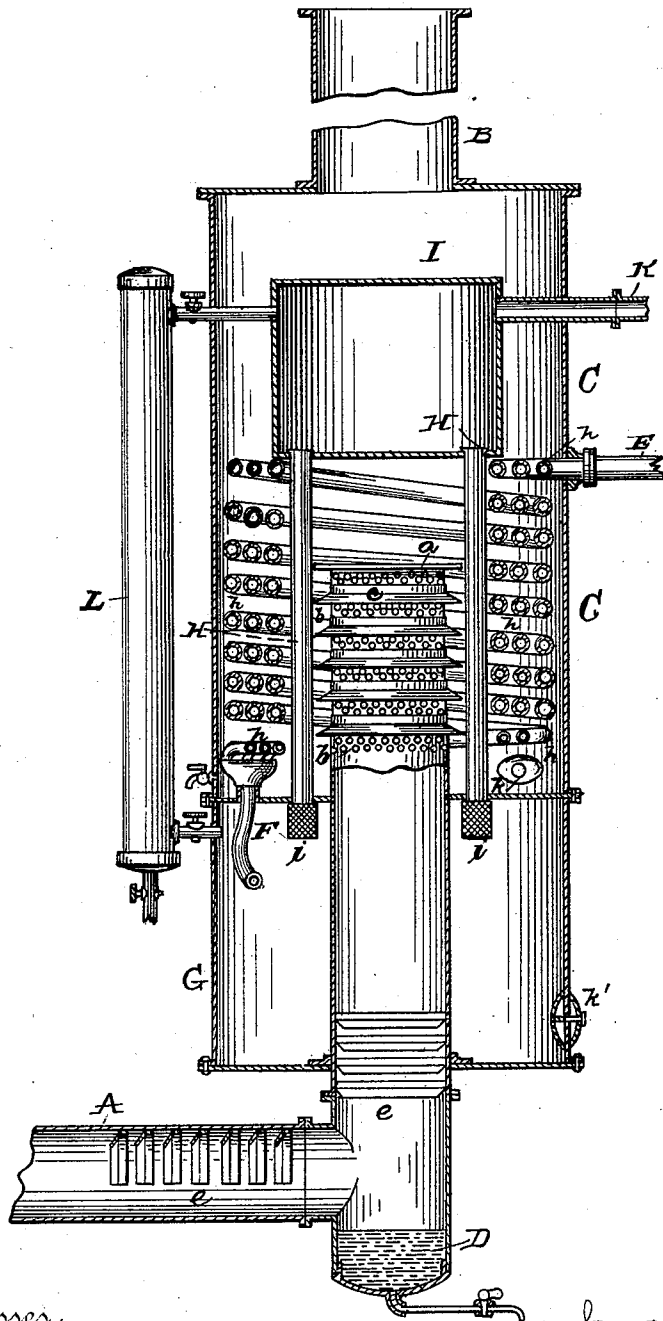


(No Model.)

J. H. VAIL.
FEED WATER HEATER.

No. 404,512.

Patented June 4, 1889.



Witnesses.
E. Rowland
William Eger

Inventor
Jonathan H. Vail
By his Attorneys *John S. [Signature]*

UNITED STATES PATENT OFFICE.

JONATHAN H. VAIL, OF NEW YORK, N. Y.

FEED-WATER HEATER.

SPECIFICATION forming part of Letters Patent No. 404,512, dated June 4, 1889.

Application filed June 9, 1888. Serial No. 276,617. (No model.)

To all whom it may concern:

Be it known that I, JONATHAN H. VAIL, a citizen of the United States, residing at New York city, in the county and State of New York, have invented a certain new and useful Improvement in Combined Exhaust-Mufflers and Feed-Water Heaters, of which the following is a specification.

The main object of my invention is to effectively combine in one structure a muffler for preventing the noise due to the escape of exhaust-steam and the escape of moisture and oil with such steam, and a heater for the feed-water supplied to the boiler; but my object is, further, to increase the effectiveness of exhaust-mufflers and feed-water heaters themselves over those which have hitherto been used, and to effectively remove sediment from the feed-water, so as to supply clean hot water to the boiler.

My invention consists in the novel devices and combinations of devices employed by me in accomplishing the above-named objects, as hereinafter set forth and claimed.

The accompanying drawing is a sectional view of a combined muffler and feed-water heater embodying my invention.

A A is the exhaust-pipe from the engine, and B the exit-passage to the stack or to the external air. The upper end of the pipe A (which is shown in elevation) is closed by a cap or cover *a*, and the upper portion of the pipe, which is inclosed within a chamber C, is pierced with numerous small holes *b*, whose combined area is preferably at least fifty per cent. greater than that of the pipe itself. Upon the outside of the pipe between the rows of holes *b*, I form or place inclined deflecting flanges *c c* encircling the pipe. The exit-pipe B leads from the upper end of chamber C. The exhaust-steam, therefore, instead of being allowed to issue forcibly in sudden jets from the pipe, spreads itself through all the various perforations *b* and fills the large surrounding chamber C. The flanges *c* prevent the steam as it issues from the holes from taking an immediate upward course and give it a still further lateral deflection to cause it to completely fill the chamber. The chamber being thus filled with the steam the same forms a cushion which

muffles any noise which might occur from the steam escaping from the holes; and the steam in the chamber escapes through the pipe B gradually and in a continuous stream, and not, as heretofore, in a series of violent jets.

In the exhaust-pipe A, I place at convenient points, as shown, internal flanges or rims of metal *e e*, which incline downward and inward, and which collect the oil and the water which may be condensed in the pipe, and the same drips down into a receptacle D provided for it, from which it may be drawn off, as shown.

E is the inlet-pipe for cold water. It is brought into the chamber C, and is there divided into branching pipes *h h*, which pipes all extend spirally around the exhaust-head and fill this portion of the chamber C, and finally terminate in a single nozzle F, which extends down into the settling-chamber G, below the heating-chamber C.

It will be seen that the water passing through the pipes *h h* is completely surrounded by the steam, which fills every part of the chamber C, and thus becomes heated before it enters the chamber G. In the chamber G the water remains and deposits its sediment, and then rises through tubes H H, which are surrounded by the coil *h h*, into the clear hot-water chamber I, which is situated within the chamber C above the exhaust-head, being supported by the tubes H H and the coil *h h*, and from which a pipe K leads to the boiler. The water remains in the chamber G comparatively at rest and exposed to a higher temperature than is attained in the heating-chamber, since the hottest of the exhaust-steam is in the pipe A passing through the chamber G. The deposit of the sediment is in this way facilitated. I prefer to provide filters *i i* at the lower ends of tubes H H, to still further clear the water before it goes to the boiler. The clear hot-water chamber I being surrounded by the steam passing from the exhaust-head to the exit-pipe, the water therein is still kept hot by such steam.

Hand-holes *k k* are provided in the chambers C and G, respectively. I prefer to provide a scum-chamber L, connected with the upper part of chambers G and I, respectively, by tubes *l l*, provided with valves for open-

ing and closing them, whereby the scum-chamber may be used to blow off the scum from the clear-water chamber, when desired.

What I claim is—

- 5 1. The combination, with an exhaust-pipe, of a chamber surrounding a portion of the same wherein the feed-water is heated, a settling-chamber below said heating-chamber also surrounding the exhaust-pipe and receiving the heated water, and a chamber above said settling-chamber and connected therewith by tubes through which the clear hot water rises, substantially as set forth.
- 15 2. An exhaust-pipe having a number of small perforations in its upper portion, and deflecting flanges above said perforations, in combination with a chamber surrounding said perforated portion, and an exit from such chamber, substantially as set forth.
- 20 3. The combination of an exhaust-pipe having a number of small perforations, a chamber surrounding the perforated portion of said pipe, and a coil of pipe in said chamber through which feed-water passes, substantially as set forth.
- 25 4. The combination of an exhaust-pipe, a chamber surrounding a portion of the same, a feed-water coil in said chamber, a settling-chamber connected with said coil and also surrounding a portion of the exhaust-pipe, and a clear-water chamber receiving the water from said settling-chamber, substantially as set forth.
- 30 5. The combination of an exhaust pipe, a heating-chamber surrounding a portion of the same, an outlet from said pipe into said chamber, an exit-pipe leading from the top of said chamber, a settling-chamber surrounding the exhaust-pipe below said feeding-chamber with which said feed-water coil communicates, a clear-water chamber within the heating-cham-
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ber and communicating with the boiler, and tubes extending from said settling-chamber to said clear-water chamber, substantially as set forth.

- 45 6. The combination of the settling-chamber, the clear-water chamber above the same, the scum-chamber, passages to said scum-chamber from near the top of said settling-chamber and of said clear-water chamber, and valves in said passages, substantially as set forth.
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7. The combination, with a vertical exhaust-steam pipe, of annular downwardly-inclined flanges within the same, and a receptacle below said flanges for the water and oil which collect on said flanges, substantially as set forth.
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8. The combination of an exhaust-pipe having a number of small perforations, a heating-chamber surrounding the perforated portion of said pipe, a coil of pipe in said chamber through which feed-water passes, a settling-chamber connected with said coil and also surrounding a portion of the exhaust-pipe, a clear-water chamber connected with said settling-chamber, and an exit from said heating-chamber, substantially as set forth.
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9. The combination of the exhaust-pipe, the settling-chamber, the clear-water chamber receiving the purified water, and an annular passage around said clear-water chamber connected with said exhaust-pipe, whereby the exhaust-steam surrounds said clear-water chamber, substantially as set forth.
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This specification signed and witnessed this 7th day of June, 1888.

JONATHAN H. VAIL.

Witnesses:

WILLIAM PELZER,
A. W. KIDDLE.