(No Model.) 2 Sheets—Sheet 1

S. R. HUGHES.

FEED WATER HEATER.

No. 328,587. Patented Oct. 20, 1885.

Fig. 1.

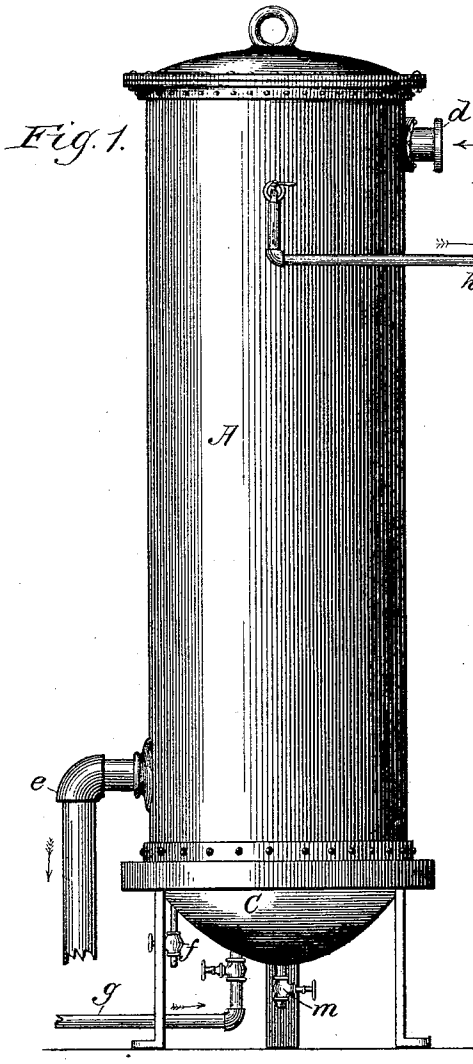


Fig. 2.

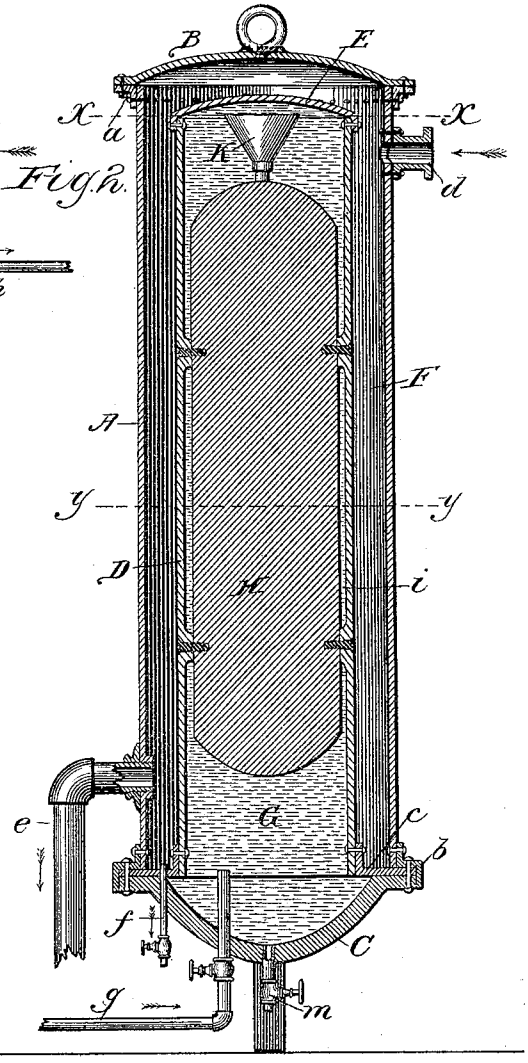
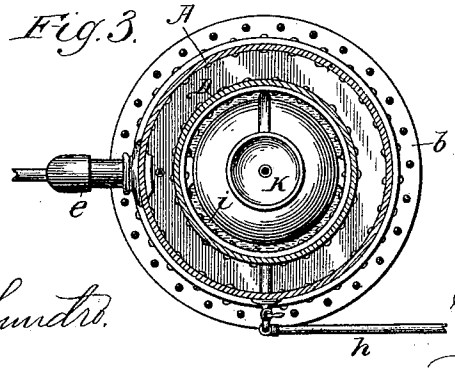


Fig. 3.



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(No Model.) 2 Sheets—Sheet 2

S. R. HUGHES.

FEED WATER HEATER.

No. 328,587. Patented Oct. 20, 1885.

Fig. 4.

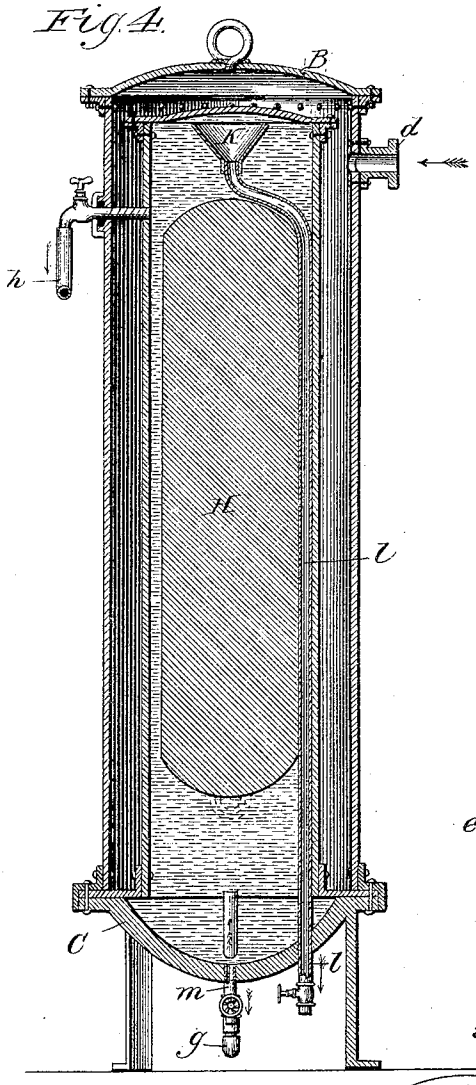


Fig. 5.

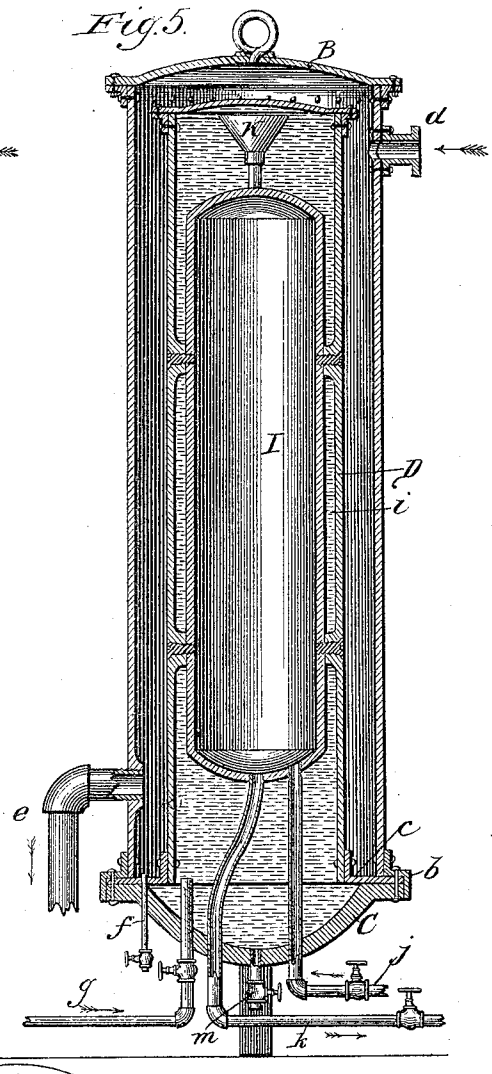
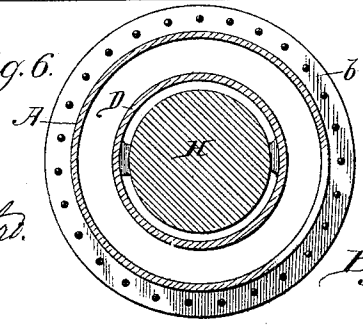


Fig. 6.



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UNITED STATES PATENT OFFICE.

SAMUEL R. HUGHES, OF BENTON HARBOR, MICHIGAN.

FEED-WATER HEATER.

SPECIFICATION forming part of Letters Patent No. 328,587, dated October 20, 1885.

Application filed December 18, 1884. Serial No. 150,627. (No model.)

To all whom it may concern:

Be it known that I, SAMUEL R. HUGHES, a citizen of the United States, residing at Benton Harbor, county of Berrien, and State of Michigan, have invented certain new and useful Improvements in Feed-Water Heaters, of which the following is a specification.

This invention relates to improvements in feed-water heaters in which the water during its passage through the heater to the boiler is heated by a series of steam-pipes arranged in the water-chamber in connection with a steam-jacket surrounding said chamber.

The objects of this invention are to dispense with the series of steam-pipes in the water-chamber, and thereby avoid numerous joints liable to leakage, owing to the contraction and expansion of the ends of the steam-pipes in the opposing heads, in which said steam-pipes are necessarily expanded; to provide a maximum area of heating-surface for the water, which surface shall be consistent with the desired supply of water and a minimum size of heater, and to arrange and connect the water-chamber with the outer shell of the heater or other support in such a manner that the liability of the leakage of its joints shall be reduced to a minimum; to simplify the construction of and reduce the number of parts heretofore employed in feed-water heaters.

Further objects are to provide access to a feed-water heater without having to break numerous joints; to provide an effective and novel form and arrangement of devices for removing scum from the water-chamber and for collecting sediment therein, and, finally, to provide novel details of general construction, hereinafter fully described. I attain these objects by devices illustrated in the accompanying drawings, in which—

Figure 1 represents a side elevation of a feed-water heater embodying my invention; Fig. 2, a central longitudinal section of the same; Fig. 3, a transverse section of the same on the line *x x* of Fig. 2. Fig. 4 is a central longitudinal section of Fig. 1, taken on a line at substantially a right angle to that of Fig. 2. Fig. 5 is a central longitudinal section showing another and modified form of construction of the water-chamber; Fig. 6, a transverse section on the line *y y* of Fig. 2.

Similar letters of reference indicate the same parts in the several figures of the drawings.

The outer shell, A, of my feed-water heater is cylindrical, and has its upper end closed by a cover, B, which is bolted to an angular band, *a*, which may be likewise bolted to or may be an upturned flange on said shell, a suitable packing being preferably employed between the joints thereof, and also between other joints occurring throughout the structure. To the lower end of this shell is bolted an angular collar or band, *b*, overlapping the edge of a concave bottom, C, bolted to the band *b*, which bottom serves as a sediment-collector, as hereinafter more fully explained. The bolts securing the bottom to the band *b* also secure a diaphragm, *c*, annular and angular in form, projecting between the head and band, and having bolted to its inner and projecting lip the inner shell, D, which is shorter in length than the outer shell.

The inner shell, D, is closed by a cap or cover, E, at its upper end, and opens at its lower end into the head or sediment-collector, as shown in Figs. 2, 4, and 5.

By the construction and arrangement described a steam-jacket, F, is formed between the inner side of the outer shell, A, and the outer side of the inner shell, D, and also between the covers of said shell, which jacket has no communication with the water-chamber G, formed by the inner shell, and is supplied by steam entering a pipe, *d*, to its upper end and escaping through a pipe, *e*, toward its lower end, the steam being supplied through a connection from the boiler, or, if desired, from a superheater, said jacket being also provided at its lower end with a blow-off pipe, *f*, closed by an ordinary cock or valve. In this connection it may be added that exhaust-steam from an engine may be supplied to the steam-jacket.

Entering the lower end of the water-chamber is a water-supply pipe, *g*, provided with a suitable valve for the supply of water to the heater from any ordinary source. The water entering the chamber is heated, as will hereinafter be fully described, and then escapes through the pipe *h*, also provided with a regulating-cock (see Fig. 1) to the boiler.

In order to utilize to the best advantage the

heat from the walls of the water-chamber raised in temperature by the steam in the surrounding jacket for heating the water quickly to a high temperature during its onward and somewhat rapid flow, a cylinder, of wood, vitrified clay, metal, or other suitable material, H, is suspended in the water-chamber by means of projections or screws in the sides thereof, so as to leave an annular space, *i*, between the surface of the cylinder and the walls of the water-chamber. By this arrangement of the cylinder the water after entering the water-chamber is spread out into a comparatively thin sheet over substantially the entire surface of the heated walls of the water-chamber, which walls are thereby fully utilized to effectively raise the temperature of the water during its onward flow.

The ends, and particularly the lower end of the cylinder, are preferably rounded or cone-shaped to decrease its resistance to and avoid retarding the flow of the water; but this is not absolutely necessary in carrying out the essential features of my invention.

Instead of using a solid cylinder to form the annular water-space in the water-chamber, I may employ a hollow cylinder, I, as shown in Fig. 5, connected at its lower end with some suitable steam-generator by a supply-pipe, *j*, and having a pipe, *k*, entering its bottom in a plane below the steam-supply pipe for permitting a continuous circulation of steam in the cylinder and for drawing off condensations therefrom.

While steam is considered the best medium for heating the cylinder I, hot-air may be used to advantage, and in either case a higher and more effective heating of the water in its passage through the water-chamber will be attained than by the employment of the solid cylinder before described.

In heaters of this character scum is continually collecting in the upper part of the water-chamber and sediment in the lower part thereof, both of which should be removed, and thereby prevented entering the boiler to diminish as much as possible incrustation therein. To this end a funnel-shaped scum-collector, K, is supported in the upper part of the water-chamber by a pipe, *l*, (see Fig. 4,) entering the apex thereof and passing down through the annular water-chamber and out the bottom thereof, where it is provided with an ordinary valve or cock; but said pipe may, if desired, be passed through the cylinder instead of through the annular water-chamber.

In the bottom of the concave sediment-collector O is a short pipe, *m*, provided with a suitable stop-cock, through which pipe sediment is removed.

In operating this feed-water heater steam is admitted in the steam-jacket and in the hollow cylinder, when the same is employed. After which, when the cold water in the water-chamber is sufficiently heated, the valve in the exit-pipe *h* is opened and the heated water permitted to flow into the boiler in the usual manner.

When for any reason access to the steam-jacket and water-chamber is desirable, it is only necessary to remove the covers of both, or the cover of the steam-jacket and the bottom C, in either of which cases it is necessary to break only two joints, and, in fact, only one joint in the heater, for the removal of the water-chamber from the outer shell.

Supporting the water-chamber from its bottom end alone permits its longitudinal extension and contraction to be uniform and without straining its joints, and as this contraction and expansion as well as lateral contraction and expansion is greater at its bottom, owing to its being subject to a high degree of heat at that point, the strain upon the single bottom joint is reduced to a minimum and the liability of leakage correspondingly diminished.

The structure as a whole is not only simple and inexpensive as compared with others now in use, but dispenses with numerous steam-pipes and a corresponding number of joints with their attending liability to leakage, not to mention the further objection of labor and time involved in removing any one of said pipes when imperfect or otherwise unfitted for use.

Having described my invention, what I claim, and desire to secure by Letters Patent, is—

1. A single cylindrical water-chamber, in combination with an external steam-jacket and an internal cylinder having closed ends and forming an annular chamber between the side walls of the water-chamber and the said internal cylinder, substantially as described.

2. The water-chamber, in combination with the hollow closed end cylinder arranged to form an annular space in said chamber and means for heating said cylinder, substantially as described.

3. The water-chamber and the steam-jacket around said chamber, in combination with a cylinder provided with convexed ends and arranged in said water-chamber, substantially as described.

4. The outer shell provided with a removable cover, B, and combined bottom and sediment-collector C, in combination with a water-chamber having an open communication with the sediment-collector, and a steam-jacket between the outer shell and water-chamber, substantially as described.

5. The outer cylinder, the removable heads B C thereof, and the diaphragm *c*, in combination with a cylindrical water-chamber supported by said diaphragm and a steam-jacket between the water-chamber and outer shell, substantially as described.

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Witnesses:
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