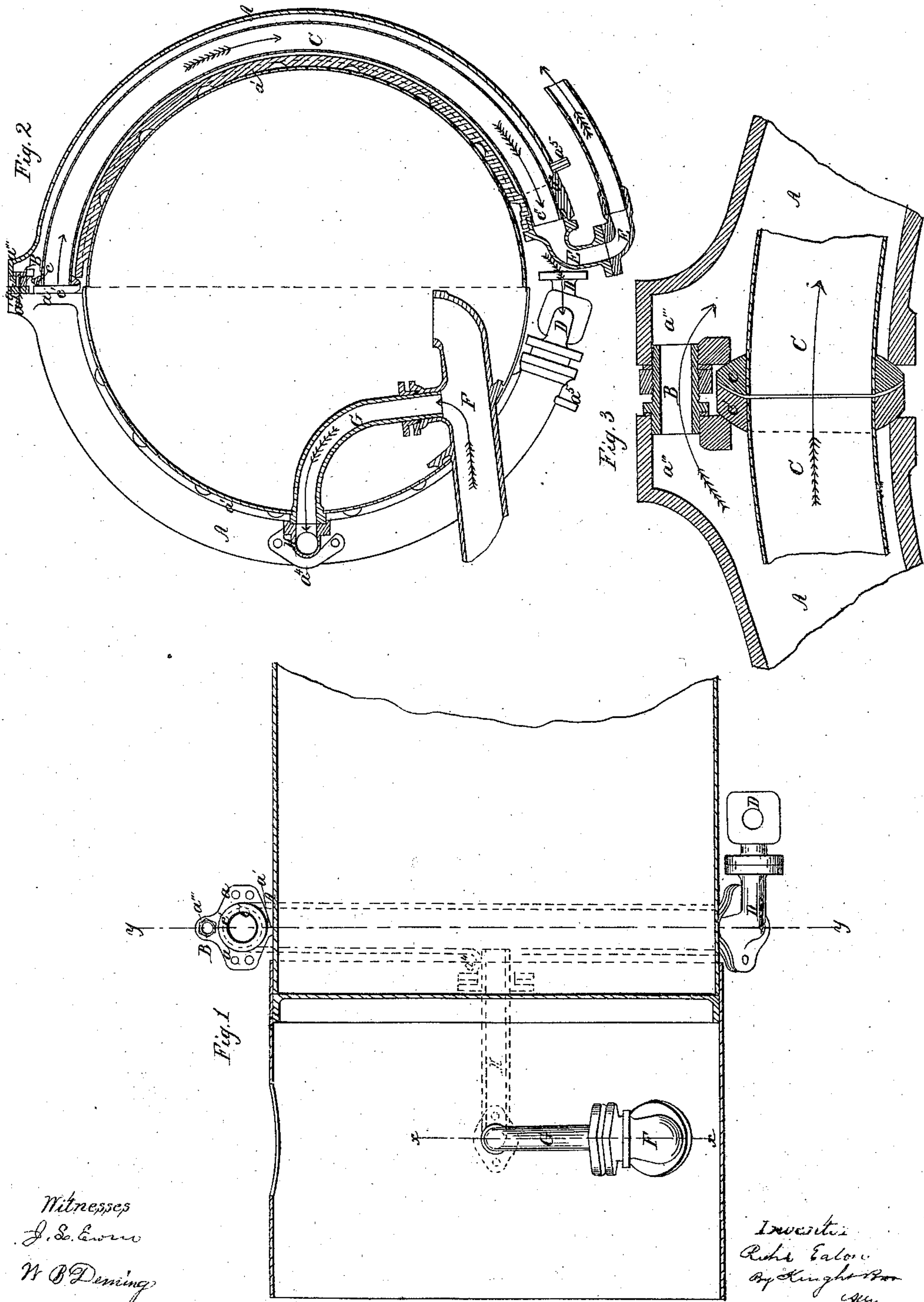


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R. EATON.
FEED WATER HEATER FOR STEAM GENERATORS.



Witnesses
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Letters Patent No. 86,515, dated February 2, 1869.

IMPROVEMENT IN FEED-WATER HEATERS FOR STEAM-GENERATORS.

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

To all whom it may concern:

Be it known that I, RICHARD EATON, of Eaton Lodge, Kentish Town, London, England, have invented a new and useful Improvement in Apparatus for Heating the Feed-Water of Locomotives by Means of the Exhaust Steam; and I do hereby declare the following to be a full, clear, and exact description thereof, reference being had to the accompanying drawings, which are made a part of this specification.

The apparatus consists of two circular and concentric pipes or tubular chambers, made in two or more sections, and connected by suitable coupling, and when in position surrounds the boiler or smoke-arch. The outer pipe or casing is connected, by means of suitable branches, with the exhaust-pipes within the smoke-box, or at some other convenient point, and is, when the engine is running, constantly filled with the exhaust steam, which is employed as the heating-agent. The inner pipe forms the conduit of the feed-water, which is heated in its transit therethrough, its ends being connected, respectively, with the feed-pump and boiler. The apparatus is heated, when the engine is not running, by its contact with the boiler, sufficiently to prevent freezing.

In the drawings—

Figure 1 is a longitudinal section of the front end of a locomotive-boiler, having my improved feed-water heater applied.

Figure 2 is a transverse section thereof, on the planes indicated by the lines $x x$ and $y y$, fig. 1.

Figure 3 is an enlarged sectional view, illustrating the manner of connecting the sections of the chambers or pipes.

A A represent the outer pipe or chamber, which is cast or otherwise made of iron or other suitable metal, in two segmental parts or sections, as shown, said sections being united at the top of the apparatus by means of bolts passing through the lips or flanges $a a$.

Its inner surface is provided with a notched rib, a' , which is fitted to the surface of the boiler, and forms a connection to conduct the heat of the latter to said chamber A when it is not otherwise heated.

Its lower ends are contracted, so as to be closed by the inner pipe, as represented at a'' , and its upper ends are provided with branches a''' , connected by means of an intermediate pipe, B, which is constructed and applied as represented in fig. 3, and forms the communication between its two parts.

It is further provided, preferably at a central point, with a pair of branches, $a^1 a^1$, for the admission of the exhaust steam, and at its lowest points, with small drain-pipes, a^5 , for the discharge of the water resulting from the condensation of the steam.

O O represent the inner pipe or chamber. It is arranged within the pipe or chamber A, concentric therewith, its diameter being sufficiently less than that of

the bore of A to leave an annular space of the requisite area for the circulation of the steam, as represented in fig. 2.

It is constructed in two parts or sections, corresponding with those of A, and is provided at its upper ends with male and female coupling-collars, $c c'$, held together by the connection of A, said collars being, respectively, of convex and concavo-convex form, and their surfaces turned to a true spherical shape, so as to fit perfectly tight into each other, and into the seated ends of the sections of the pipe A, as represented in fig. 3. The spherical form of the couplings adapts them to accommodate themselves to any deviations in the pipe from the true line, caused by inaccuracies of workmanship, expansion, &c.

The lower ends c'' of this pipe pass through the contracted portions a'' of A, where they are connected, respectively, to the pipes leading from the pump and to the boiler, through the medium of "bends" or elbows D and E.

The steam is conducted to the pipe or chamber A from the exhaust-pipes F, two in number, by means of pipes G H, opening into said pipes F, inside of the smoke-box, as represented, or at any other convenient point, and into the chamber A, through the medium of the branches a^1 .

The red arrows in the drawing indicate the course of the steam.

The blue arrows indicate the course of the water.

The operation of the apparatus is as follows:

The engine being started, the exhaust steam passes through the pipes F G H, and enters the chamber A, at opposite sides, and circulates within said chamber, around the pipe C, through which the feed-water is being forced, with an intermittent motion, by the pump, and imparts its heat thereto, the feed-water then passing in a highly-heated state to the boiler.

The apparatus, surrounding the boiler or smoke-arch, is not liable to freeze while the engine is standing on sidings, or running down long grades without steam, or when standing in the steam-shed in winter, as would otherwise be the case, as sufficient heat will be imparted to it by its contact with the boiler to effectually prevent this.

The circular form of the apparatus renders its parts simple and compact, and lessens materially the amount of piping required to form its connection with the boiler and pump.

The apparatus is quite out of the way, and does not present an unsightly appearance.

I am aware that feed-water heaters, in which the heat is imparted by the exhaust steam, have before been used extensively in connection with stationary engines, and in some few instances upon locomotive-engines, but the apparatus applied to the latter have been so complicated, cumbersome, and unsightly, so in-

conveniently located, and so liable to freeze and become useless in the winter, that no successful use has hitherto been made of them.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. The feed-water-heating apparatus, consisting of the pipes or tubular chambers A A and C C, arranged one within the other, and applied substantially as herein described.

2. The construction and arrangement, on the chamber A, of the rib or flange *a'*, whereby to form a heat-conducting connection with the surface to which said

chamber A is applied, substantially as herein described.

3. The coupling-collars *c' c''*, constructed substantially as described, in combination with pipes or tubular chambers A A, C C, substantially as herein set forth.

To the above specification of my invention, I have signed my hand, this day of , 1868.

RICHARD EATON.

Witnesses:

N. CLENDENNING,

E. H. STUART.