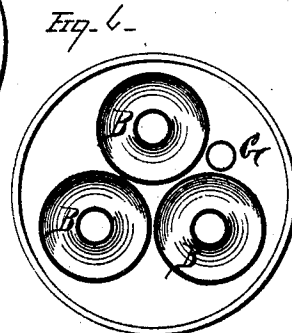
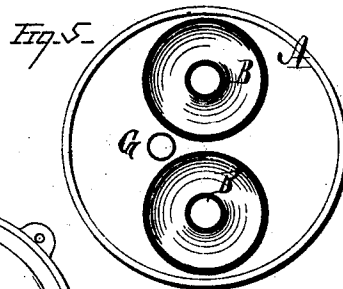
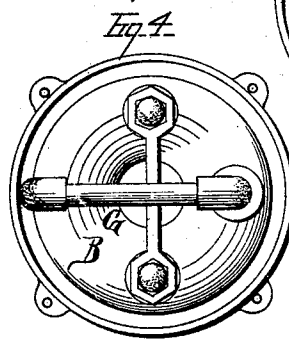
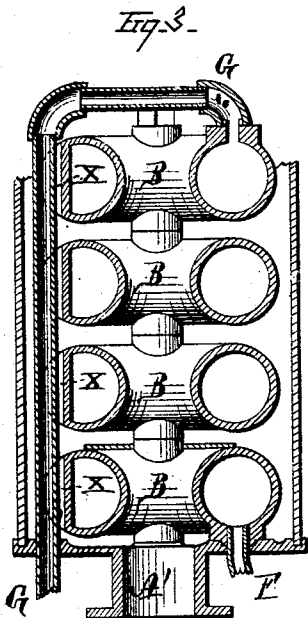
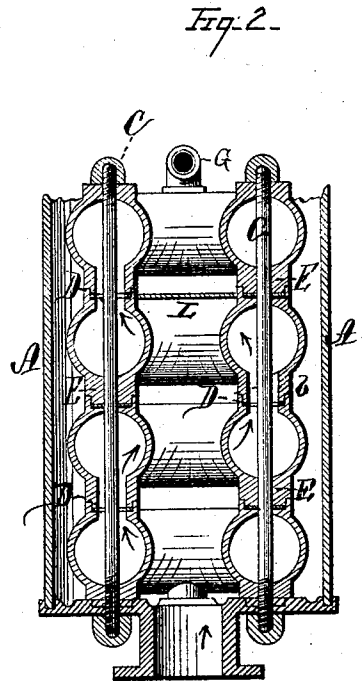
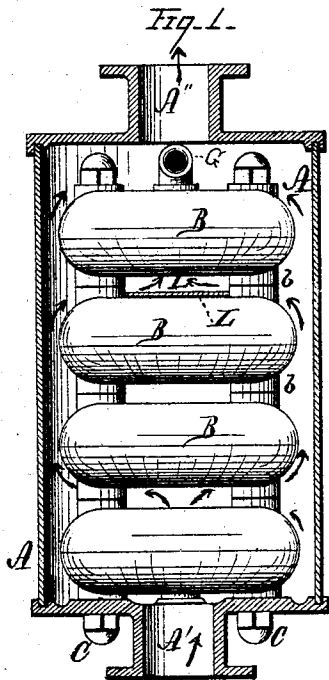


G. W. RICHARDSON.
Feed-Water Heaters.

No. 145,591.

Patented Dec. 16, 1873.



WITNESSES.

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UNITED STATES PATENT OFFICE.

GEORGE W. RICHARDSON, OF TROY, NEW YORK, ASSIGNOR TO BENJAMIN STARBUCK AND GEO. H. STARBUCK, OF SAME PLACE.

IMPROVEMENT IN FEED-WATER HEATERS.

Specification forming part of Letters Patent No. **145,591**, dated December 16, 1873; application filed September 29, 1873.

To all whom it may concern:

Be it known that I, GEORGE W. RICHARDSON, of the city of Troy, in the county of Rensselaer and State of New York, have invented a new and Improved Feed-Water Heater; and I do hereby declare the following to be such a clear, full, and exact description of the same as will enable others skilled in the art to which it pertains to use it, reference being had to the accompanying drawings, which form a part of this specification.

In the drawings, Figure 1 represents the interior of the feed-water heater, a part of the case having been cut away. Fig. 2 represents a vertical cross-section of the heater. Fig. 3 represents a section by a vertical plane taken at right angles to that of Fig. 2. Fig. 4 represents a top view of the heater with the top of the casing removed. Fig. 5 is a variation of my invention, in which two tiers of sectional tubing are arranged within one casing; Fig. 6, another variation, wherein three tiers of sectional tubing are arranged within one casing.

My invention consists of the combination of devices and appliances hereinafter described and claimed, for the purpose of heating the water before it is fed into a boiler, in which—

A is an outer casing, provided with openings A' A'' at its two ends, through which exhaust steam is made to pass. Within this casing A are hollow rings B, of cast-iron or other suitable material. These rings are made separate, and are united to each other by bosses *b*, at which points packing is placed between them, which takes up any expansion in the direction of the length of the casing. The hollow rings B, being superposed upon each other, are firmly tied together by longitudinal bolts C, which bolts are secured at the top by nuts, and at the bottom pass through the casing, and are secured by nuts upon the outside. Thus there is a combination formed of ring B, bolts C, and packed joints *b*, which will compensate for any expansion of the rings due to heat.

It will be seen that the bolts pass through large openings at the points D, whereas at the points E they fit snugly.

One or more diaphragms, L, may divide the space in the chamber, so as to deflect the current or course of the steam.

An inlet or water port, F, is provided at the bottom tier of hollow rings, and from the top

ring passes an exit or feed pipe, G, directly to the hot-water pump.

The operation of this feed-water heater is as follows: Exhaust steam is admitted into the port A', and passes up through the chamber A, out of the exhaust-port A'', and the steam in its passage is so deflected by intervening diaphragms L that it is made to expend all of the heat possible upon the rings B. Cold water enters the inlet-port F, passes up through the rings B, as indicated by the arrows in Fig. 2, and becomes thoroughly heated before passing out of the exit or feed pipe G, which passes down through the heater from top to bottom, between the casing and rings in the depressions X, formed in these rings, as shown.

I have described the course of the exhaust steam as being from bottom to top; but it is evident that either the steam or the water, or both, may be made to take the reverse course.

There may be any desired number of the hollow rings B; and instead of there being but one tier of these rings, there may be two tiers, as shown in Fig. 5, three, as shown in Fig. 6, or more.

Having thus described my invention, what I claim is—

1. In a feed-water heater, the series of annular hollow rings B, between each two of which are the solid bossed support E and the hollow or tubular bossed support D, arranged to alternate from top to bottom of the series of rings, by which the water is made to circulate around through the annular rings, as specified.

2. In a feed-water heater composed of case A and hollow rings B, the depressions X in the rings, to allow of the insertion of the pipe G between the rings and casing, as and for the purpose set forth.

3. As an article of manufacture, the herein-described feed-water heater, consisting of casing A, inlet-ports A' A'', and hollow rings B, having cup-joints and bosses packed, as shown, and secured by rods and nuts C, and having inlet and outlet pipes F G, all constructed, arranged, and operating substantially as described.

GEO. W. RICHARDSON.

Witnesses:

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