(No Model.)

H. FAIRBANKS.

FEED WATER HEATER.

No. 371,048. Patented Oct. 4, 1887.

Fig. 1

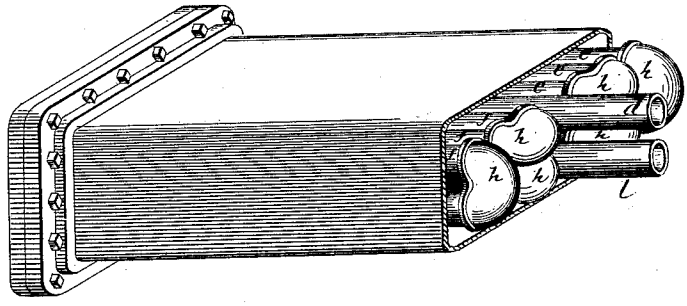


Fig. 4

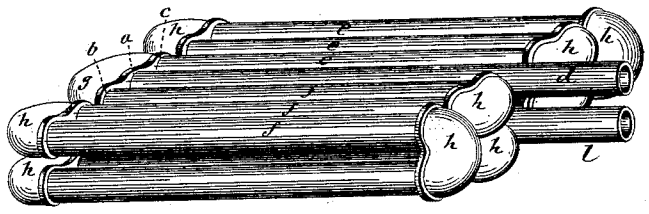


Fig. 2

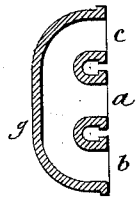


Fig. 6

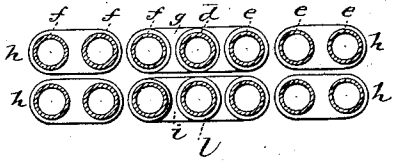


Fig. 3

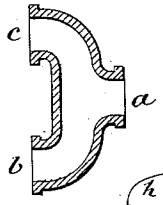
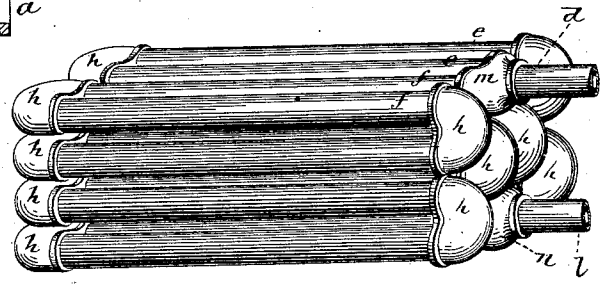


Fig. 5



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UNITED STATES PATENT OFFICE.

HENRY FAIRBANKS, OF ST. JOHNSBURY, VERMONT, ASSIGNOR TO THE FEED WATER HEATER COMPANY, OF PORTLAND, MAINE.

FEED-WATER HEATER.

SPECIFICATION forming part of Letters Patent No. 371,048, dated October 4, 1887.

Application filed February 14, 1887. Serial No. 227,518. (No model.)

To all whom it may concern:

Be it known that I, HENRY FAIRBANKS, of St. Johnsbury, in the county of Caledonia and State of Vermont, have invented a new Improvement in Feed-Water Heaters; and I do hereby declare the following, when taken in connection with accompanying drawings and the letters of reference marked thereon, to be a full, clear, and exact description of the same, and which said drawings constitute part of this specification and represent, in—

Figure 1, a perspective view of the heater, a portion of the case removed to show the series of tubes therein; Fig. 2, a section of the W or three-way connection; Fig. 3, a section of the Y or three-way connection. Fig. 4 represents the two series of tubes as connected by the W three-way connection. Fig. 5 represents the two series as connected by the Y three-way connection; Fig. 6, a transverse section of Fig. 4, looking toward the W-connection.

This invention relates to an improvement in feed-water heaters, with special reference to heaters which are adapted to be applied beneath the boiler of a locomotive, and in which the heater consists of a circulating-coil within a chamber, the chamber receiving the exhaust-steam from the cylinder and the coil serving to give to the water a circuitous path through the said chamber, whereby it becomes heated by the exhaust-steam, and it is an improvement upon the patent of Magoon, No. 298,006. In that patent, as in the usual construction of heaters where a circuitous coil is employed within a chamber, the coil is practically a continuous tube, so that the water entering at one point passes as through one tube throughout the circuit and then escapes by another passage. The continuous coil serves a very good purpose when the stream is perfectly steady, as from an injector; but I have found in practice that by dividing the stream of water the friction of water is very greatly reduced, and in case of the use of a pump there is very much less water-hammer in a divided circuit than in a continuous tube or circuit.

The object of my invention is to produce a device by which the stream may be divided, which shall be simple and effective and practically require no additional space in the heater.

To this end my invention consists in a heating-coil composed of two circuits, the two circuits being brought together at one end in a Y or W connection to receive a single stream, which by such connection is divided and forced through the two circuits and at the other end again brought together by a W or Y connection into a single exit-stream. By a W-connection is to be understood a three-way connection for a coil, with three openings on the same side, as seen in Fig. 2, in which the central opening, *a*, represents the inlet or outlet, as the case may be, while the two sides *b c* represent the turns made to divide the stream into two circuits, or to gather it from the two circuits, as the case may be. By a Y-connection is to be understood one in which the inlet or exit *a* is upon one side, while the two divisions *b c* are upon the opposite side, and as seen in Fig. 3. The Y or W connection is used according to the number of tubes in the circuit, as, for illustration, a fourteen-tube heater—that is, with two circuits of seven pipes each, as represented in Fig. 4—will require a W-connection, while a sixteen-tube heater, as seen in Fig. 5, will require a Y-connection.

In making the coils for heaters the tubes are cut to the required length, *d*, Fig. 4, representing the inlet-tube, *e* representing the tubes of the circuit on one side, and *f* representing the tubes of the circuit upon the opposite side. The tubes are all parallel. The inlet-tube *d* extends from one end of the case toward the opposite end, where it enters the central opening, *a*, in the W-connection *g*. The next tube in the series *e*, on one side, is introduced into the opening *c* in the connection *g*, and the next tube of the other circuit is introduced into the opening *b* on the opposite side. The several tubes of each circuit are connected by common U-bends *h*, and in the case of fourteen tubes, as seen in Fig. 4, they are in two layers, one above the other, the under one being the inlet. The tubes on each side return through the second layer of tubes until they come together into a second W-connection, *i*, like the connection *g*, and from the central opening in this connection *i* the exit-tube *l* leads. Under this

arrangement water is introduced through the tube *d*, and, passing to the W-connection *g*, it divides and turns in opposite directions, one part of the stream through the series of tubes *e* and the other part of the stream through the series of tubes *f*, the divided stream continuing through the respective series until they come together at the W-connection *i*. Thence the water passes out through the tube L.

In case of sixteen tubes the Y-connection is employed, as seen in Fig. 5. In this case *d* represents the inlet-tube which enters the single opening in the Y-connection *m*, and there the stream is divided by passing through the series of tubes *e* on one side and the other part of the stream through the series of tubes *f* on the opposite side, until finally they are brought together at the second Y-connection *n*, from which they are discharged through the outlet-tube *l*. The system of divided-circuit tubes is arranged in a case, as seen in Fig. 1, which case forms a chamber, as in the Magoon heater, to which steam is admitted from the cylinders to communicate heat to the circuit tubes, and so that water introduced, as before described, will pass through the respective circuits and, becoming heated, will escape through the outlet-tube to the boiler, or wherever it may be. This division of the stream greatly reduces the friction upon the water in passing through the tubes, over what it would be in a single stream, and dividing the stream so greatly reduces water-hammer from the action of the pump as to prevent all liability of accident therefrom or objection because of water-hammer.

The illustration of the W and Y, or what may be called three-way, connections for dividing the stream from a single inlet into two circuits, and bringing the said two circuits again together into a single outlet, will be sufficient to enable those skilled in the art to apply the said connections to circuits of any desirable number of tubes.

In the three-way connections two of the ways serve to connect the two series of tubes, and the other, or third, way serves as the inlet or outlet to or from the said two series, as the case may be.

I have described the invention as steam being admitted into the chamber and water to the tubes; but, like other heaters, this order may be reversed.

I claim—

A feed-water heater composed of two series of tubes, forming two independent circuits, and a three-way connection between the said two series at one end, the third way forming the inlet to said two series, the said two series of tubes connected at the other end by a three-way connection, the said two series opening respectively into two of the ways and the third way serving as the single outlet from the two series, the said two series of tubes arranged in a chamber with an inlet and an exit into said chamber around said two series of tubes, substantially as described.

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