

(No Model.)

S. SMITH.
FEED WATER HEATER.

No. 559,757.

Patented May 5, 1896.

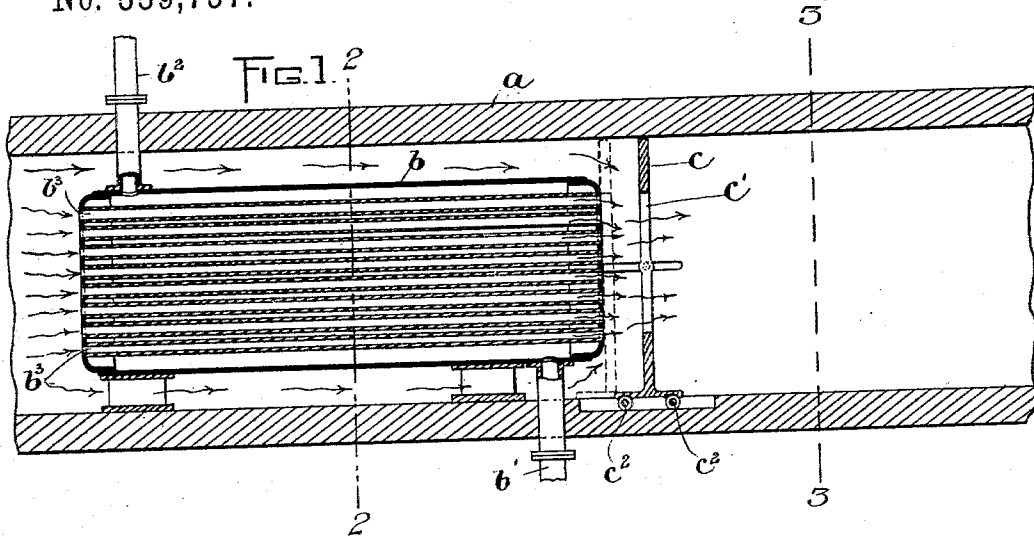


FIG. 2.

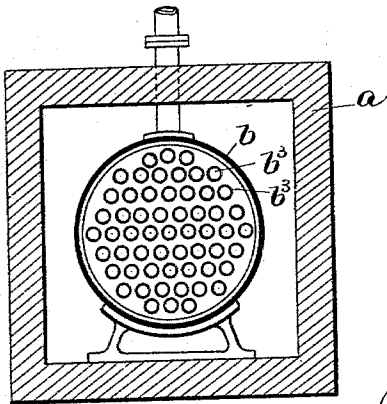
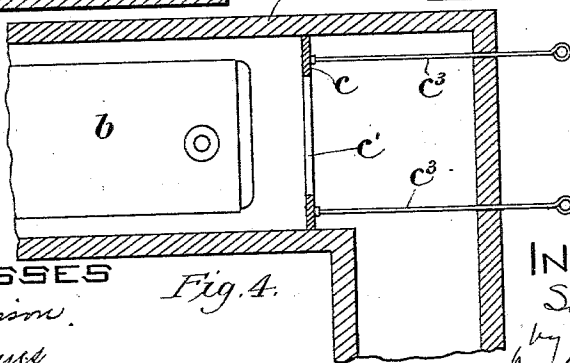
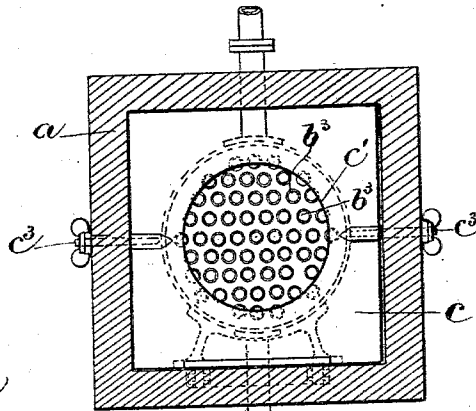


FIG. 3.



WITNESSES

A. D. Harrison.

A. D. Adams.

Fig. 4.

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UNITED STATES PATENT OFFICE.

SIDNEY SMITH, OF CAMBRIDGE, MASSACHUSETTS.

FEED-WATER HEATER.

SPECIFICATION forming part of Letters Patent No. 559,757, dated May 5, 1896.

Application filed November 29, 1895. Serial No. 570,351. (No model.)

To all whom it may concern:

Be it known that I, SIDNEY SMITH, of Cambridge, in the county of Middlesex and State of Massachusetts, have invented certain new and useful Improvements in Feed-Water Heaters, of which the following is a specification.

This invention has for its object the provision of a simple and effective apparatus for heating feed-water by the use of fuel for the generation of steam, the particular object being to convert the largest number of pounds of water into steam with the smallest consumption of fuel. The furnace is the place where the chemical action takes place and where the heat is evolved from the fuel. The boiler absorbs a portion of the heat generated, and the water in the feed-water heater receives its heat from that remaining in the flue connecting the boiler with the chimney. The sectional area of this flue at the place where the feed-water heater is located is sufficiently large to allow full and free passage for all the gases produced by the chemical action in the furnace and along the flues, with the exception of such as have been absorbed or radiated in their passage up to the rear end of the feed-water heater.

The perfection, value, and utility of my invention consists in its ability to produce the maximum amount of steam in a boiler, using at the same time, in combination with the boiler, a flue, feed-water heater, and damper, which will cause to be absorbed the maximum amount of heat remaining in the flue and transmit the same to the water in the feed-water heater.

My feed-water heater is preferably of cylindrical form, (though it may be of any desired form necessary to conform to the shape and dimensions of the flue,) with tubes or flues similar in arrangement to those of the ordinary fire-tube or flue-boiler. A damper placed at the end of this feed-water heater toward the chimney or stack has an opening through it opposite to these tubes or flues, so that they are always open for the passage of the products of combustion. This damper controls the chemical reactions which take place in the furnace and along all the flues, and also the units of heat in the large space around the feed-water heater, causing

them to react against the absorbing surfaces of the feed-water heater, and regulates the volume of gases which shall be allowed to escape up the chimney. This combination of definite and accurate flue area, feed-water heater, and damper control and govern the chemical reactions which take place in the generating of heat and absorption of the same, and the feed-water heater being thus enabled to take up a large amount of the heat not absorbed by the boiler becomes an auxiliary to the boiler and renders it capable of producing the maximum amount of steam with the minimum consumption of fuel.

Of the accompanying drawings, forming a part of this specification, Figure 1 represents a longitudinal section of the flue or passage which connects the furnace with a stack or chimney, showing the water-receptacle and damper in said flue. Fig. 2 represents a section on line 2 2 of Fig. 1. Fig. 3 represents a section on line 3 3 of Fig. 1. Fig. 4 represents a view showing a different arrangement of handles for operating the damper.

The same letters of reference indicate the same parts in all the figures.

In the drawings, *a* represents a flue or passage, which may be of any suitable construction and adapted to conduct products of combustion from a furnace to a stack or chimney.

b represents a water-receptacle, which is preferably of cylindrical form and is provided with a water-inlet *b'*, connected with a suitable source of supply, and an outlet *b''*, which may communicate with a tank from which it may be pumped into a boiler. The receptacle *b* is so proportioned relatively to the flue *a* that a space surrounds said receptacle, said space being properly proportioned for conducting a definite amount of the products of combustion from the furnace along the external surface of the receptacle.

c represents a damper, which is formed to obstruct the marginal portion of the flue *a*, and has a central opening *c'* of sufficient capacity to permit the passage of the products of combustion when the damper is open. The damper is movable toward and from one end of the receptacle *b*, its form and arrangement being such that it may be closed against the end of the receptacle, thus entirely closing

the space surrounding the receptacle, or it may be adjusted at any desired distance from the end of the receptacle. When the damper is sufficiently near the end of the receptacle to abruptly deflect the products of combustion inwardly toward the center of the flue without entirely closing the space around the receptacle, the products of combustion are caused to pass in close proximity to the external surface of the receptacle and are sufficiently confined in the space around the receptacle to facilitate the absorption of heat from the products of combustion by the liquid in the receptacle. When the damper is adjusted at such a distance from the end of the receptacle that there will be a passage between it and the receptacle substantially equal to the area of the space surrounding the receptacle, there will be no confinement or obstruction to the passage of the products of combustion, and they will therefore escape with the maximum rapidity.

b^3 b^3 represent a series of tubes extending longitudinally through the receptacle b , and constituting flues through which the products of combustion may pass, the receptacle and its tubes constituting a structure which is similar to an ordinary tubular boiler. The tubes are arranged so that when the damper is closed against the end of the receptacle b the delivering ends of the tubes will be within the opening c' of the damper.

The above-described apparatus may be operated as follows: When the maximum freedom of draft is desired, the damper is moved away from the receptacle, as shown in Fig. 1, the products of combustion then passing freely through the space surrounding the receptacle and between the end of the receptacle and the damper, as well as through the tubes b^3 . When the damper is closed against the end of the receptacle, it prevents the passage of the products of combustion through the space around the receptacle and causes them to pass only through the tubes b^3 , the external surface of the receptacle being at the same time exposed to the heat from the products of combustion, owing to the fact that the space surrounding the receptacle is open to the flue or passage at one end. The heat from the products of combustion is thus thoroughly utilized, as will be readily seen.

The damper c may be mounted upon wheels or trucks c^2 , and the damper may be provided with a handle or handles c^3 , projecting through suitable openings in the side walls of the flue a . I do not limit myself, however, to this particular construction, and may support and operate the damper by any other suitable means.

When a draft capable of variation is not desired, the damper may be fixed in contact with the rear end of the receptacle, thus permanently closing one end of the space sur-

rounding the receptacle, the other end being open so that the products of combustion can act on the exterior of the receptacle. I do not, therefore, limit myself to a movable damper. An equivalent for the damper, when it is fixed or immovable, would be a brick wall surrounding a suitable opening and formed to obstruct one end of the space surrounding the water-receptacle.

The handles c^3 may be arranged as shown in Fig. 4, if preferred, the handles extending in the direction of movement of the damper.

I claim—

1. The combination of a water-receptacle having tubes or flues suitable for the passage of heat from a furnace extending through it, a furnace or fire-box, a passage connecting said fire-box with a stack or chimney, said passage including a space surrounding said receptacle, properly proportioned for conducting a definite amount of the products of combustion from the furnace along the external surface of said receptacle, and a damper formed to obstruct one end of said space and having a central opening arranged to leave said tubes or flues continuously open.

2. The combination of a water-receptacle with tubes or flues suitable for the passage of heat from a furnace extending through it; a furnace or fire-box; a passage connecting the fire-box with a stack or chimney, said passage including a space surrounding said receptacle, properly proportioned for conducting a definite amount of the products of combustion from the furnace along the external surface of said receptacle; and a damper movable toward or from the end of said receptacle nearest the chimney to open or close the said space, the said damper having a central opening placed opposite the tubes or flues of the said receptacle in such manner as to make it impossible to shut off or impede the flow of the products of combustion through the said tubes.

3. The combination of a water-receptacle, a furnace or fire-box, a passage connecting said fire-box with a stack or chimney, said passage including a space properly proportioned to conduct a definite amount of the products of combustion from the furnace along the external surface of the receptacle, and a damper formed to obstruct one end of said space and having a central opening, said damper being movable toward and from the rear end of the water-receptacle.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, this 19th day of November, A. D. 1895.

SIDNEY SMITH.

Witnesses:

C. F. BROWN,
A. D. HARRISON.