(No Model.)

J. J. HOPPES.

FEED WATER HEATER.

No. 406,512. Patented July 9, 1889.

Fig. 1

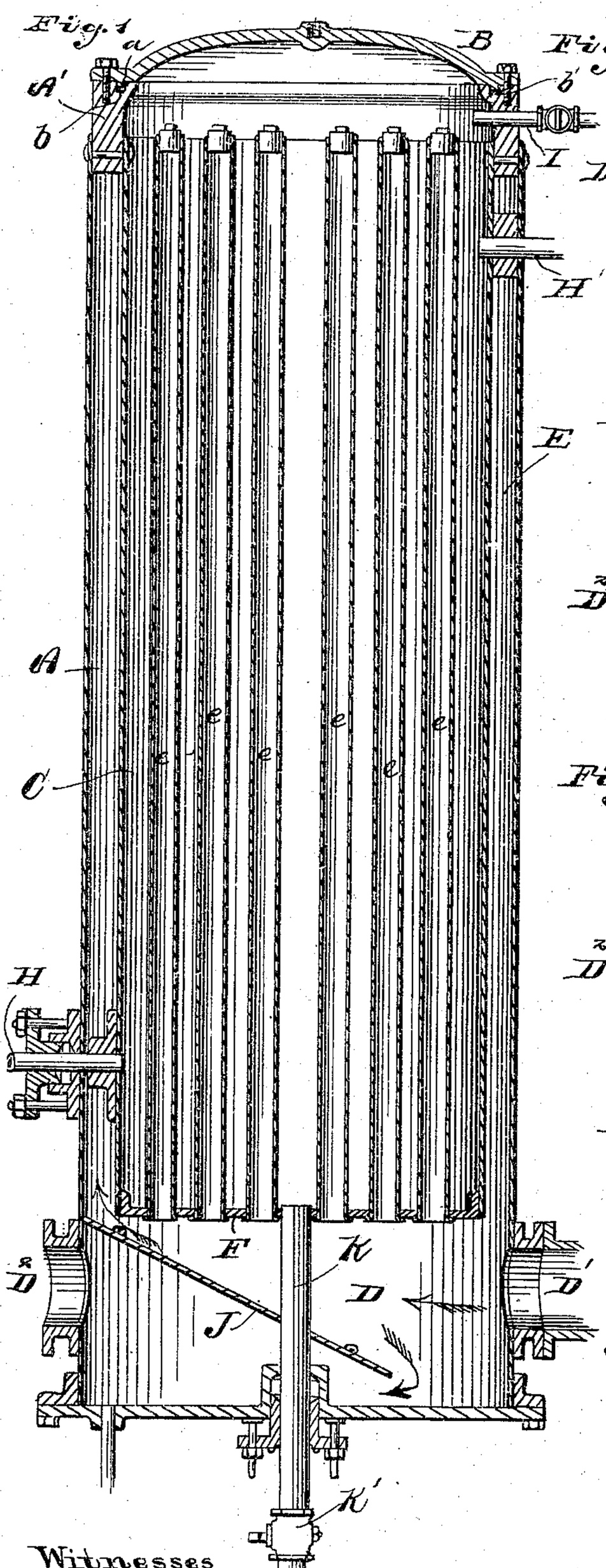


Fig. 3

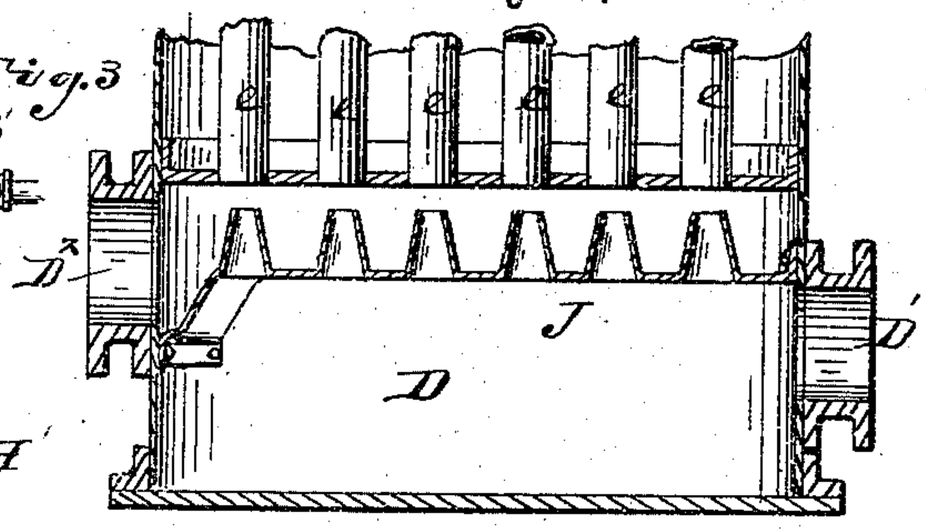


Fig. 4

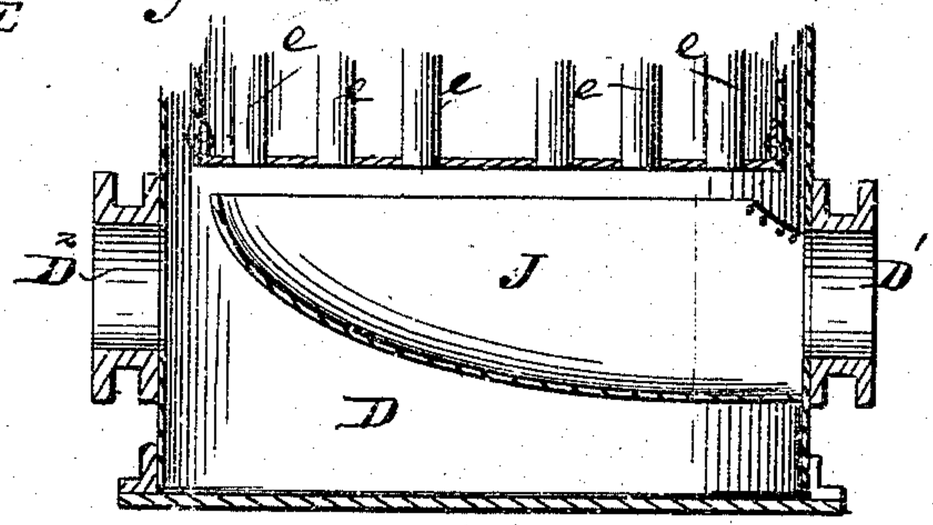


Fig. 5

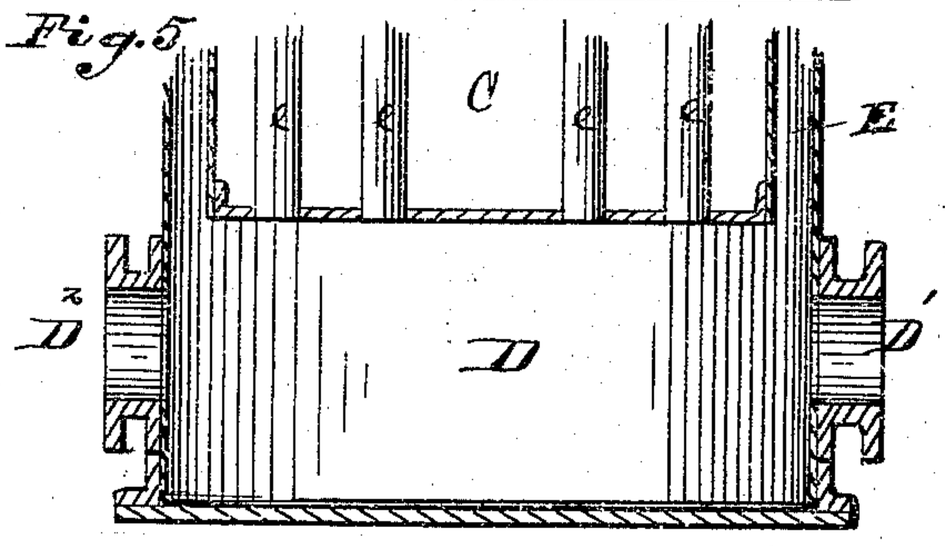
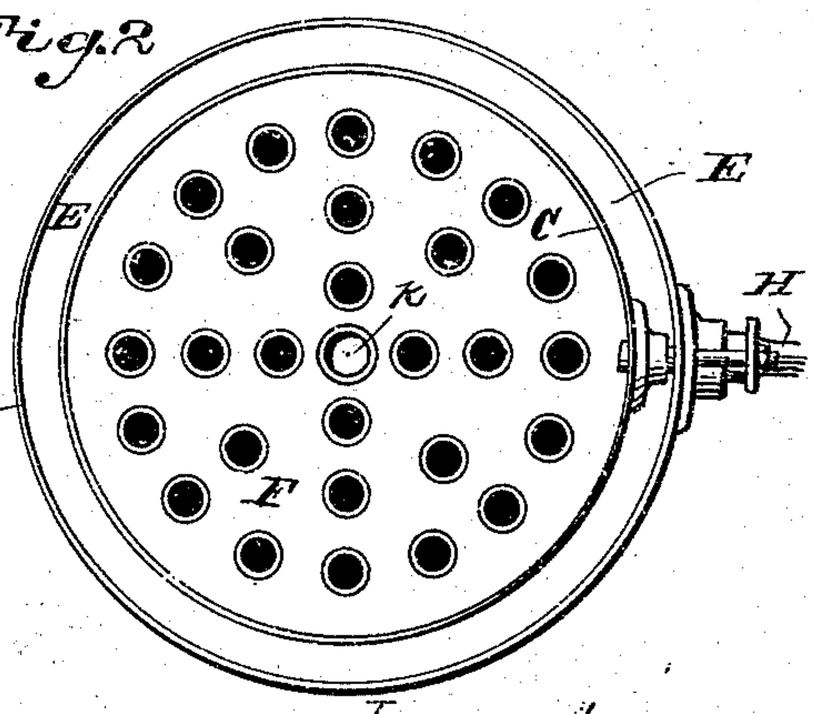


Fig. 2



Witnesses

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UNITED STATES PATENT OFFICE.

JOHN J. HOPPES, OF SPRINGFIELD, OHIO.

FEED-WATER HEATER.

SPECIFICATION forming part of Letters Patent No. 406,512, dated July 9, 1889.

Application filed December 19, 1887. Serial No. 258,363. (No model.)

To all whom it may concern:

Be it known that I, JOHN J. HOPPES, a citizen of the United States, residing at Springfield, in the county of Clark and State of Ohio, have invented certain new and useful Improvements in Feed-Water Heaters, of which the following is a specification.

My invention relates to feed-water heaters for steam-boilers; and it particularly relates to that class of heaters in which the temperature of the feed-water is raised by the utilization of the heat obtained from the steam exhausted from the engine.

The object of my invention is to provide a heater which shall be simple in its construction, efficient in its operation, and so arranged that all the parts thereof are easily accessible for the purpose of cleaning, the parts being at the same time so combined and arranged that the unequal expansion of the metal forming the same, due to the varying temperatures to which the different parts are exposed, shall not affect the utility of the device or cause unusual strain thereon.

My invention consists in the various constructions and combinations of parts hereinafter described, and pointed out in the claims.

In the accompanying drawings, Figure 1 is a vertical sectional elevational view of the heater embodying my invention. Fig. 2 is a transverse sectional view of the same. Figs. 3, 4, and 5 are sectional views of a portion of the heater, showing modifications in the manner of admitting and conducting the exhaust-steam thereto, as hereinafter more fully set forth.

In the feed-water heaters of this class heretofore constructed it has been common to pass the exhaust-steam from the engine through a series of pipes or conductors, which are surrounded by or in contact with the feed-water in its passage to the boiler. The principal difficulties encountered in the construction and operation of feed-water heaters of this class are the unequal expansion and contraction to which the different portions are subjected by reason of the unequal temperatures presented thereto, and also in the great difficulty experienced in cleaning the same. In my improved heater herein set forth, I have sought to overcome this difficulty by the use of a series of heating-tubes leading directly from a heating or supply chamber into which the exhaust-steam is conducted, the said heating-tubes being closed at one end, so that the steam does not pass through the same, but are adapted to receive the steam or heat therefrom and retain it while the heat is given off to the feed-water which surrounds the said tubes.

The outer casing A of the device is made, preferably, of a plain cylindrical form, provided at the top with an annular casting A′, to which the outer casing A is riveted. Secured to the top of the ring or casting A′ is a cup or cover B, preferably provided with an annular projection *a*, adapted to fit into a corresponding groove *b* in the said casting A′, and in contact with a packing-ring, of rubber or other suitable material *b*′, placed therein.

Secured to the inner side of the ring or annular casting A′ is an inner casing C, which projects downwardly in the main casing A almost to the bottom thereof. The space between the bottom of the inner cylindrical and the outer casing being adapted to form a supply-chamber D, into which the steam from the engine is admitted through a pipe D′ and discharged through an opening D^2, said outlet and inlet openings being contracted with reference to the chamber D, so that the steam will expand in said chamber, an annular chamber E is thus formed between the walls of the inner and outer casings C and A, respectively. The inner casing is closed at the bottom by a plate F, provided with a series of openings adapted to receive upwardly-extending pipes or tubes *e*, which I term "heating-tubes." These tubes are preferably made of a plain cylindrical form and of uniform external diameter. They are closed at the top, preferably by means of plugs, which are screwed into the said tubes, so as to leave the external diameter free and unencumbered.

The tubes are screwed or otherwise secured into the plate F, so that they may be readily removed, if desired. The feed-water to be heated is pumped into the cylinder or casing C through the supply-pipe H, and passes to the boiler through an outlet-pipe H′. At or near the upper portion of the water-chamber C, I provide a blow-off pipe and valve I, adapted to blow out the upper portion of the heater and remove the im-

purities which gather on the top of the water.

In the lower supply-chamber D, I preferably provide a partition or deflector J, extending diagonally across the said chamber in front of the entrance-pipe D′. The operation of the device as thus described is as follows: The exhaust-steam from the engine, entering from the pipe D′, expands by reason of the contracted outlet and inlet openings in the supply-chamber D, and a portion of the same, by reason of its expansion, enters the tube *e*, and into the space E, about the water-receiving chamber C. In addition to the expansion of the steam, the deflector D will cause the same to change direction and enter into the chamber E and the tube *e*. The tubes *e* being placed in a vertical position, the heat from the steam admitted to the chamber D will rise and be retained therein, and in a similar manner will rise and be retained in the chamber E, surrounding the water-space C. There being no outlet at the top of the tubes *e* and the chamber E, there will be no passage through the same; but the heat from the exhaust-steam will, to a very large extent, remain therein and be continually imparted to the feed-water surrounding the same. By this construction it will be seen that, instead of an alternate supply and exhaust of the heat in the tubes and chamber, a more uniform heat is secured.

Leading from the bottom of the water-space C and passing through the chamber D is an outlet or discharge pipe K, preferably provided with a straight-way valve K′, through which the contents of the water-space C are discharged when it is desired to clean the same. It will be seen that by removing the cover B the interior of the water-space C is readily accessible for the purpose of cleaning. The tubes *e*, being of a plain cylindrical form and uniform in diameter, may be readily cleaned by means of an annular scraper adapted to fit over the same, and the accumulations thereon, being thus removed, may be readily washed through the passage-pipe K.

In order to compensate for the unequal expansion of the outer and inner casings A and C, I preferably provide the supply-pipe H and the passage-pipe K with stuffing-boxes, where they pass through the outer casing, so that the same may come and go by the expansion or contraction of the said casings. The deflector D, while useful in assisting in the expansion of the steam and in deflecting the same into the tubes in the chamber, may be dispensed with, as the expansion of the steam will be sufficient to cause the same to enter the tubes and heating-chamber, and even though the steam is exhausted directly through the chamber D, as shown in Fig. 5, it will be found that a large amount of the heat contained therein will rise into the tubes *e* and be imparted to the feed-water surrounding the same. This action will be materially assisted and rendered continuous by the fact that the steam in the heating-tubes, being surrounded by the feed-water, will be more or less condensed, and thus create a vacuum within, which will draw a fresh supply of hot steam from the supply-chamber D.

In Figs. 3 and 4 I have shown the chamber D provided with a modified form of deflector J. In Fig. 4 the deflector is made concave and almost or quite surrounds the entrance-pipe D. In Fig. 3 the deflector is made in the form of a partition, dividing the chamber in two parts, the said chamber being provided with openings immediately under the receiving-tubes, and funnel-shaped nozzles placed over said openings to direct the steam directly into said tubes. In this case the heating-chamber E, between the outer and inner casings A and C, is shown with the tubes *e*, being alone depended upon for furnishing the heat to the feed-water. This in many cases will be found sufficient.

A feed-water heater, as thus described, it will be seen, is very simple in its construction, and all the parts are readily accessible for cleaning. By the arrangement of the heating-tubes, as described, a large amount of heating-surface is presented to the feed-water. The said tubes being closed at the top and having no direct passage through the same, the heat is better retained therein, and the tubes are not subjected to the sudden changes of temperature occasioned by the exhaustion and supply of steam thereto to such an extent as when the steam is passed directly through the same from the engine-cylinder. It will also be seen that in view of the fact that the steam does not pass through the tubes, but only through the supply-chamber, there will be little or no back pressure produced on the engine, as in the case where the steam is exhausted through a circuitous route of small or crooked tubes.

I have shown in the drawings a heater arranged with the tubes vertical. It is obvious, however, that they may be placed horizontal, if desired, sufficient inclination being given to permit the water produced by condensation to pass out of the same. It is obvious that other modifications may be employed without departing from the spirit of my invention.

Having thus described my invention, I claim—

1. The combination, in a feed-water heater with a water space or chamber, of a steam-supply chamber extending entirely under said water-space and provided with contracted outlet and inlet openings, heating-tubes opening in said steam-supply chamber closed at one end and extending longitudinally into said water-space, whereby steam is caused to enter said heating-tubes from said supply-chamber without the aid of circulating-tubes, substantially as specified.

2. The combination, in a feed-water heater with a water space or chamber, of a steam-

supply chamber extending entirely under said water-space and provided with contracted outlet and inlet openings, heating-tubes leading into said supply-chamber closed at one end and extending longitudinally through said water-space, and a deflector in said supply-chamber to further retard the passage of the steam through the same and cause it to enter said heating-tubes, substantially as specified.

3. The combination, with an outer casing having an inner casing secured therein, so as to form a heating passage or chamber between the same, a supply-chamber in the lower portion of said outer casing, and below the bottom of said inner casing, the vertical heating-tubes extending into said inner casing, said tubes being closed at the top and open at the bottom in the said supply-chamber, substantially as and for the purpose set forth.

4. The combination, with an outer and inner casing, the supply-chamber in the lower portion of said outer casing, the vertical heating-tubes leading from said supply-chamber in said inner casing, said tubes being of uniform external diameter and closed at the top, as described, an inlet and outlet pipe connected to said inner chamber, a blow-off pipe above said outlet-pipe, a discharge-pipe leading from the bottom of said inner casing and stuffing-boxes around said supply and discharge pipe where they pass through said outer casing, substantially as and for the purpose set forth.

5. The combination, with the water-space C, of a supply-chamber D, the heating-tubes *e* closed at one end and extending into the water-space, and the deflector J, substantially as and for the purpose set forth.

In testimony whereof I have hereunto set my hand this 16th day of December, A. D. 1887.

JOHN J. HOPPES.

Witnesses:
JOSHUA SCOTT,
PAUL A. STALEY.