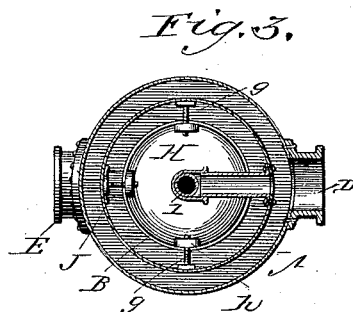
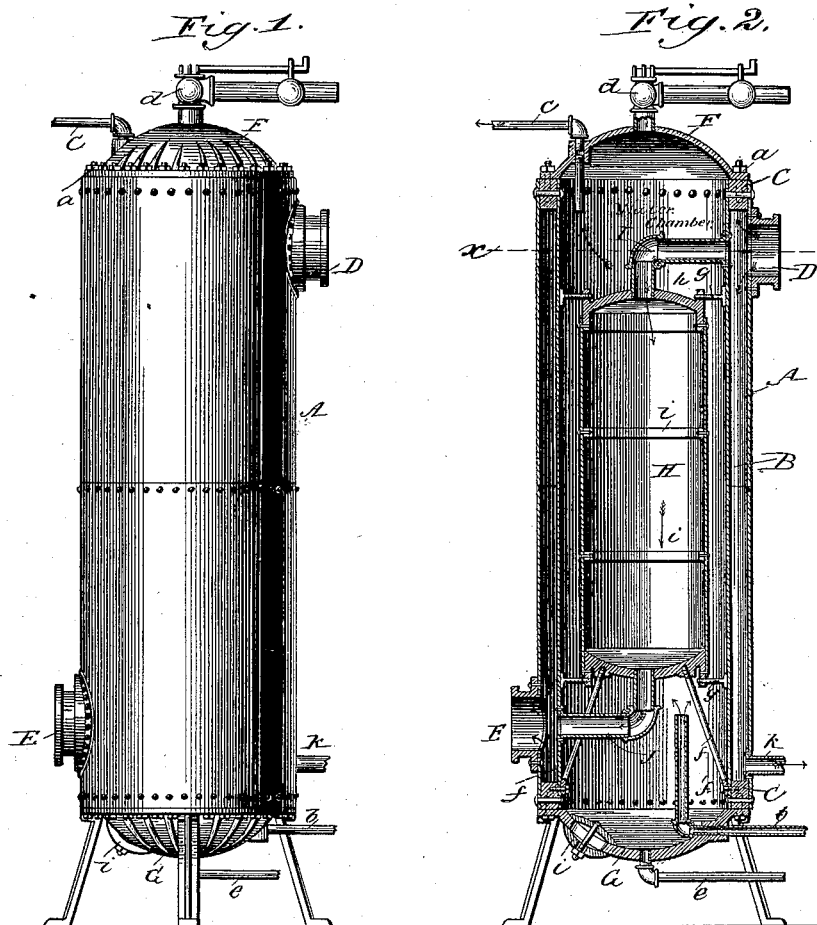


(No Model.)

S. R. HUGHES.
FEED WATER HEATER.

No. 345,593.

Patented July 13, 1886.



Witnesses.
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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. 345,593, dated July 13, 1886.

Application filed February 2, 1886. Serial No. 190,576. (No model.)

To all whom it may concern:

Be it known that I, SAMUEL R. HUGHES, a citizen of the United States, residing in Benton Harbor, county of Berrien, 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 just prior to its delivery to the boiler is passed through a heated chamber or over a series of steam-pipes, in order to raise the temperature of the water as near the boiling-point as possible, but is more especially designed as an improvement on United States Letters Patent No. 328,587, granted me October 20, 1885.

In this patent was shown and described separate means for heating the inner cylinder and the external steam-jacket, and no connection whatever is shown between said cylinder and jacket. So, also, were shown separate and distinct covers for the water-chamber and external steam-jacket, together with numerous other details of construction necessitating the employment of a number of parts, which if dispensed with, and the construction thereby rendered more simple, would materially lessen the cost of manufacture and promote the general utility of such a device.

The prime object of this invention is to utilize the steam employed to heat the external steam-jacket for heating the interior steam-cylinder by connecting the inlet and outlet openings of said cylinder with the steam-jacket, whereby steam fed to the said jacket will circulate freely through and heat both the said jacket and cylinder. Another object is to dispense with a separate cover for the steam-jacket and water-chamber, and thereby promote simplicity of construction by doing away with unnecessary parts. Further objects are to provide means for centering and maintaining the steam-cylinder suspended within the water-chamber, but which cylinder shall be free to have both a longitudinal and lateral expansion without strain or injury to the supporting-walls of the water-chamber; to provide access to the interior of a steam feed-water heater without necessitating the breaking of numerous joints; to simplify the general construction, arrangement, and reduce the number of parts to the minimum; and, finally,

to provide certain details of construction hereinafter described, and illustrated in the accompanying drawings, in which—

Figure 1 represents a side elevation of a device embodying my invention; Fig. 2, a central vertical section thereof; Fig. 3, a horizontal section on line *x x*, Fig. 2.

Referring by letter to the accompanying drawings, A and B, respectively, indicate an outer and an inner shell or cylinder secured or riveted at the top and bottom thereof to two annular rings, C C, which rings are located between the two cylinders, lying flush with the top and bottom thereof, thus serving to seal the space between the two cylinders, while maintaining the said cylinders in their normal relative position. The space thus formed constitutes a steam-jacket, through which live or exhaust steam is passed, as in my patent aforesaid, by means of the inlet-port D, connected with the boiler or engine and located near the top of said cylinders, and an outlet-port, E, near the bottom thereof.

Secured by stud-bolts *a* to the annular rings C, and closing the ends of the inner cylinder, are two caps or covers, F and G, constituting a top and bottom, respectively, for the said cylinder, into which latter is fed through the pipe *b* the water to be heated, which, when raised to a sufficiently high temperature, is drawn off to the boiler through the pipe *c*; hence it will be seen that the space thus inclosed constitutes a water-chamber. I may here add that the pipe *b* and *c* may be supplied with the usual valves or cocks for regulating the passage of the water to said chamber. The cap F is supplied with any suitable blow-off pipe and valve for draining the accumulations on top of the water, in order to prevent the incrustation of the walls of the water-chamber, and thereby promote the purity of the water when delivered to the boiler; and the bottom cap is concaved on the inner side thereof to form a sediment-collector, from which the sediment may be drawn off, when desired, through a pipe, *e*, which may also be provided with a suitable valve or cock. (Not necessary to be illustrated.)

Supported upon rods *f f*, preferably screwed into the lower end thereof and within the water-chamber, is a steam-cylinder, H, maintained in an upright position and readily centered

within said chamber by means of screw-bolts *g*, the screw-threaded ends of which work through correspondingly-threaded holes provided in suitable ears or flanges, *h*, projecting from the outer faces of the cylinder-heads, and the heads of which bolts bear or impinge against the inner face of the walls of the water-chamber. It will readily be observed that such a construction—that is, the means just described for maintaining this steam-cylinder in position—fully provides for and permits the longitudinal expansion of the said cylinder, while securing the cylinder to the side walls of the water-chamber only at the ends thereof, which is to some extent limited by the annular rings *i i*, riveted to the cylinder between the ends thereof, and which serve to materially strengthen this cylinder.

Opening into the steam-cylinder through the ends thereof are two pipes, *I* and *J*, connecting said cylinder with the steam-jacket through the inner wall, *B*, thereof, and near the top and bottom of said jacket, the pipe *I* serving as an inlet and the pipe *J* as an outlet for the steam entering said cylinder, preferably opening into the steam-jacket opposite the inlet and outlet ports of said jacket. By this construction steam supplied to the jacket will freely circulate through and heat equally both the jacket and cylinder, and the thin layer of water in the water-chamber between said cylinder and jacket would soon be raised to a temperature only a little lower than that of the steam; and I may here add that either live and superheated or exhaust steam may be employed in connection with my heater.

The construction and arrangement of the several parts of my heater, besides reducing to a minimum the cost of manufacture, promotes the simplicity of the heater as a whole to such a degree as to greatly enhance its value and utility over such devices as heretofore constructed.

In order to gain admittance to the water-chamber, it is only necessary to remove the one cap or covering for said chamber, which at the same time permits ready access to the steam-cylinder from either end of the said chamber, and by such construction it will readily be observed that the centering and supporting of the cylinder within the chamber may be readily and easily accomplished; and to further this end the lower ends of the rods *f f* are formed into eyes, through which project the stud-bolts *j'*, passing through said eyes and the cylinder *B*, and screwing into the ring *C* between the outer and inner shells, *A* and *B*, which construction, while forming a support for the interior steam-cylinder, permits a slight lateral adjustment thereof sufficient to center the said cylinder, which may be accomplished by means of the screw-bolts *g g*, as before described.

Securing the outer and inner shells, *A* and *B*, together, by riveting them at the top and bottom thereof to the rings *C C* not only

serves to provide a sealed chamber between said shells, constituting an external steam-jacket, but greatly simplifies the construction of these parts, to which it gives additional strength, and the said steam jacket may be provided near the lower end thereof with a small pipe, *k*, passing through the shell *A*, to be utilized as a blow-off for said jacket, through which to discharge the condensations thereof.

As a result of the construction just described, I am enabled to dispense with a separate cover for the jacket and water-chamber, and employ only one cover at each end thereof, as shown, and still attain the same results and advantages common to the prior construction.

I am aware that prior to my invention a feed-water heater has been constructed having a water-chamber between an internal and external steam-jacket; but in such prior construction the connection between the steam-jackets has been such that the steam must necessarily pass through one before it can enter the other, while in mine there is a direct circulation from end to end of both the steam-jacket and cylinder, which are simultaneously supplied with steam from a common supply; also, in such prior construction the water is subjected to the heat of steam on two sides of differing temperature, owing to the cooling of the steam in the external jacket by reason of the double influence of the water and atmosphere, while by my invention the water is at all times subjected to a substantially uniform temperature on both sides, owing to the direct circulation of the steam, thereby utilizing the heat of the steam to the greatest degree, and raising the water to a temperature not possible in the prior construction.

In conclusion I may state that the covers or ends of the water-chamber, which are concavo-convex in cross-section, may be provided on their convex surfaces with radial ribs for additional strength, and the lower one thereof may also be provided with a hand-hole, *l*, for permitting access to the said chamber. The joints between these parts, and in fact all the joints occurring throughout the structure, are preferably provided with a suitable packing, in order to render them both water and steam tight.

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

1. In a feed-water heater, a water-chamber and an external steam-jacket for said chamber, in combination with a closed internal steam-cylinder and pipes or passage forming a connection between the ends only of the said cylinder and the steam-jacket, whereby there is a direct circulation of steam from end to end of said cylinder, and both the cylinder and jacket simultaneously supplied with steam from a common supply, substantially as described.

2. In a feed-water heater, the water-chamber

and the steam-cylinder located therein, in combination with ears or lugs rigid with said cylinder, and screw-bolts working through said ears or lugs, and having heads bearing or impinging against the walls of the water-chamber, whereby a longitudinal expansion of said steam-cylinder is permitted without strain to its supports, substantially as described.

3. In a feed-water heater, the water-chamber, in combination with the steam-cylinder located therein, the supporting-rods *ff*, the ears *hh* on the heads of said cylinder, and the screw-bolts *gg*, screwing into said ears, and having their heads bearing or impinging against the walls of the water chamber, substantially as described.

4. In a feed-water heater, the combination of the outer and inner shells or cylinders, A and B, the rings C C, and the caps or covers

F and G, whereby both a steam-jacket and water-chamber are produced, and the necessity for employing two separate covers for said jacket and chamber dispensed with, substantially as described.

5. In a feed-water heater, the outer and inner cylinders, A and B, with the rings C C, constituting a steam-jacket, the caps F and G for said cylinders, and in connection therewith forming a water-chamber, in combination with the steam-cylinder H, located in said water-chamber, the strengthening-rings *ii*, rods *ff*, ears *hh*, screw-bolts *gg*, and pipes I and J, connecting said cylinder with the steam-jacket, substantially as described.

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Witnesses:

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