

(No Model.)

2 Sheets—Sheet 1.

W. H. RUSHFORTH.  
FEED WATER HEATER.

No. 391,389.

Patented Oct. 16, 1888.

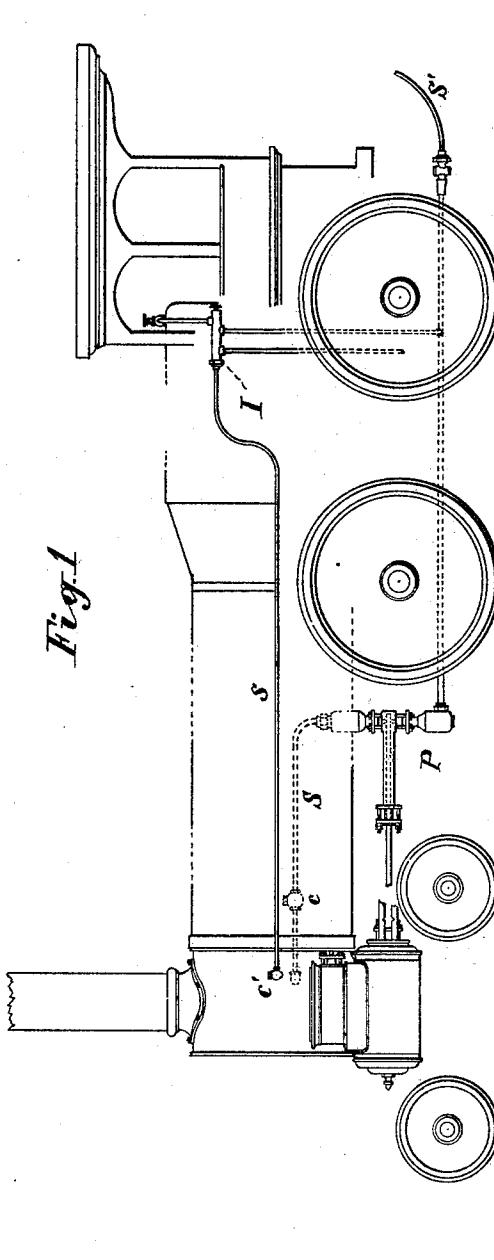


Fig. 1

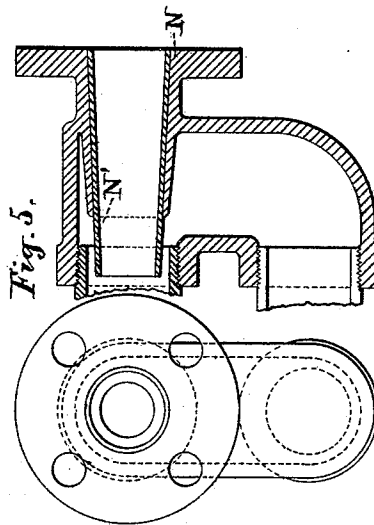


Fig. 5.

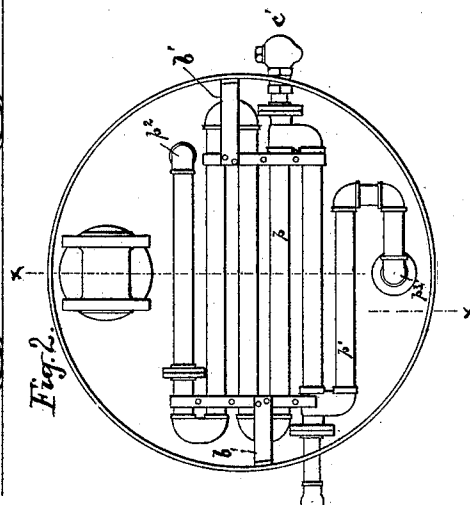


Fig. 2.

WITNESSES:

a. s. Fitch  
L. L. Suerden.

INVENTOR,

William H. Rushforth  
BY *Aly. W. Vermilyea*  
his ATTORNEY.

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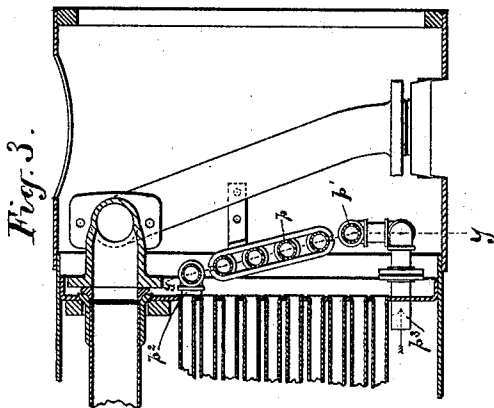
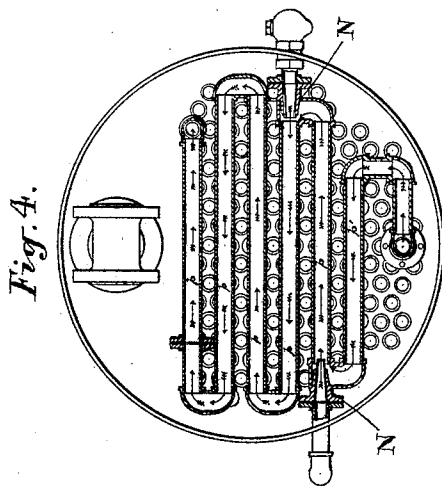
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# UNITED STATES PATENT OFFICE.

WILLIAM H. RUSHFORTH, OF RUTHERFORD PARK, NEW JERSEY, ASSIGNOR  
TO THE RUSHFORTH FEED WATER HEATER COMPANY, OF NEW YORK,  
N. Y., AND JERSEY CITY, NEW JERSEY.

## FEED-WATER HEATER.

SPECIFICATION forming part of Letters Patent No. 391,389, dated October 16, 1888.

Application filed January 11, 1887. Serial No. 223,907. (No model.)

### *To all whom it may concern:*

Be it known that I, WILLIAM H. RUSHFORTH, of Rutherford Park, in the county of Bergen and State of New Jersey, but a subject of the Queen of Great Britain and Ireland, have invented an Improvement in Feed-Water Heaters.

The following is a specification of my invention and its mode of operation, reference being had to the accompanying drawings, forming part of the same, in which—

Figure 1 is a side elevation of a railway-locomotive to which my invention has been applied, showing the exterior feed-water connections. Fig. 2 is a front elevation of a device embodying my said invention, showing also the walls of the smoke-box within which it is placed. Fig. 3 is a central vertical longitudinal sectional view of said device and smoke-box and a portion of the said boiler. Fig. 4 is a central vertical sectional view of said device on line *y y*, Fig. 3; and Fig. 5 is an enlarged central sectional view of the joint made between the pipe leading from the ordinary pump or injector and the suction and delivery pipes hereinafter mentioned.

My invention is designed to facilitate the heating of the water in a steam-boiler by means of a heating-coil located in the smoke-box of the engine, through which coil the feed-water passes before entering the boiler.

The invention is further designed to insure a constant circulation of the boiler-water through the heating-coil at all times, so as to prevent the speedy destruction of the apparatus by the intense heat of the smoke-box, and to prevent the opening of seams and loosening of rivets, due to unequal expansion and contraction, by maintaining a practically uniform temperature throughout the boiler.

According to this invention the coil is connected at its ends with the boiler, one connection being preferably near the top of the boiler and the other near the bottom thereof, the heating-coil being entirely below the water-line of the boiler. These dispositions are important to secure the constant circulation referred to. An inlet-nozzle connected with the feed-pipe enters the coil at one of the bends thereof.

N is the injector or nozzle, which I prefer to employ to accomplish the main purpose of my invention.

*p* is the pipe leading from the nozzle to the upper part of the boiler, and *p'* the pipe leading from the lower part of the boiler, as plainly seen in Figs. 3 and 4, the parts that enter the boiler being respectively lettered *p*<sup>2</sup> and *p*<sup>3</sup>. These pipes *p* and *p'* I prefer to make, as shown, of several straight sections and return-bends, placed in the smoke-box of the locomotive, or other equivalent position, (supported by braces *b b'*, secured to the side of the smoke-box,) where the heat escaping from the flues of the boiler will strike directly upon them, their form being adapted to present as large a heating-surface as possible for the space they occupy without interrupting the draft.

To the nozzle I connect the feed-pipe leading from the pump P or the injector I, and sometimes I employ two nozzles and connect them one to the pump and the other to the injector, so that the feed-water from said pump or injector, or both, when in action will issue from said nozzle or nozzles. Check-valves *cc'* are used to prevent any backward flow of the feed-water, and S' is the pipe leading from the tank to the pump or injector.

As shown in Fig. 5, the nozzle N and return-bend may be formed in one piece, by which means an excessive number of joints is obviated, thus reducing the liability of leakage and a uniform distance of insertion of the nozzle into the connecting-pipe is insured; but to provide for any desired variation of the length of the nozzle, I use a second and interior nozzle, N', fitting closely within N, which can easily be changed or altered to make its length, and consequently the distance of its penetration, accord with the wishes of those using it. It need not be as heavy as the main nozzle N, and may therefore be inserted farther without choking the passage.

The operation of the apparatus shown is as follows: Water is forced through pipe S by the action of the pump or injector, and issuing from N passes onward through *p* to the upper part of the boiler, which it enters through *p*<sup>2</sup>. In its course through *p* it is highly heated, and does not therefore suspend the making of steam

when it enters the boiler—a point greatly to be desired. Again, being so heated it is not likely to form scale within the boiler. The use of the nozzle N insures its passing upward, and results in its being exposed to the heat for a much greater period than if it passed downward. When the feed is cut off, the water in the pipes  $p$   $p'$ , growing warmer under exposure to the heat issuing from the flues, passes into the boiler through  $p^2$ , and its place is supplied by colder water through  $p^3$  and the burning out of the connections  $p$   $p'$ , unavoidable were there but one opening therefrom to the boiler, is avoided.

The nozzle I prefer to locate as near the bottom boiler-connection,  $p^3$ , and in such position that the entering feed-water will be forced to take an upward course, that it may have as long a traverse, and consequently as great exposure to the heat issuing from the flues, as possible before it enters the boiler and be prevented from entering through  $p'$  and  $p^3$  and reversing the preferred course of circulation.

I do not wish to be understood as limiting

myself to the nozzle N, since it is obvious that the injector I itself might be used instead.

In a subsequent application filed June 27, 1888, No. 278,360, I have described certain improvements in feed-water heaters, which are applicable to and designed to be used in connection with the invention described and claimed herein.

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

In a locomotive or other engine, the combination, with the boiler and feed-water pipe, of a heating-coil located in the smoke-box of the engine entirely below the water-line of the boiler and connected at each end with the boiler, said connections being at different levels, and an inlet-nozzle projecting into said coil at one of the bends thereof, substantially as set forth.

WM. H. RUSHFORTH.

Witnesses:

A. G. N. VERMILYA,  
L. L. DUERDEN.