(No Model.)

F. M. LUDLOW.

FEED WATER HEATER.

No. 357,934. Patented Feb. 15, 1887.

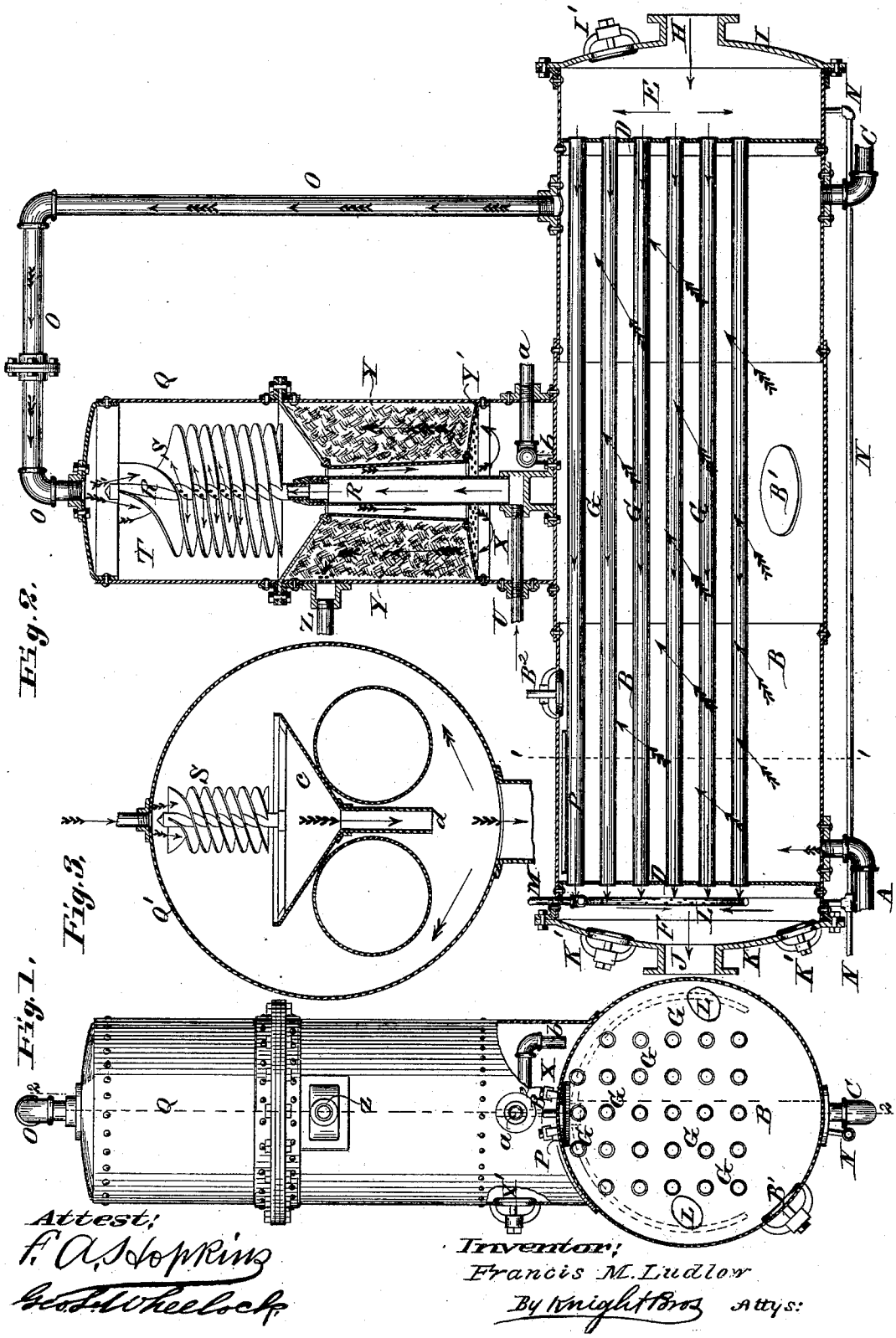


Fig. 2.

Fig. 3.

Fig. 1.

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UNITED STATES PATENT OFFICE.

FRANCIS M. LUDLOW, OF ST. LOUIS, MISSOURI.

FEED-WATER HEATER.

SPECIFICATION forming part of Letters Patent No. 357,934, dated February 15, 1887.

Application filed April 19, 1886. Serial No. 199,556. (No model.)

To all whom it may concern:

Be it known that I, FRANCIS M. LUDLOW, of the city of St. Louis, in the State of Missouri, have invented a certain new and useful Improvement in Feed-Water Heaters, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming part of this specification, and in which—

Figure 1 is a transverse section at 1 1, Fig. 2, showing parts broken away. Fig. 2 is a longitudinal section at 2 2, Fig. 1. Fig. 3 is a detail transverse section of a steam-boiler, showing the heating-helix applied thereto.

The feed-water from the force-pump first enters the bottom of a tubular heater and passes from the upper part thereof to a chamber in which is the helix, over which the water passes and is received in a chamber below, from which it passes upward through filtering material and then through a pipe leading to the boiler.

A is the pipe through which water enters the water-chamber B at the bottom, and near one end of the said chamber.

C is a blow-off or discharge pipe for the chamber B.

D are diaphragms separating the water-chamber B from steam-chambers E and F. The two steam-chambers are connected by tubes G passing through the diaphragms D.

H is the opening in the head I, through which the exhaust-steam from the engine enters the chamber E, the steam passing through the tubes G into the chamber F, and any uncondensed steam escaping through the opening J in the head K. In the upper part of the chamber F is a cold-water jet-pipe, L, fed by a pipe, M. I prefer to curve the jet-pipe in the same manner as the top of the chamber F. The pipe has a number of small perforations, through which the cold water passes, forming a fine spray for the condensation of the steam in the chamber.

I′ is a hand-hole in the head I, and K′ are hand-holes in the head K.

N is a pipe in communication with the lower parts of the chambers E and F and in communication with the suction-chamber of a pump, by which the water may be returned to the boiler or to any chamber of the feed-water heater.

The feed-water entering through the pipe A fills the chamber B and escapes through a pipe, O, from the upper part of the chamber at the opposite end from the induction-pipe A. As the water gradually ascends in the chamber B it is heated by the tubes G, which causes the earthy particles to separate from the water and settle in the bottom of the chamber B, the sediment being blown out from time to time through the blow-off pipe C.

It will be seen that the steam-tubes are all at a distance from the sides and the bottom of the chamber B, so that the water at these parts will not receive direct heat from the tubes, while the water in proximity to the tubes will be heated by them. The consequence will be that the water surrounding the tubes will ascend, while that at the sides will descend, forming a continuous circulation, which will insure the rapid heating of the water and prevent the accumulation of sediment on the tubes, thus keeping them in a condition for the free conduction of heat from the steam to the water.

B′ is a man-hole in the bottom of the chamber B, by which access may be had without removing the heads I or K.

B^2 is a hand-hole in the top of the chamber B.

P is a scum-pan, which is placed on top of the upper tubes, G, to collect the scum.

The pan may be removed from the chamber through the hand-hole B^2 and the scum emptied from the pan, or, a suitable pipe being attached, the scum can be blown off.

The eduction-pipe O extends to the upper end of the heating and filtering vessel Q, as shown in Figs. 1 and 2, or the upper part of the boiler Q′, as seen in Fig. 3. The vessel Q is shown secured to the top of the horizontal heater by a flange-joint; but there is no communication between their interiors except by the pipe O. The water from the pipe O falls upon the closed conical top of the steam-pipe R, upon which is supported the helix S. The helix is shown with four broad plates extending in coils around the pipe R, so nearly horizontal through the greater part that the water spreads in broad streams over them and flows down the whole length of the helix. The pipe R has numerous small holes for the passage of steam between the plates of the

helix into the chamber T. The steam-pipe R receives steam directly from the boiler through a pipe, U. It will be seen that the steam-pipe R is placed centrally in the vessel Q, passing through a water-passage, V, leading from the upper chamber, T, to the lower chamber, X, which is beneath the annular filter Y. The filter Y has a perforate metal bottom, Y′, through which the water flows, and after passing through the filtering material escapes through the pipe Z, leading to the steam-boiler.

Any mud settling in the chamber X may be got rid of through a blow-off pipe, *a*, having branches *b* leading to the lower parts of the chamber X.

X′ is a hand-hole in the side of the chamber X.

The chamber B and pipe O are full of water when the apparatus is in operation, and the water fills the vessel Q up to about the bottom of the helix.

In the modification shown in Fig. 3 the helix is placed within the steam-space of the boiler Q′ or steam-drum, and of course the steam-pipe R is absent, as the helix is immersed in steam at a high temperature. Beneath the helix is a flaring receiver, *c*, with a vertical discharge-spout, *d*, through which the feed-water and the scale-forming material precipitated therefrom flow from the helix to the lower part of the boiler. Thus it will be seen that the feed-water does not mix with the water in the upper part of the boiler.

It will be seen that in the use of the apparatus as shown in Figs. 1 and 2 the feed-water is first heated by the exhaust-steam and then by the live steam. A large proportion of the sediment is left in the chamber B, and almost, if not quite, all of the remainder in chamber X; but where all has not been removed the rest is taken out by the filter.

It will be seen that the water in the chamber B will be agitated among the tubes, while in the side and bottom spaces, which are clear of tubes, the movement of the water is steady, so that the sediment settles to the bottom of the chamber around the sides of the heater-shell and away from the tubes.

I claim as my invention—

1. In a feed-water heater, the combination, with a tank having induction and eduction ports, of heating-tubes passing through said tank a suitable distance from the sides and bottom thereof, so as to leave a clear space for the circulation of the water and the subsidence of foreign substances, the means for heating said tank being entirely above the bottom thereof, and means for removing the sediment, substantially as set forth.

2. In a feed-water heater, the combination, with a heated chamber and a water-supply pipe discharging thereinto, of a helix upon which the water falls, the outer edges of the fins or blades of which said helix is constructed being without upwardly-projecting flanges, in order that the water may be thrown off therefrom by the centrifugal force which it acquires in descending the helix, substantially as set forth.

3. In a feed-water heater, the combination of a heated settling-chamber, through which the water passes, a second heated chamber, into which the water is subsequently discharged, and a helix within the last-named chamber, upon which the water falls, substantially as set forth.

4. The combination of the helix S with central steam-pipe with apertures for the passage of steam between the plates of the helix.

5. In a feed-water heater, the combination, with an air-tight vessel having upper and lower chambers, of a passage connecting them, a filter between said chambers separated from the upper chamber and passage and in communication with the lower chamber by a perforated diaphragm, induction-openings for admitting water and steam to the upper chamber, an eduction-opening at the upper part of said filter, a blow-off in the lower chamber, and a helix in the upper chamber, substantially as and for the purpose set forth.

6. The combination, in a vessel having an opening at top, of an upper chamber containing a helix, S, a lower chamber connected with the upper chamber by a passage, and having a blow-off pipe, and a filter connected with the lower chamber through a perforate plate or gauze, and having discharge at the upper part.

7. In a feed-water heater, the combination, with the horizontal chamber B and the steam-chambers E and F at the respective ends thereof, of the horizontal tubes G, connecting said steam-chambers, the perforated water-pipe L in the chamber F, and the pipe N, communicating with both of said steam-chambers, substantially as and for the purpose set forth.

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Witnesses:
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