(No Model.)

E. L. STEWART.

FEED WATER HEATER.

No. 372,499. Patented Nov. 1, 1887.

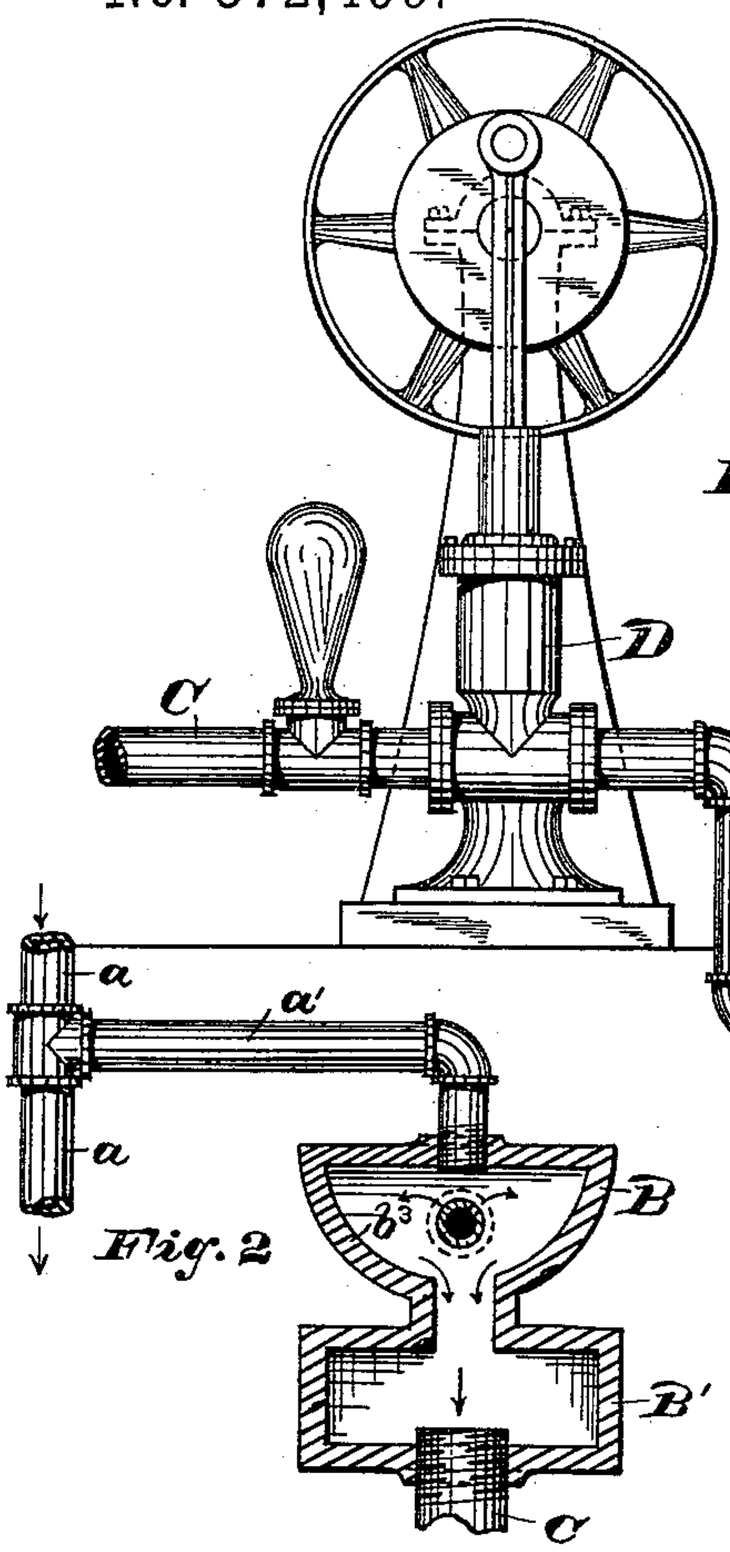

Fig. 2

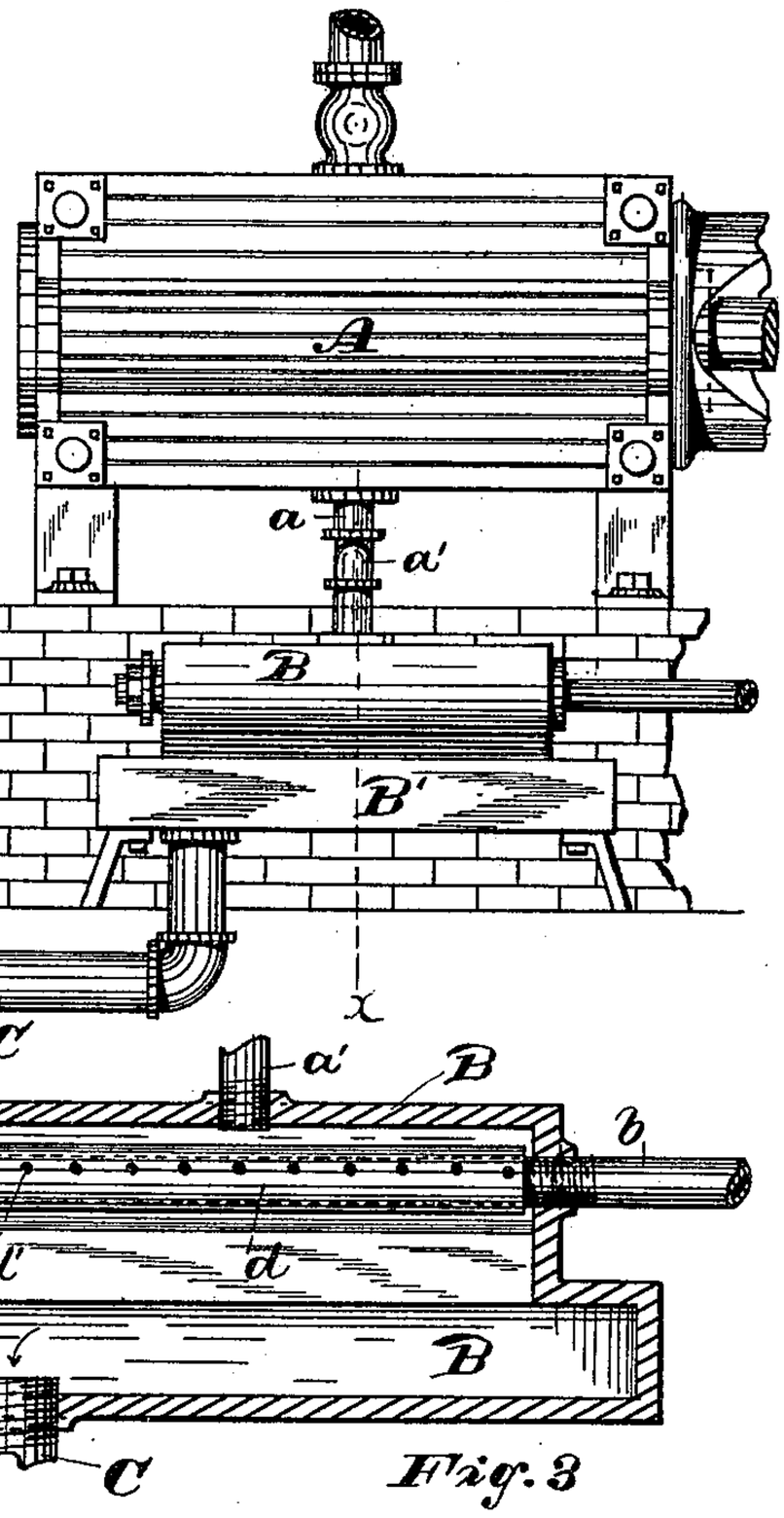

Fig. 1

Fig. 3

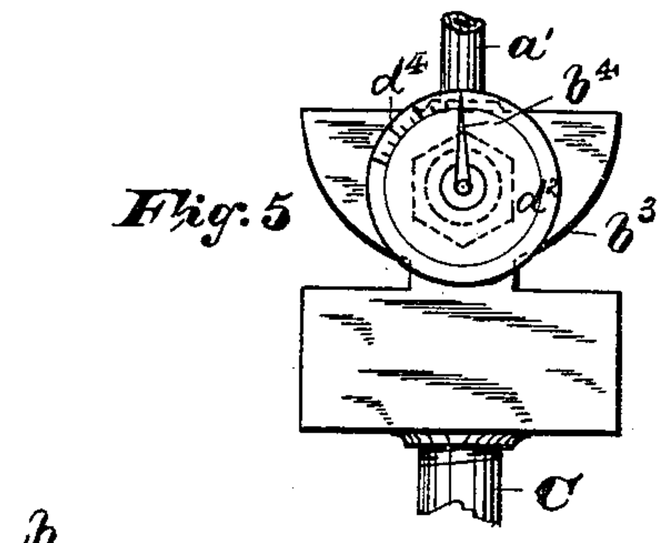

Fig. 5

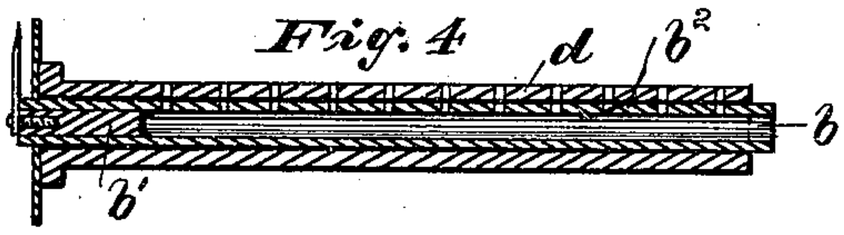

Fig. 4

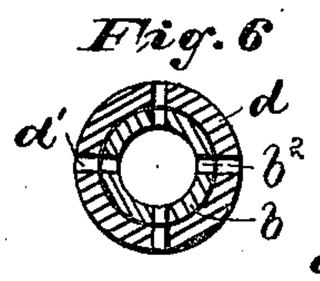

Fig. 6

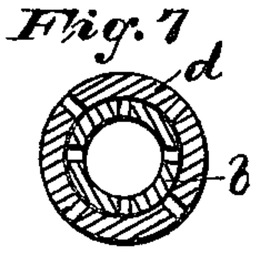

Fig. 7

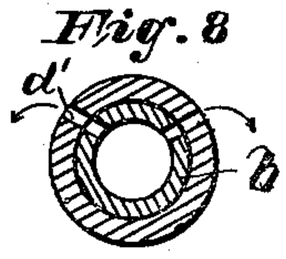

Fig. 8

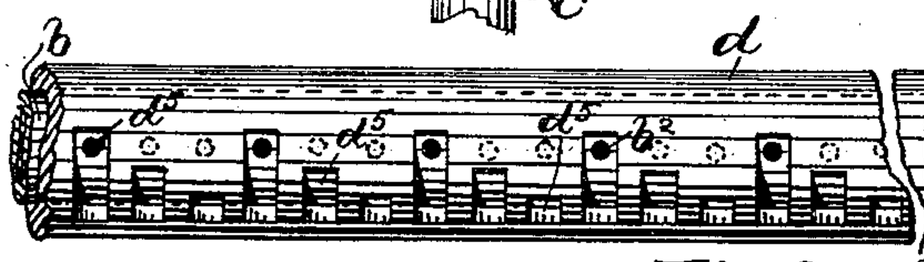

Fig. 9

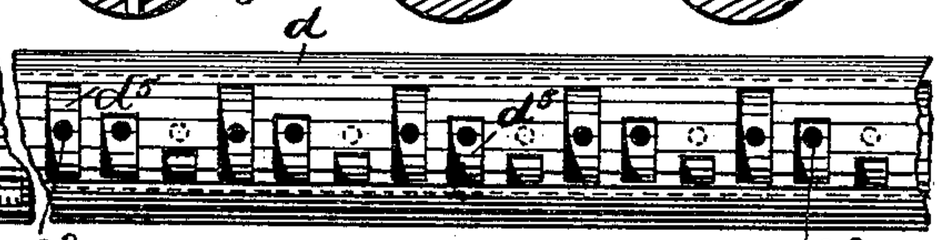

Fig. 10

WITNESSES:

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UNITED STATES PATENT OFFICE.

EDWARD L. STEWART, OF BORDENTOWN, NEW JERSEY.

FEED-WATER HEATER.

SPECIFICATION forming part of Letters Patent No. 372,499, dated November 1, 1887.

Application filed February 9, 1887. Serial No. 226,997. (No model.)

To all whom it may concern:

Be it known that I, EDWARD L. STEWART, a citizen of the United States, residing at Bordentown, in the county of Burlington and State of New Jersey, have invented certain new and useful Improvements in Feed-Water Heaters; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to letters of reference marked thereon, which form a part of this specification.

This invention is designed to provide a feed-water heater for boilers in which the quantity of cold water which comes in contact with the exhaust-steam is regulated according to the work to be performed by the engine, and is so distributed that it takes up the heat from the exhaust-steam more completely and rapidly, causing thereby the rapid condensation of the steam, and thus relieving the engine of the back pressure. The water is also fed to the boiler at a much higher temperature by the great absorption of heat, producing, in consequence, greater economy in fuel.

In the accompanying sheet of drawings, in which similar reference-letters represent like parts in each of the views, Figure 1 is a side elevation of the steam and working cylinder of a Corliss engine to which is attached my improved feed-water heater, which is also in side elevation. Fig. 2 is a transverse section of Fig. 1, taken through line *x*. Fig. 3 is a longitudinal section of the water-heating chamber. Fig. 4 is a longitudinal section of the perforated end of the feed-water pipe and the inclosing-collar. Fig. 5 is a front elevation of the heating-chamber. Figs. 6, 7, and 8 are transverse sections taken through the concentrically-arranged feed-pipe and inclosing-collar, illustrating several forms of construction thereof; and Figs. 9 and 10 illustrate another construction of said collar and two positions of the same.

In said views, A indicates the cylinder of the engine, that shown in the drawings for the purposes of illustration being a portion of a Corliss engine.

a is the exhaust-pipe leading from said cylinder.

B and B′ are respectively the upper and lower compartments of the feed-water heating-chamber.

b is the cold-water feed-pipe leading into the upper chamber, B, of the heater, and C is a pipe leading from the lower compartment, B′, to the pump D, and thence to the boiler through which the hot feed-water is conducted to the boiler. A pipe, *a*′, leads from the exhaust-pipe *a* to the compartment B, and conducts the exhaust-steam into the same.

On or around the perforated end of the cold-water feed-pipe is arranged a collar, *d*, which in the views is so arranged as to rotate around the perforated end of the feed-pipe *b*, which is rigidly secured in the walls of the chamber, and is provided with a plug, *b*′, which prevents the escape of the feed-water through the end of said pipe, as indicated in Fig. 4. The portion of the feed-water pipe that extends through the compartment B is provided with two or more rows of perforations, b^2, which may be formed therein, as indicated in Figs. 6, 7, and 8, or in any suitable manner to produce the desired result. The arrangement shown in the last-named figure is considered advantageous, inasmuch as the water is thrown upward and outward against the curved sides b^3 of the upper compartment and flows down the same into the lower compartment, B′. As the water is forced or drawn through the perforations in the feed-pipe, it is subdivided, and, if the perforations are made small enough, is sprayed, so that it absorbs the heat from the exhaust-steam and condenses the same much more rapidly than would result if the steam came in contact directly with the entire volume of cold water in the pipe. The water is still further broken by striking the curved sides of the upper compartment, the arrows in Fig. 4 indicating the direction taken by the water as it passes from the feed-pipe into the chambers B and B′ and pipe C.

Perforations *d*′, as indicated in Figs. 3, 4, 6, 7, and 8, are provided in the rotating collar *d*, corresponding in number, size, and arrangement to the perforations in the feed-pipe *b*, and so long as said perforations *d*′ are turned away from the openings in the feed-pipe, as shown in Fig. 7, the escape of the water is prevented; but when the collar is turned so as to bring the perforations in a line the water

passes freely into the chambers or compartments. The quantity of the outflowing water may be regulated by so turning the collar that only a small portion of the openings d' are in a line with the perforations in the pipe b, as will be understood.

On the end of the collar is a dial, d^2, and behind said dial is an angular portion, d^3, by means of which the collar may be turned in either direction by a wrench; or said collar may be provided with an arm projecting therefrom, which may be grasped by the hand in turning the collar. The indicator b^4 is immovably attached to the block b' or the end of the pipe b, and the dial turns around the indicator. If desirable, the dial may be formed on or rigidly secured to the heating-chamber and the indicator turn with the rotating collar.

On the dial are indicating-marks d^4, which indicate the distance necessary to turn the collar to regulate the flow of the water.

In Figs. 9 and 10 is illustrated a construction of the regulating-collar in which a certain number of the perforations are uncovered at the same time at regular intervals along the feed-pipe, while the remainder of said perforations are covered. By turning the collar a certain distance another series of perforations are uncovered, thus increasing the flow of the water, and by turning the said collar a third time the rest of the perforations are uncovered, thus permitting the escape of water to the full capacity of the pipe. This is attained by forming in the collar groups of elongated openings or slots d^5 of varying lengths, so arranged that every third perforation is uncovered simultaneously along the pipe, or, when the groups consist of two slots of different lengths, every alternate perforation is uncovered at the same time.

As will be evident, the number of slots in groups may be of any number according to the quantity of water desired.

As indicated in Figs. 2 and 3, the pipe C projects up into the compartment B', to prevent all of the water from escaping therefrom, whereby a body of water is retained in the bottom of the lower compartment and the condensation of the steam and the heating of the water are accelerated.

While a longitudinally-moving collar might be used instead of the rotating collar, still the latter is considered preferable.

Having thus described my invention, what I claim is—

1. In a feed-water-heating apparatus, a heating or condensing chamber consisting of upper and lower compartments, B and B', connected by a narrow opening, as set forth, the bottom of the said upper compartment sloping down to the narrow opening connecting the upper and lower compartments, for the purposes set forth.

2. In a feed-water heater, the combination of a heating-chamber consisting of upper and lower compartments, B and B', connected by a narrow opening, as set forth, the bottom of said upper compartment sloping down to the narrow opening connecting said upper and lower compartments, a pipe opening into the interior of said upper compartment and adapted to be connected with the exhaust of an engine, a feed-water pipe extending into said upper compartment and provided with a series of perforations therein to divide the water-column, and a pipe opening into the lower compartment of said chamber to conduct the water therein to the boiler, for the purposes set forth.

3. In a feed-water heater, the combination, with a water and steam chamber, of a feed-pipe extending into said chamber and provided with a series of perforations therein, a rotating collar arranged around the perforated end of said pipe and provided with a series of openings therein, which, when said collar is turned, permits the escape of the water therethrough into the chamber, and means for indicating the relation of said openings to the perforations in the feed-pipe, for the purposes set forth.

4. In a feed-water heater, the combination, with a water and steam chamber, of a feed-pipe extending into said chamber and provided with a series of perforations therein, a rotating collar arranged around the perforated end of said feed-pipe and provided with a series of perforations or openings therein, which, when said collar is turned, permits the escape of the water therethrough into the chamber, a pointer secured to the end of said feed-pipe outside of the steam-chamber, and an indicating dial or plate secured to and turning with said rotating collar adjacent to said pointer and provided with marks thereon, for the purposes set forth.

5. In a feed-water heater, the combination, with the feed-pipe having a perforated end, of an inclosing-collar having a series of graduated groups of openings or elongated slots therein, for the purposes set forth.

In testimony that I claim the invention set forth above I have hereunto set my hand this 31st day of January, 1887.

EDWARD L. STEWART.

Witnesses:
FREDK. F. CAMPBELL,
FREDK. C. FRAENTZEL.