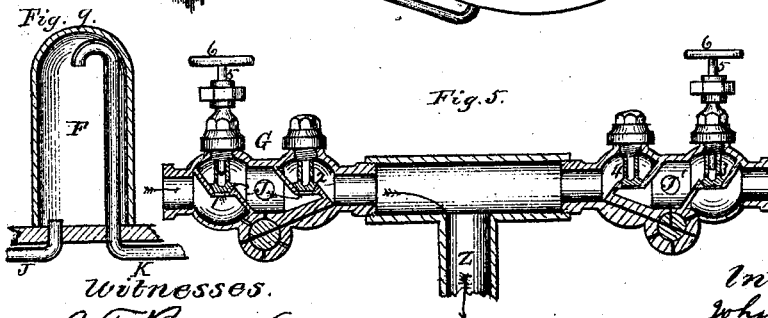
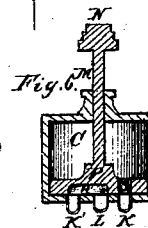
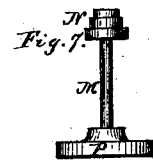
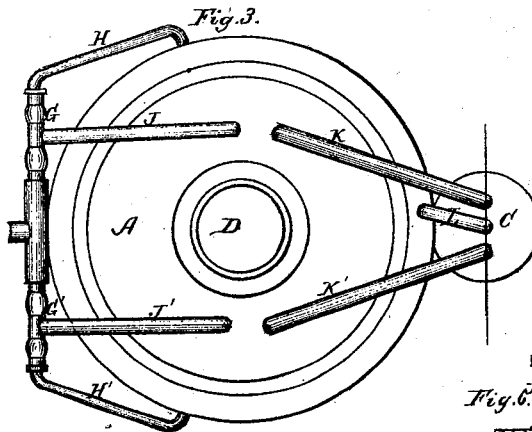
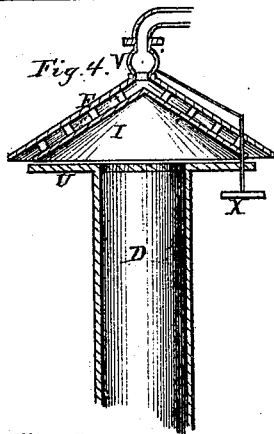
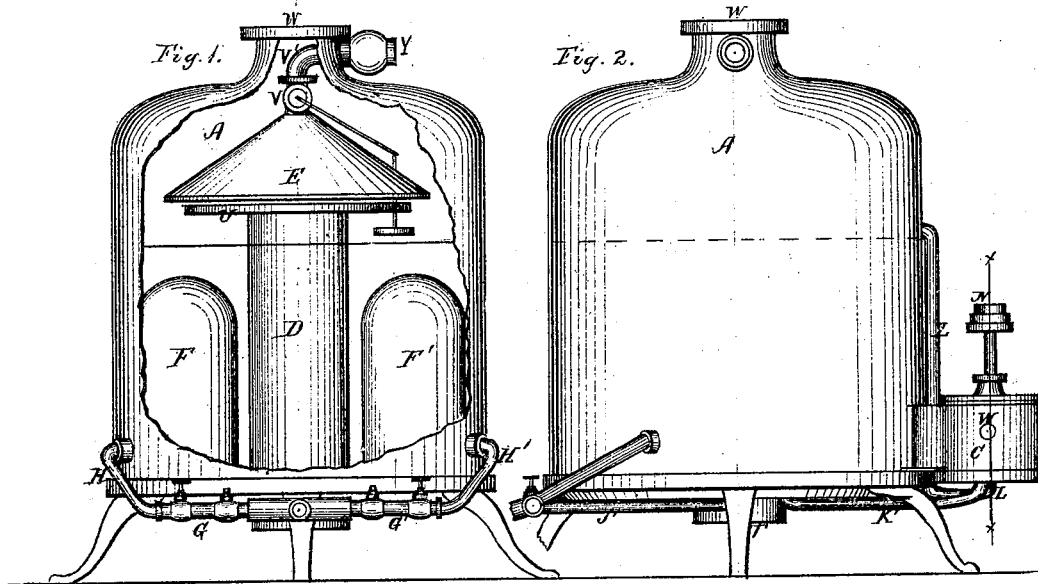


*Mills & Howarth,*

*Condenser.*

*No. 110668,*

*Patented Jan. 3. 1871.*



*Witnesses.*  
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# United States Patent Office.

JOHN H. MILLS, OF BOSTON, AND JOHN HOWARTH, OF SALEM, MASSACHUSETTS.

Letters Patent No. 110,668, dated January 3, 1871.

## IMPROVEMENT IN HOT-WATER FEEDERS FOR STEAM-BOILERS.

The Schedule referred to in these Letters Patent and making part of the same.

We, JOHN H. MILLS, of Boston, Suffolk county, and JOHN HOWARTH, of Salem, in the county of Essex and State of Massachusetts, have invented certain Improvements in Hot-water Feeders for Steam-Boilers and Water-Elevators, of which the following is a specification.

Figure 1 is a front elevation of our invention with a portion of the case broken away to show the internal construction;

Figure 2 is a side elevation;

Figure 3 is a plan view inverted;

Figure 4 is a sectional view of the heating apparatus;

Figure 5 is a sectional view of the valves G G';

Figure 6 is a section through line *x x*, figs. 2 and 3;

Figure 7 is a side elevation of valve P, with its shaft;

Figure 8 is a plan view of the latter invented; and

Figure 9, a sectional view of one of the chambers F F'.

The object of this invention is to heat the feed-water for steam-boilers by the exhaust steam from an engine to a degree of temperature approaching that of the steam; also, to precipitate the impurities contained in the water before it enters the boiler, and to feed said water to the boiler; also, to produce an apparatus for elevating water by the pressure of steam when disconnected with the boiler-feed.

It consists of a cylindrical vessel, into the top of which the cold water is admitted and divided into small particles by falling on a flaring or conical cap over the pipe which admits the exhaust steam, whereby it is heated.

It also consists of two steam-tight chambers within said heater, into each of which the heated water is caused to flow alternately, and from whence it is alternately expelled into the boiler supply-pipe by means of steam blasts from the engine, both of which operations, viz: the forcing of the water into the chambers and the egress of the same, being effected by means of a peculiar arrangement of valves, which, with the general details of construction and method of operation, will be more fully described hereinafter.

In the drawing—

A represents the heater, which is provided with the vertical pipe D, through which exhaust steam is admitted at T.

U represents a circular flange on the top of pipe D.

E I represent conical plates, located one within the other and immediately above pipe D, as shown in fig. 4.

The plate E has an opening in the top to admit the cold-water supply-pipe V', while the plate I is solid, a conical space being left between them.

V Y represent valves to regulate the supply of water, the latter valve being operated by a float, X, which rests upon the surface of the water in heater A. The valve V is to shut off the supply when the heater is not in use.

F F' represent steam-tight vessels within the heater A, and communicating, through the bottom of the latter, with pipes J J' K K'.

H H' represent bent pipes leading from the lower portion of heater A to the double check-valves G G', fig. 5, which latter being the invention of one Greene, (of the firm of Greene, Trowbridge & Baldwin, New York city,) need not be particularly described.

C represents a steam valve-chest, located at the back of heater A, and provided with the disk-valve P, which is attached to the vertical shaft M, on the upper end of which is the graduated pulley N.

The valve P is provided on its under side with the oblong port R, and has an orifice, S, on the opposite side, extending entirely through.

The pipes J J' connect valves G G' with the lower portions of chambers F F', and the pipes K K' connect the upper portions of the same with the valve-chest C, as shown in figs. 3 and 9.

L represents the exhaust-pipe from chest C, which pipe opens into heater A above the high-water line, and enters the bottom of chest C, between pipes K K', exactly in the center of the space between the latter, and the distance between each of the pipes K K' and L is exactly equal to the length of the port R, and from the port R to the orifice S.

W represents an opening in the top of heater A for the escape of the exhaust steam after it has performed its function.

### Operation.

The exhaust steam, passing up through pipe D, impinges on the under side of conical plate I, heating the same and passing out under its edges upward; at the same time cold water is admitted through the supply-pipe and falls upon the upper side of plate I, where it is scattered into fine particles, outward, against the sides of heater A, and, by contact with the heated plate I, and mingling with the exhaust steam, becomes thoroughly heated to nearly the temperature of the latter, and, accumulating in the bottom of the heater, will deposit its impurities, which can be removed as occasion requires. The exhaust steam, which is not absorbed by the above operation, passes off through orifice W, as above mentioned. The valve P is slowly revolved by belting or gearing, and steam is admitted to the chest C through orifice W, above valve P. It

will be seen that, when the valve occupies the position shown in fig. 6, the port R will connect with the pipes K' and L, and the pipe K will connect with orifice S, thus allowing the steam in chamber F' to exhaust through pipes K' and L into the upper part of heater A, (supposing chamber F' to have been filled with steam,) while the steam which enters chest C through orifice W has a free passage into chamber F through orifice S and pipe K. Supposing the chamber F to have been filled with water from the heater A; by means of the valve G and pipes H I, it will be seen that, at the same moment that the chamber F' is exhausted, steam is admitted to the chamber F, and, bearing with full pressure on the surface of the water therein, forces it downward, through pipe J, between valves 1 and 2 of valve G, and, pressing downward upon valve 1, forces it more firmly into its seat and prevents it from opening. While pushing upward on valve 2, the water rises and flows into the T-shaped coupling and through the boiler supply-pipe Z, as indicated by the arrows.

While this operation continues water from heater A flows through pipe H' into valve G, and, raising valve 3, flows through pipe J' into chamber F', (which, as before described, is exhausted of steam,) and fills the same at the moment that the chamber F is emptied. The chamber F is now filled with steam, while F' is nearly filled with water; at this point the valve P is so revolved as to bring the port R into connec-

tion with the pipes L and K, and the orifice S into connection with the pipe K', which will exhaust chamber F and force steam into chamber F', being simply the reverse of the previous operation, the water rushing out through valve G', pipe J', and into the boiler-supply Z, and the water from heater A rushing in through valve G and pipes H J and filling chamber F.

The valves 1 and 3, fig. 5, are provided with stems 5, which project upward through stuffing-boxes, and are adjusted by hand-wheels 6, to regulate the flow of water through said valves, thus controlling the amount of water flowing into the chambers F F', independently of the valve P.

Having thus fully described our invention,

What we claim as new, and desire to secure by Letters Patent, is—

1. The arrangement for heating the feed-water, consisting of the exhaust-pipe D and conical plates E I, substantially as described.

2. The arrangement of the chambers F F', heater A, and chest C, as specified.

In testimony whereof we have signed our names to this specification in the presence of two subscribing witnesses.

JOHN H. MILLS.  
JOHN HOWARTH.

Witnesses:

J. O. HAYDEN,  
CHARLES F. BROWN.