R. D. SINGER & F. DULLI.

FEED WATER HEATER.

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1,116,635. Patented Nov. 10, 1914.

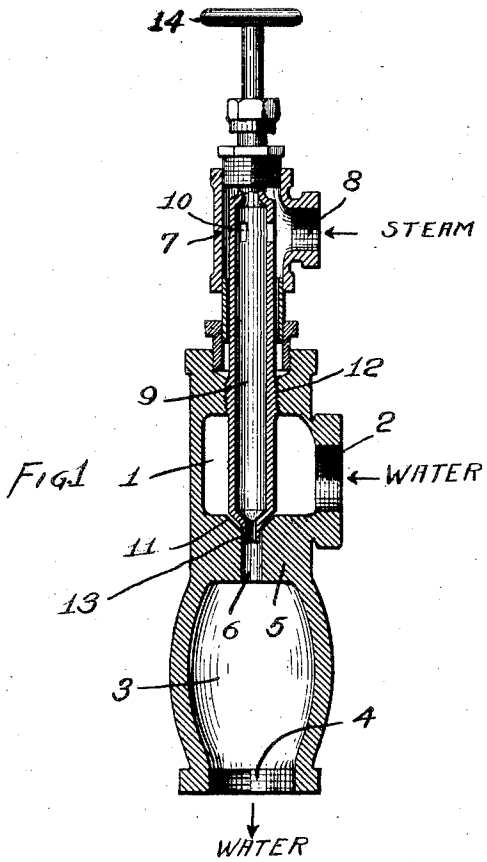

Fig. 1

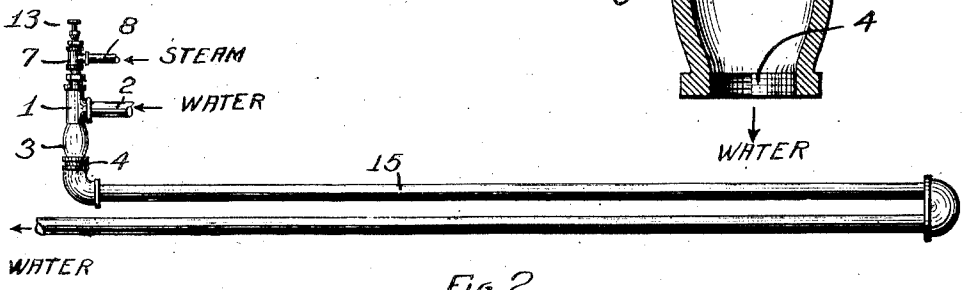

Fig. 2

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FEED-WATER HEATER.

1,116,635. Specification of Letters Patent. Patented Nov. 10, 1914.

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To all whom it may concern:

Be it known that we, ROBERT D. SINGER and FREDRICK DULLI, citizens of the United States, residing at Hamilton, Butler county, Ohio, have invented certain new and useful Improvements in Feed-Water Heaters, of which the following is a specification.

This invention concerns itself with a heater for dealing with the feed water of a steam boiler and has been designed primarily as an auxiliary heater to serve in connection with a feed water heater of ordinary type in which the cold water is raised in temperature by being subjected to the heating effect of exhaust steam before being forced into the boiler, our water heater, when employed in this auxiliary manner being disposed between the pump or injector and the boiler.

Our improvements will be readily understood from the following description taken in connection with the accompanying drawing in which:—

Figure 1 is a vertical diametrical section of our improved water heater; and Fig. 2 an elevation of the same, on a much smaller scale, and shown in connection with a mixing coil.

In the drawing:—1, indicates a water-chamber formed within a cast body; 2, a water-inlet to this chamber, this water-inlet being designed for connection with the discharge pipe of the feed pump or injector which is to force the water into the boiler; 3 a mixing-chamber in alinement with chamber 1; 4, a water-outlet from the mixing-chamber, this outlet being designed for connection with piping leading to the boiler into which the feed water is to be forced by the pump or injector; 5, a diaphragm separating water-chamber 1 from mixing-chamber 3; 6, a passageway through the diaphragm placing the two chambers in communication with each other; 7, a steam-chamber in alinement with the water-chamber and mixing-chamber; 8, a steam-inlet to this steam-chamber, this inlet being designed to connect with piping leading from the steam space of the boiler; 9, a steam-tube, closed at its upper end and open at its lower end, and arranged in the common axis of the three chambers, this steam-tube being capable of rotary and endwise motion; 10, ports placing the upper end of the steam-tube in communication with steam-chamber 7; 11, a valve formed by the lower end of the steam-tube and adapted to coöperate with a proper seat in diaphragm 5; 12, a screwed connection between the steam-tube and the general structure to permit of the steam-tube being adjusted endwise relative to the valve seat at its lower end; 13, a nozzle projecting from the lower end of the steam-tube and entering passage 6 but with such degree of looseness as will at all times form an annular steam passage around the nozzle; 14, a hand wheel on the upper end of a stem projecting upwardly from the steam-tube; and 15, a pipe coil connected with the water-outlet 4 and forming a portion of the pipe system placing the apparatus in connection with the boiler to be supplied with water.

If the steam-tube is screwed down so as to close valve 11 then no water can be pumped through the apparatus, though steam may flow through the steam-tube but, being taken from the boiler being fed, it will have insufficient pressure to open the usual check valve disposed between the boiler and the water feeding apparatus. But if the steam-tube be screwed upwardly somewhat then a water passage will be provided at valve 11, and water from the pump or injector will pass into passageway 6 and be joined by the steam from the steam-tube and enter mixing-chamber 3 and go thence to the boiler, the water in its passage taking up heat from the steam and having its temperature raised accordingly and, while the heat thus taken from the admitted steam is derived from the boiler, it is received by the water under such conditions as to bring about a material advantage, as has been determined by practical tests. The water passing the valve 11 may be in comparatively small quantities, as determined by the adjustment of the valve, and the pump or injector should be slowed accordingly, though in many practical installations the rate of water delivery will regulate itself in accordance with the resistance offered at valve 11. The relationship of the volumes of water and steam entering the mixing-chamber may be adjusted to be such that the steam strikes the water while the water is in the form of an annular film, believed to be the best condition for the transfer of heat, and it is believed that to this is due the fact that a given number of heat units is absorbed more advantageously by the feed water before it

enters the boiler than would be absorbed from the fire by a large body of water in the boiler.

The jet of steam flowing into passage 6 within the incoming annulus of water might be thought to act after the manner of an injector, but this thought loses its weight when it is considered that the water entering passage 6 is forced thereinto by the pump or injector at a pressure necessarily greater than that in the boiler, so that the annulus of water has a pressure equal to and generally greater than that of the jet of steam. It has been our thought that the steam and water would be thoroughly mixed in the mixing-chamber and result in the condensation of the steam into the water and the raising of the temperature of the water. And this we believe to be the case if the mixing-chamber is large enough, but we have found that an increase in efficiency is obtained by virtually enlarging this chamber. This might, of course, be done, by simply enlarging the mixing-chamber, but in practice we have found satisfactory results to flow from adding coil 15, of large pipe between the mixing-chamber and the boiler, this coil virtually adding to the volume of the mixing-chamber so that in case the condensation of the steam is not perfected within the mixing-chamber it will be done in the coil.

We claim:—

1. A feed water heater comprising a chamber-structure containing a water-chamber, a water-inlet thereto adapted for receiving water to be forced into the water-chamber by a pump or injector, a mixing-chamber, a partition separating the mixing-chamber from the water-chamber, a passage-way through the partition, an outlet from the mixing-chamber adapted for connection with a boiler, a steam-chamber, a steam-inlet adapted to admit steam from the boiler to the steam-chamber, a steam-tube passing from the steam-chamber through the water-chamber, a valve formed on an end of the steam-tube and adapted to coöperate with a seat formed in said partition, ports in the steam-tube at the steam-chamber, and means for adjusting the steam-tube endwise to regulate the degree of opening of said valve, combined substantially as set forth.

2. A feed water heater comprising a chamber-structure containing a water-chamber, a water-inlet thereto adapted for receiving water to be forced into the water-chamber by a pump or injector, a mixing-chamber, a partition separating the mixing-chamber from the water-chamber, a passage-way through the partition, an outlet from the mixing-chamber adapted for connection with a boiler, a steam-chamber, a steam-inlet adapted to admit steam from the boiler to the steam-chamber, a steam-tube passing from the steam-chamber through the water-chamber, a valve formed on an end of the steam-tube and adapted to coöperate with a seat formed in said partition, ports in the steam-tube at the steam-chamber, means for adjusting the steam-tube endwise to regulate the degree of opening of said valve, and a pipe coil connected with the outlet from the mixing-chamber, combined substantially as set forth.

3. A feed water heater comprising a chamber-structure containing a water-chamber, a water-inlet thereto adapted for receiving water to be forced into the water-chamber by a pump or ejector, a mixing-chamber, a partition separating the mixing-chamber from the water-chamber, a passage-way through the partition, an outlet from the mixing-chamber adapted for connection with a boiler, a steam-chamber, a steam-inlet adapted to admit steam from the boiler to the steam-chamber, a steam-tube passing from the steam-chamber through the water-chamber, a valve formed on an end of the steam-tube and adapted to coöperate with a seat formed in said partition, ports in the steam-tube at the steam-chamber, a threaded connection between the steam-tube and the chamber-structure to permit of the adjustment of the steam-tube endwise to regulate the degree of opening of said valve, a stem connected with the steam-tube and projecting outside the chamber-structure, and a handle for turning said stem, combined substantially as set forth.

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