

(No Model.)

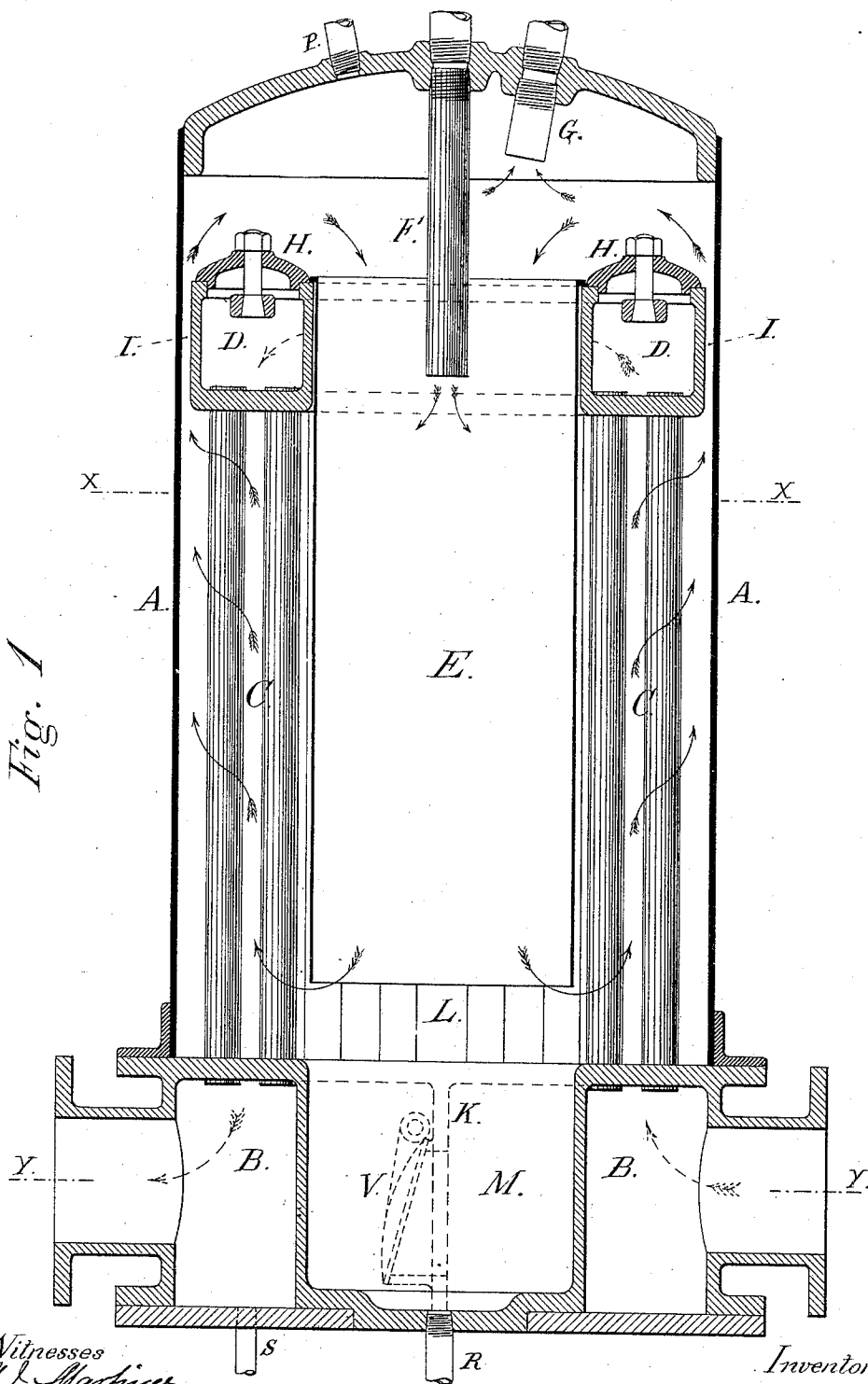
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A. A. GOUBERT.
FEED WATER HEATER.

No. 319,232.

Patented June 2, 1885.

Fig. 1



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Fig. 2

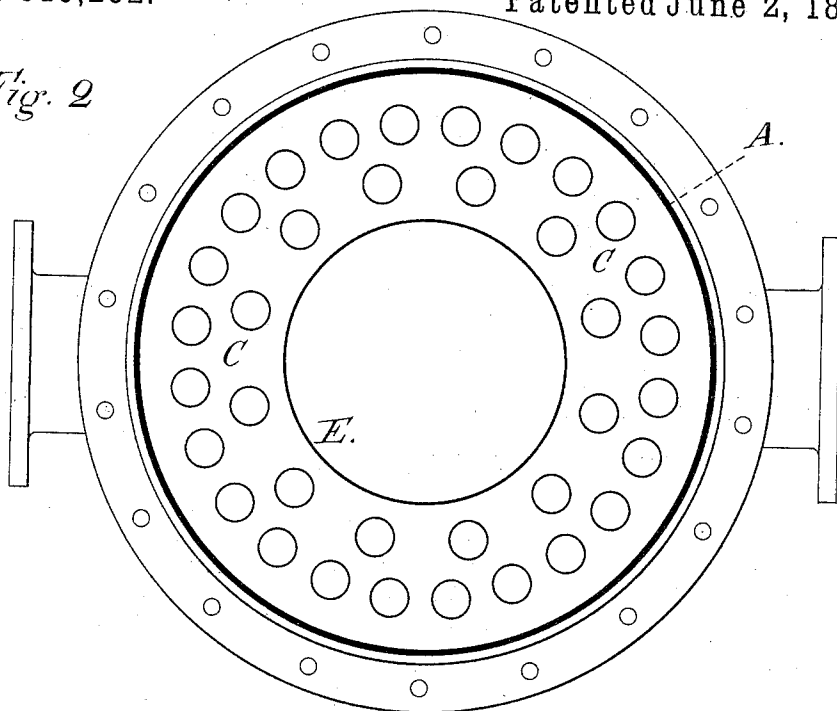
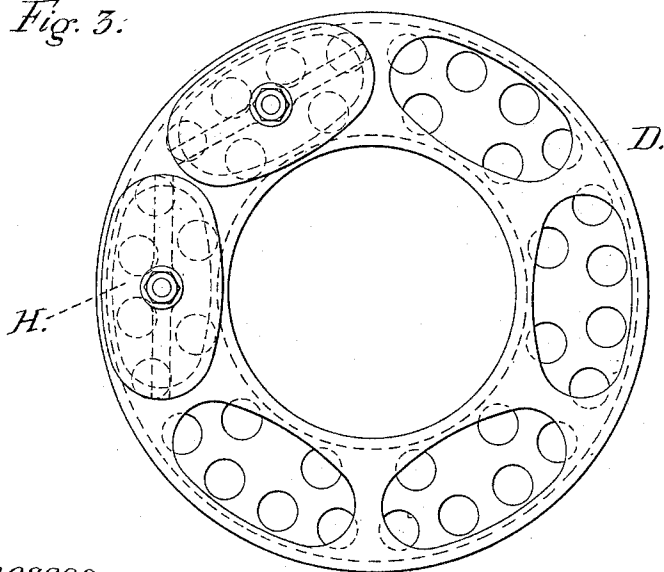


Fig. 3.



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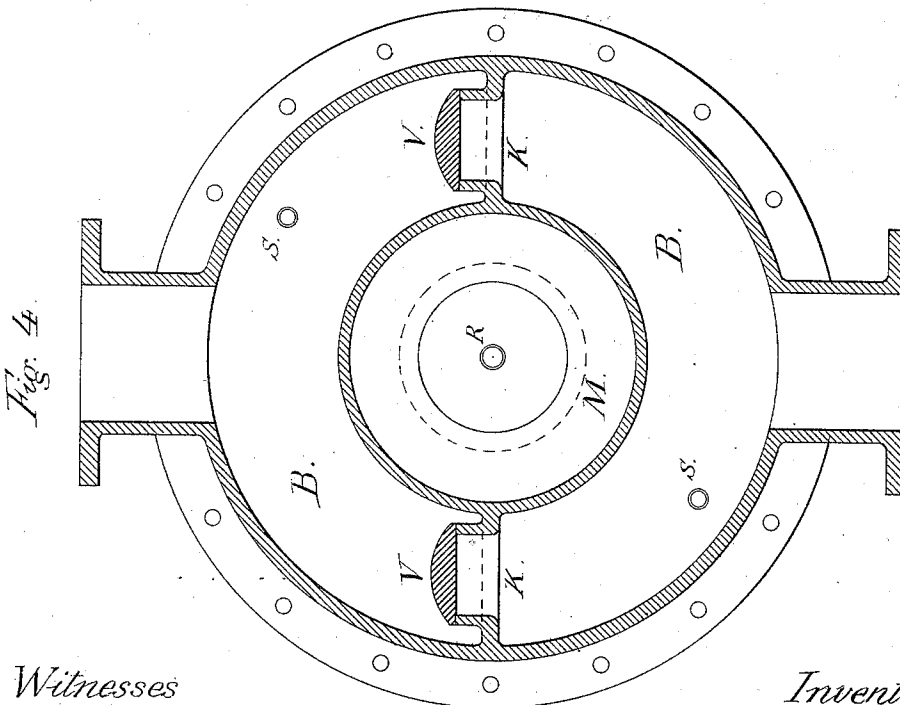
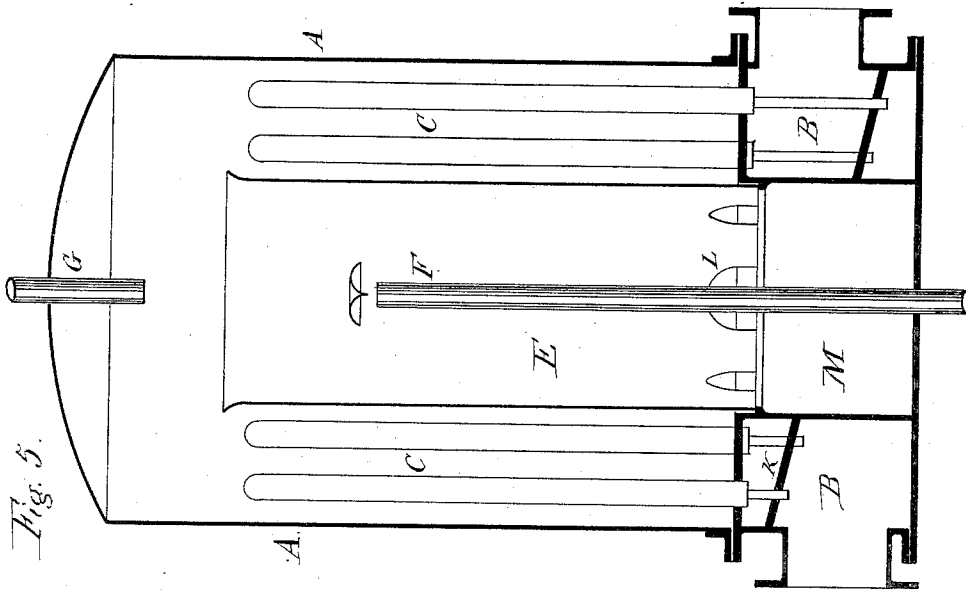
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UNITED STATES PATENT OFFICE.

AUGUSTE A. GOUBERT, OF JERSEY CITY, NEW JERSEY.

FEED-WATER HEATER.

SPECIFICATION forming part of Letters Patent No. 319,232, dated June 2, 1885.

Application filed March 5, 1885. (No model.)

To all whom it may concern:

Be it known that I, AUGUSTE A. GOUBERT, a citizen of the United States, residing at No. 307 York street, Jersey City, in the county of Hudson and State of New Jersey, have invented a new and useful Improvement in Feed-Water Heaters, of which the following is a specification.

My invention relates to that class of feed-water heaters and purifiers in which the water to be heated is contained in a closed chamber having tubes projecting into it, whereby the heat is transmitted from the steam inside of the tubes to the water in the chamber; and my improvements consist, first, in providing a large central circulation pipe or channel for the purpose of inducing a positive circulation of the water to be heated; secondly, in providing a recipient or settling well at the bottom of the apparatus, where the separation and settling of precipitated salts can take place undisturbed; thirdly, in the manner of introducing the cold water into the apparatus, consisting in injecting the said water inside of the above-mentioned circulation-pipe; fourthly, in providing the lower steam-chamber with a relief valve or valves to prevent an excess of back-pressure on the engine; fifthly, in providing the upper return-steam chamber with a number of small hand-holes and hand-hole plates, each placed over and giving access to a few of the tubes, whereby a single tube can be reached for inside cleaning or repairs without breaking the joints over all the tubes, all as and for purposes hereinafter described.

In the drawings, Figure 1 is a sectional elevation of the apparatus as I prefer to construct it. Fig. 2 is a horizontal section through the line X X in Fig. 1. Fig. 3 is a top view of the annular upper steam-chamber, D. Fig. 4 is a horizontal section through the line Y Y in Fig. 1, showing the relief-valves. Fig. 5 shows modifications of certain parts of my invention, and shows them applied to a well-known form of heater at present in use.

Similar letters of reference indicate corresponding parts in the various figures.

A is a chamber containing the water to be heated.

B is a steam-chamber divided into two parts by a partition, K.

C C are heating-tubes having their ends expanded or otherwise fastened into the top of

the chamber B and the bottom of the upper steam-chamber, D, which is annular in shape and forms the upper connection between the tubes.

E is a large tubular shield or circulation-pipe, which is shown in Fig. 1 as hanging on the chamber D, and in Fig. 5 as resting on the chamber B, but the purpose of which is to form a channel for the downward current of water.

F is the cold-water inlet-pipe.

G is the hot-water outlet-pipe.

H H are hand-hole plates or covers for closing the openings in the top of the annular steam-chamber D.

I is an annular passage left between the chamber D and the shell of the water-chamber A for the upward flow of the heated water.

L is a space or passage left between the lower end of E and the top of B for the flow of the water from the interior of E to the heating-surface.

M is a separating and settling chamber or well, in which the water, not being in contact with the bulk of the heating-surface, is comparatively still.

P is the scum-blow-off pipe.

R is the mud-blow-off pipe.

S is the drain-pipe to carry away the water of condensation.

V is a relief-valve forming a communication between the inlet side and the outlet side of the chamber B for the escape of surplus steam.

The operation of my apparatus is as follows: If we suppose the chamber A to be filled with water and that steam be admitted into the apparatus, the said steam will travel up one set of tubes and down the other, as shown by the dotted arrows in Fig. 1. It may be noted here that the exhaust-steam entering at a temperature near 212° Fahrenheit leaves at atmospheric pressure, less than one-sixth being condensed in heating the feed-water, and that the temperature inside of the heating-surface is practically the same all over. The water among the tubes C, becoming now heated, ascends and a circulation is established upward among the heating-surfaces and downward in the central channel, E, as shown by the black arrows in Fig. 1, until the water is heated to the same temperature as that of the steam. A uniform and increased effectiveness of the heating-surfaces is thus secured, while, on account of the said circulation, the

chances of incrustation by adherence of precipitated salts to the tubes are lessened. If cold water be now forced in through the inlet-pipe F, this cold water meets a large body of hot water coming down the pipe or channel E, and becomes heated to a considerable extent, and therefore precipitates a portion of the salts it holds in solution before it reaches the heating-surface. These salts not being precipitated in contact with the heating-surface do not adhere to it, and the chances of incrustation are thus again lessened. The water traveling downward in the pipe E arrives at its lower edge, turns under it and spreads uniformly among the tubes, while a large portion of the precipitated sediment is projected into the well M, where, the water being comparatively still, it separates and settles at the bottom until it is blown off through the pipe R, and the purified and heated water passes out at G.

Records of experiments on the transmission of heat through pipe-surfaces show that to transmit the heat necessary to heat the feed-water to 212° one-quarter of one square foot of heating-surface for each horse-power of boiler is sufficient under favorable circumstances. In all the heaters at present in use it is found necessary to provide from one to one and a half square foot for the same purpose—that is, from four to six times as much. This is undoubtedly due to deficient circulation in a great measure, the heat being mostly transmitted by radiation, instead of by conduction. Another cause is the speedy incrustation of the tubes, as the heating of the cold water to a high degree, and consequent precipitation of sediment, only takes place in contact with the tubes. In all other heaters of that class, also, the cold water is introduced in the lower part of the apparatus, but on one side, and the tubes nearest to the inlet have the greatest efficiency, as the difference in temperature between them and the water is the greatest, while the tubes on the opposite side are much less efficient, there being a great lack of uniformity thereby in the efficiency of the heating-surface.

The object of my invention is to remedy as far as possible all these defects.

In feed-water heaters of the class of that shown in Fig. 1, in which the steam is made to travel up one set of tubes and down the other, it is found that the friction in the tubes and at each turn of the steam retards the flow and causes a considerable amount of back-pressure on the engine, especially when, the load on the engine becoming greater, the steam follows farther before being cut off and a larger amount of steam is exhausted. To overcome this difficulty, I introduce in the path of the steam one or more relief-valves, V, forming a communication between the steam inlet and outlet nozzles, and this valve is so adjusted that should the back-pressure increase above, say, one-quarter of a pound per square inch, it opens and a portion of the

steam passes through it, instead of passing up the tubes. It is evident that this valve may be placed in a connecting-pipe or by-pass between the inlet and outlet pipes, and outside the heater; but I prefer to locate it in the partition K, as shown in the drawings.

I claim as my invention—

1. In a feed-water heater, the combination, with a water-chamber, of a set of heating-tubes, a central vertical channel separated from the heating-surface by a tubular shield, all contained within the said water-chamber, and a passage for the water between the lower part of the shield and the bottom of the water-chamber, substantially as and for the purposes herein specified.

2. The combination, in a feed-water heater, of a water-chamber, a set of heating-tubes therein contained, a central vertical channel for the downward flow of the water, and a cold-water inlet-pipe arranged to discharge into the center of the said channel, as and for the purposes herein specified.

3. In a feed-water heater, the combination of a water-chamber, a set of heating-tubes therein contained, a central vertical channel separated from the heating-surface by a tubular shield, a passage for the water between the bottom of the shield and the lower tube-sheet, and a settling and separating well placed below the said passage, substantially as set forth.

4. The combination, in a feed-water heater, substantially as herein described, of the water-chamber A, the divided steam-chamber B, the tubes C, the annular steam-chamber D, the annular passage I, the circulation-pipe E, and the passage L, all arranged to act substantially as herein specified.

5. In a feed-water heater in which the steam travels inside of a set of heating-tubes, the combination of the steam inlet and outlet pipes with a relief valve or valves placed between the said inlet and outlet pipes, and forming, when open, a communication between the two, substantially as set forth.

6. The combination, in a feed-water heater, of a water-chamber containing heating-tubes, a steam-chamber divided by a partition into two compartments, the steam being admitted to the tubes through one of these compartments and passing out through the other, and a relief valve or valves placed in the said partition and forming when opened a communication between the said compartments, as set forth.

7. In a feed-water heater, substantially as herein described, the combination of the tubes C, the annular steam-chamber D, and the hand-holes and hand-hole plates H, substantially as and for the purposes herein specified.

Signed by me this 2d day of March, 1885.

AUGUSTE A. GOUBERT.

Witnesses:

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