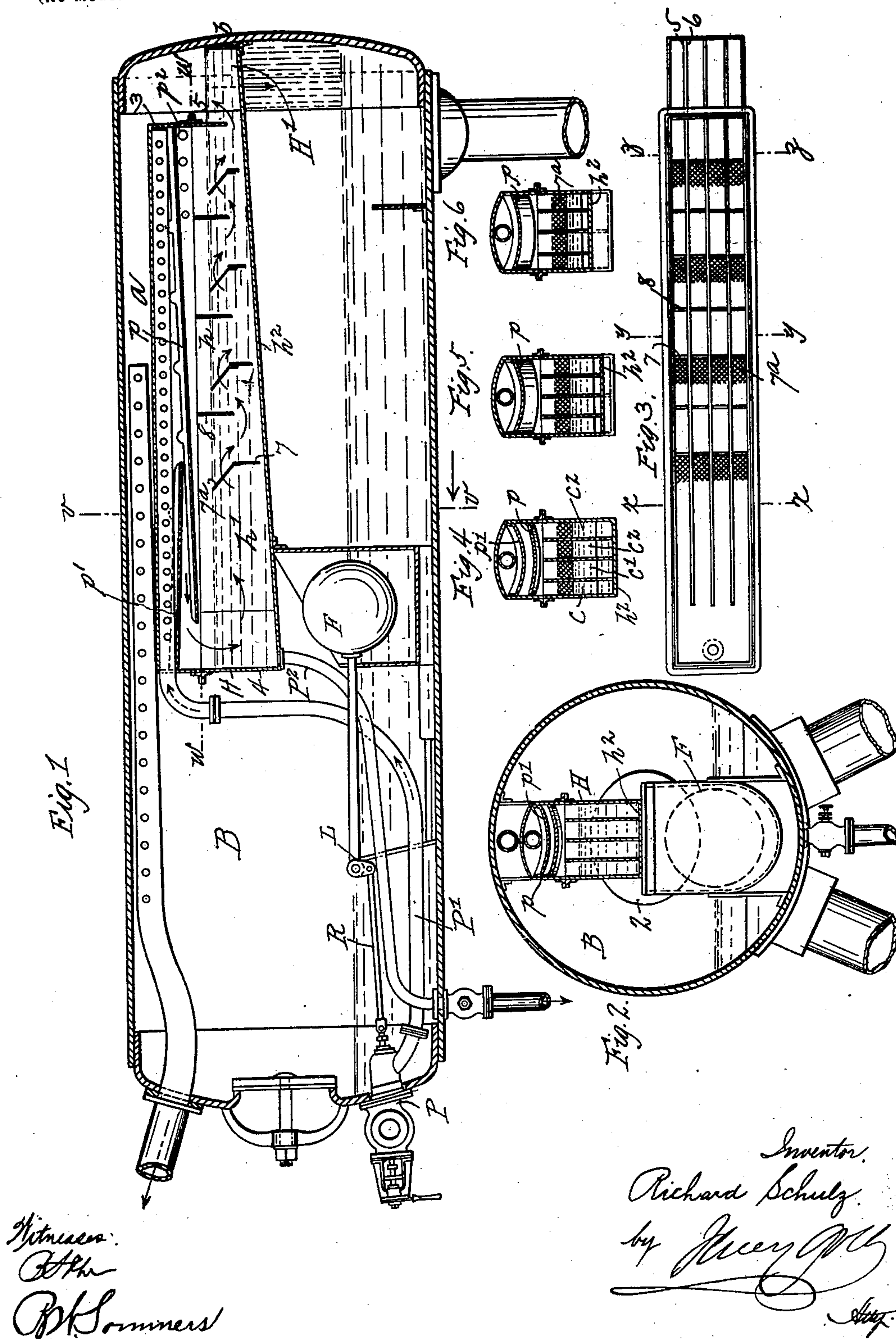


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Patented Jan. 29, 1901.

R. SCHULZ.
FEED WATER HEATER.
(Application filed June 28, 1900.)

(No Model.)



UNITED STATES PATENT OFFICE.

RICHARD SCHULZ, OF BERLIN, GERMANY.

FEED-WATER HEATER.

SPECIFICATION forming part of Letters Patent No. 666,822, dated January 29, 1901.

Application filed June 28, 1900. Serial No. 21,971. (No model.)

To all whom it may concern:

Be it known that I, RICHARD SCHULZ, a subject of the King of Prussia, German Emperor, residing at Berlin, Germany, have invented certain new and useful Improvements in Feed-Water Heaters; and I do hereby 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 letters and figures of reference marked thereon, which form a part of this specification.

This invention has relation to feed-water heaters for steam-boilers; and it has for its object a construction whereby the feed-water can be heated to or approximately to the temperature of the boiler-water before it reaches the latter and also whereby such feed-water is freed from impurities, whether solid—as, for instance, salts liable to form boiler incrustations—or liquid, as oil or grease.

That my invention may be fully understood I will describe the same in detail, reference being had to the accompanying drawings, in which I have illustrated my improved feed-water heater in connection with the upper boiler of that type of steam-generators having such upper boiler and one or more lower boilers connected with said upper boiler by means of a series of water-tubes (not shown in the drawings) and by means of a water leg or legs, (partly shown in said drawings,) the type of boiler being well known and examples of such shown in my applications for Patent, Serial No. 15,390, filed May 3, 1900, and Serial No. 19,727, filed June 9, 1900. I do, however, not desire to limit the use of the heater and purifier to this type of steam-generator nor to its location within the boiler of any type of generator, as it will be obvious from the description which follows of the construction and function of said heater and purifier that it may be used in conjunction with any type of steam-generator and may be located either within the steam-space of the boiler or, if sufficient steam-space is not available, partly within said steam-space and partly within the water-space, or said heater and purifier may be located in a suitable chamber externally of the boiler and adapted to be supplied with boiler-steam, in which case such

heater may be used for supplying feed-water to a multiplicity—i. e., a battery—of boilers, for instance.

In said drawings, Figure 1 is a longitudinal section of the upper boiler of that type of water-tube steam-generators having an upper and one or more lower boilers, illustrating my improved feed-water heater and purifier also in longitudinal section. Fig. 2 is a cross-section taken on line *vv* of Fig. 1, looking in the direction of arrow. Fig. 3 is a plan view of the lower body of the heater, the upper body having been removed; and Figs. 4, 5, and 6 are vertical transverse sections taken, respectively, on lines *ww*, *xx*, *yy*, and *zz* of Fig. 3.

The feed-water heater and purifier H, when located within a boiler, as shown in Figs. 1 and 2, and if the vertical diameter of said boiler admits of this, is preferably arranged wholly within the steam-space and is of such cross-sectional area as to be readily introduced or removed from the boiler through the manhole usually provided in one or the other boiler-head. In the drawings I have shown this manhole 2 in the front head of the boiler B. The length of the heater may of course vary with the length of the boiler, but should be sufficient to admit of the heating of the feed-water to or about to the temperature of the boiler-water.

The heater may be secured in the boiler in any desired manner. Its rear end may be supported from suitable angle-brackets secured to the rear boiler-head *b*, while the forward end of said heater may be supported from cross-braces or, as shown, from a housing open at front and top for the float F, that controls the supply of feed-water to the heater, said float being mounted on the long arm of a bell-crank lever L, the short arm of which is connected by a rod R with the feed-water-supply controlling-valve in pipe P, having delivery branch P'.

The feed-water heater H consists of a casing having an upper and lower body connected together and divided into an upper receiving and preheating chamber *h* and a lower heating and delivery chamber *h'* by a forwardly-inclined cross-partition *p*, extending from the rear wall 3 of the upper chamber *h* nearly to the front wall 4 of the heater,

a reversely-inclined cross-partition p' being provided and extending from the front wall of the heater some distance over the partition p , as shown in Fig. 1, so as to guide the feed-water supplied to said chamber h to chamber h' . These cross-partitions p and p' are concave-shaped in cross-section, as clearly shown in Figs. 4, 5, and 6, and in the lateral walls at the rear end of the heater below the cross-partition p and also in the rear end wall of the upper chamber h' are ports p^2 for the admission of steam below and above said partition, which is thus highly heated and therefore heats the feed-water supplied thereto.

In order that the feed-water may be more readily and thoroughly preheated on its admission into the heater-chamber h , the feed-pipe P enters the heater through an opening in its front wall and extends along the roof of said chamber h to its rear wall, that portion of pipe P within the chamber being provided with numerous perforations, as shown in Fig. 1, so as to deliver the feed-water over the full length of the cross-partitions p and p' in the form of spray, and as cross-partition p does not extend to the front wall of the chamber h , as well as the chamber h' , above the feed-water level in the latter are constantly filled with boiler-steam. Obviously the feed-water supplied to the chamber h in the form of spray at once takes up the heat from the steam, and as the partitions p and p' are heated by steam the feed-water and water of condensation flowing in a comparatively thin stream over said partitions is further heated before it reaches the chamber h' .

The heater-casing is of greater depth at its forward end than at its rear end and has a shallow rear extension H' , into which the rear wall of chamber h dips, so as to allow the water from chamber h' to flow under said rear wall and into said rear extension, from which said water overflows into the boiler. The lateral walls of the rear extension H' therefore determine the level of the water in the heater-chamber h' , and the depth of the overflow extension can be varied according to the conditions of use.

The heater-chamber h' is divided longitudinally into a number of channels $c c' c^2 c^3$, extending from the delivery end of partition p to the rear wall of the overflow extension H' , as shown in Figs. 1 and 3. Each of these channels is formed by two vertical partitions 5 and 6, rising above the level of the water in chamber h' , while in the overflow extension H' said partitions are of the same height as the lateral overflow-walls and may, if desired, be dispensed with in so far as said extension is concerned.

By means of the construction described I provide between each two channels $c c'$ and $c^2 c^3$ a steam-chamber open at top, to which the boiler-steam in chamber h' has free access. I furthermore provide means for retarding the flow of water from the deeper for-

ward end of the heater to the overflow extension and for arresting impurities carried into chamber h' by the feed-water. This I accomplish by interposing in the channels $c c' c^2 c^3$ a certain number of baffle-plates or cross-partitions 7 and 8, arranged at suitable distances apart in such a manner as to compel the feed-water to flow alternately upward and downward or take a vertical zigzag course from the forward to the rear end of said channels. The baffle-plates 7, as shown in Figs. 1 and 3, have an upper forwardly-inclined foraminous extension 7^a and do not extend quite to the bottom h^2 of the heater, thus leaving a clear space along the full length of the bottom of each said channels $c c' c^2 c^3$.

The object of the described construction is, first, as stated, to retard the flow of water from the forward end of the heater to the overflow extension, so as to admit of a thorough heating of the feed-water before it passes into the boiler; second, to arrest or intercept solid impurities and allow them time to subside and settle along the bottom of the aforesaid channels; third, to intercept and arrest such lighter impurities as may float on the top of the water in chamber h' , as oil, grease, or other light impurities, and, fourth, to admit of the ready removal of such impurities. For the last-named purpose I provide at the forward or deeper end of the heater a purge-pipe P^2 , having a suitable stop-cock, which when opened while steam is being generated the latter will blow the contents of the heater out through said pipe, as will be readily understood. Practice has demonstrated that the greater proportion of the impurities will settle in the deeper receiving end of the heater H , where the greater portion of the lighter or floating impurities will likewise collect, these deposits and floating impurities diminishing in quantity from baffled section to baffled section of the channels $c c' c^2 c^3$, the rear-most sections being practically free from such impurities, so that the feed-water will reach the boiler in a practically pure state, thus minimizing the formation of boiler incrustations.

From what has been said it will not be difficult to understand that the feed-water will reach the boiler at the same temperature as the boiler-water, or at about 200° centigrade, under a boiler-pressure of fifteen atmospheres.

The operation of the feed-water heater is an automatic one and requires no supervision.

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

1. A feed-water heater and purifier, comprising a closed shell or casing divided longitudinally into superposed chambers in communication with each other at one end of the casing, an outlet for the lower chamber at the opposite end of said casing above the bottom thereof, means for supplying feed-water to the upper chamber, means for baffling the di-

rect flow of water through the lower chamber, and ports at the delivery end of the casing, for admitting steam to both chambers; in combination with a steam-chamber in which said heater and purifier is contained, for the purpose set forth.

2. The combination with a steam-boiler, of a feed-water heater and purifier located wholly or partially within the steam-space of said boiler and comprising a closed shell or casing divided longitudinally into superposed chambers communicating with each other at one end, an outlet for the lower chamber at the opposite end of the casing above its bottom, ports at the latter end above the normal water-level in the casing admitting steam to both chambers, a water-feed pipe extending into the upper chamber, and means for baffling the direct flow of the water through the lower chamber, for the purpose set forth.

3. The combination with a steam-boiler of a feed-water heater and purifier located wholly or partially within the steam-space of the boiler, and comprising a closed shell or casing divided longitudinally into superposed chambers in communication with each other at one end, an outlet for the lower chamber at the opposite end and above the bottom of said casing, ports at the latter end above the normal water-level in the casing admitting steam to both chambers, a perforated feed-pipe extending the full length of the upper chamber, means for baffling the direct flow of water through the lower chamber and means for blowing sedimentary matter out of the latter chamber, for the purpose set forth.

4. The combination with a steam-boiler, of a feed-water heater and purifier located wholly or partially within the steam-space of the boiler and comprising a closed shell or casing divided longitudinally into superposed chambers in communication with each other at one end, an outlet for the lower chamber at the opposite end and above the bottom of said casing, ports at the latter end above the normal water-level in the casing admitting steam to both chambers, a perforated feed-pipe extending the full length of the upper chamber, means controlled by level variations in the boiler and controlling the supply of water to the heater and means for baffling the direct flow of water through the lower chamber, for the purpose set forth.

5. A feed-water heater consisting of a casing of greater depth at one end than at the other and having an overflow extension at the end of least depth, said casing divided into upper and lower chambers in communication

with each other at the end of greatest depth, a perforated feed-pipe extending the full length of the upper chamber, a guide extending from the forward end of said chamber over the intercommunicating space between the two chambers and over the floor of the upper chamber, means for admitting boiler-steam to both chambers, and means for retarding the flow of water through the lower chamber to the overflow extension, for the purpose set forth.

6. A feed-water heater having upper and lower chambers in communication with each other at one end, and outlet for and at the opposite end of the lower chamber, said lower chamber divided into circulating-channels extending from end to end of the chamber, baffle-plates in said channels arranged to form a circuitous passage and a clear passage along the floor of the chamber, means for feeding water to the upper chamber, means for admitting steam to both chambers and a purge-pipe opening into the lower chamber at its receiving end, for the purpose set forth.

7. A feed-water heater having upper and lower chambers in communication with each other at one end, an outlet for and at the opposite end of the lower chamber, said lower chamber divided into circulating-channels extending from end to end of the chamber, a heating-chamber between each two channels, baffle-plates in said channels arranged to form a circuitous passage and a clear passage along the floor of the chamber, means for feeding water to the upper chamber, means for admitting steam to both chambers, and a purge-pipe opening into the lower chamber at its receiving end, for the purpose set forth.

8. A feed-water heater having upper and lower chambers in communication with each other at one end, an outlet for the lower chamber at the opposite end, means for feeding water to the upper chamber, means for supplying steam to both chambers, said lower chamber divided into channels by heating-chambers open at top and extending from end to end of said lower chamber, and means for maintaining the level of the water in the channels below the open end of said heating-chambers, for the purpose set forth.

In testimony that I claim the foregoing as my invention I have signed my name in presence of two subscribing witnesses.

RICHARD SCHULZ.

Witnesses:

MAX. C. STAEHLER,
HENRY HASPER.