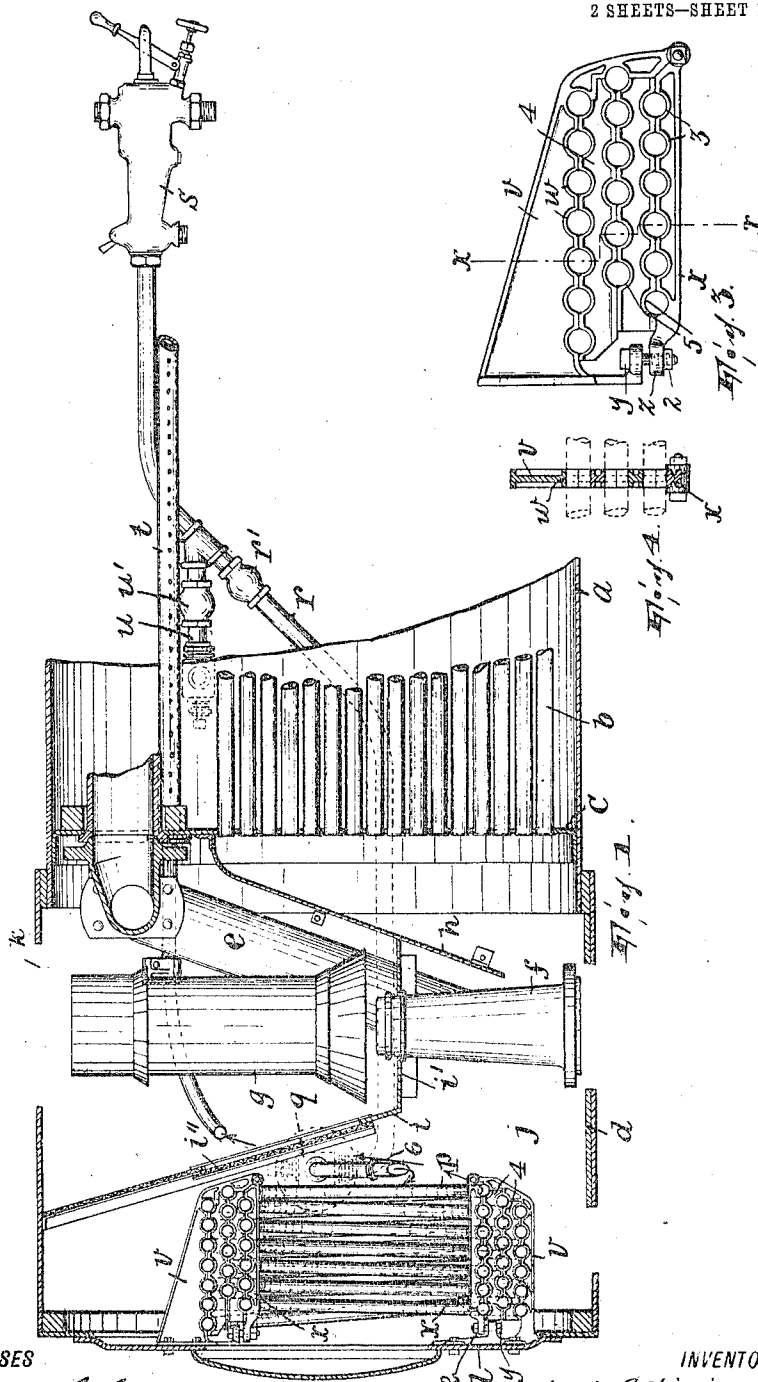


D. T. WILLIAMS.  
FEED WATER HEATER.  
APPLICATION FILED MAR. 26, 1912.

1,039,000.

Patented Sept. 17, 1912.

2 SHEETS—SHEET 1.



WITNESSES

*Wm. Drell.*  
*Chas. Kaufmann*

INVENTOR,

*David J. Williams,*

BY

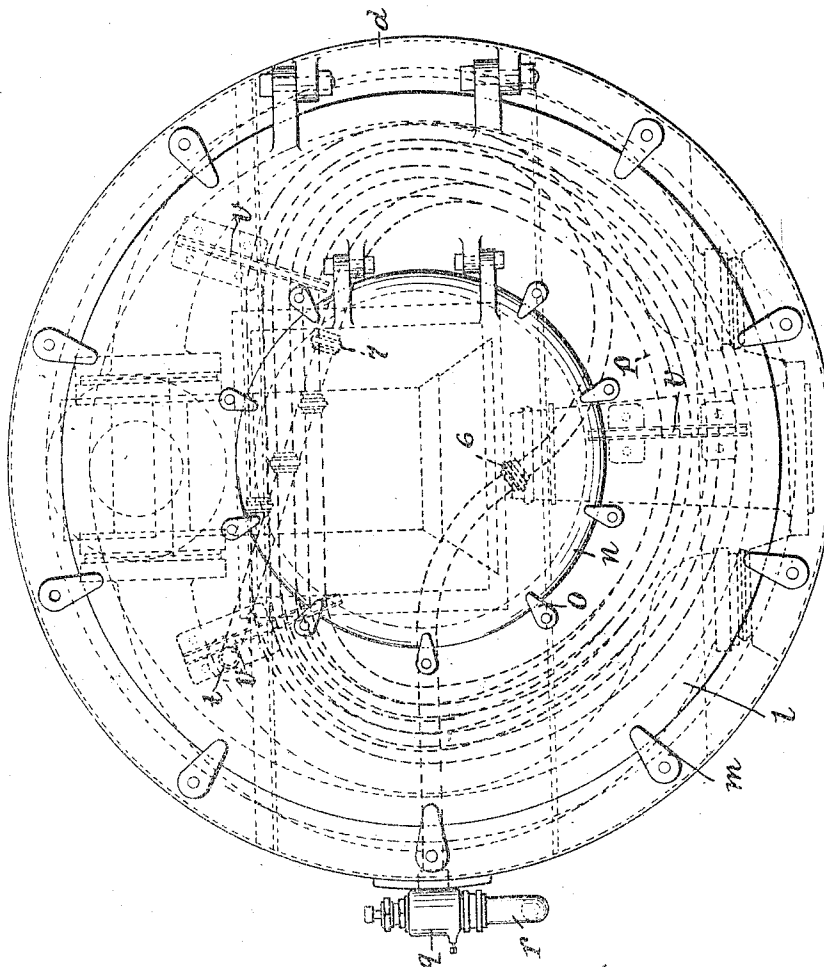
*John D. Williams,*  
ATTORNEY

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2 SHEETS—SHEET 2



Wm. A. R.

**WITNESSES**

Wm. Bell.  
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# UNITED STATES PATENT OFFICE.

DAVID T. WILLIAMS, OF PATERSON, NEW JERSEY, ASSIGNOR OF ONE-HALF TO FRANK L. CONNABLE, OF WILMINGTON, DELAWARE.

## FEED-WATER HEATER.

1,039,000.

Specification of Letters Patent.

Patented Sept. 17, 1912.

Application filed March 26, 1912. Serial No. 886,355.

*To all whom it may concern:*

Be it known that I, DAVID T. WILLIAMS, a subject of the King of England, residing at Paterson, in the county of Passaic and State of New Jersey, have invented certain new and useful improvements in Feed-Water Heaters, of which the following is a specification.

This invention relates to feed-water heaters for boilers of the locomotive class and particularly to that type of such heaters which are located in the smoke-box of the boiler. My principal objects are so to construct and arrange a feed water heater within the smoke-box of a boiler of the locomotive class that as little alteration as possible of the smoke-box and its appurtenant apparatus will be required and their efficiency retained unimpaired; that the heater itself may have the maximum efficiency; that the heater will stand securely held within the smoke-box, substantially proof against loosening, in whole or in part, under the vibrating action of the locomotive or its mechanism; and that free and convenient access to the interior of the smoke-box may be had.

In the accompanying drawings, Figure 1 is a longitudinal sectional view of the forward part of the boiler and the smoke-box of a locomotive, showing my feed-water heater in position; Fig. 2 is a front elevation of the smoke-box; and, Figs. 3 and 4 are a side elevation of one of the supports for the heater and a sectional view on line *x-x* of Fig. 3, respectively.

The boiler *a*, having the flues *b* and flue-sheet *c*; the smoke-box *d*; steam pipes *e*, leading from the boiler downwardly through the smoke-box; the blast-pipe *f* and petticoat-pipe *g*; deflector plate *h* extending from the flue-sheet *c* above the flues at a forward incline and to a point near the bottom of the smoke-box and back of the blast-pipe; the diaphragm *i* having the imperforate horizontal portion *i'* thereof penetrated by the blast-pipe and the upwardly inclined portion *i''* thereof formed as or with a screen for permitting the gases and smoke from the flues, after having been deflected

downwardly by the deflector plate and so caused to enter the chamber *j* (formed by the diaphragm and deflector plate forward thereof) at the bottom of said chamber, and to traverse said chamber, to escape to the opening *k* which leads to the stack (not shown), are or may be all substantially the same as in constructions now commonly employed.

To the front of the fire box is hinged the annular door *l* held closed by the clips *m*, and to the door *l* and adapted to close its opening is hinged the door *n*, held closed by the clips *o*.

With a view to attain the objects above described the feed-water heater is supported in the smoke-box at the front thereof, preferably by the annular door *l*, and is so arranged and constructed as not to interfere with the flow of the gases and smoke through the chamber *j* and at the same time to absorb the maximum amount of heat from the escaping gases and smoke. The said heater preferably consists of concentric helical windings or coils of tubing *p*, say three such coils, connected with each other so as to form a continuous conductor for the feed-water; in the construction shown the course through the heater is via the outer, intermediate and inner coils, in the order named.

At *q*, attached to the outside of the fire-box, is a check valve with which the free end of the outermost coil is connected and with which is also connected the pipe *r* leading from any suitable means, such as injector *s*, for forcing the water through the system into the boiler; the end *t* of the innermost coil is extended rearwardly through the flue-sheet into the boiler, its extremity being perforated, as shown, so as to disperse the water discharged therefrom as much as possible. If desired, a branch *u* of the pipe *r* may lead directly into the boiler, said pipe *r* and the branch respectively having valves *r'*, *u'* whereby the alternative feeding of the water to the boiler, indirectly through the heater, or directly through pipe *u*, may be controlled.

The coils are preferably flattened at the top, as seen in Fig. 2, so that the whole

thereof will always be water-charged, it being understood that the minimum water level in the boiler is usually some little distance above the horizontal plane of the uppermost flues and hence above the coils; for the same reason, the discharge end *t* of the innermost coil is depressed below the level of the water in the boiler, as shown.

The several convolutions of the coils and the coils themselves are spaced from each other, allowing the hot smoke and gases to flow freely through them.

The heater as a whole, its several coils, and each convolution of each coil, are securely held in place as follows: Projecting inwardly from and bolted to the annular door *l* are three cradles or brackets *v* which are or may be all substantially alike. One of these brackets is shown in Figs. 3 and 4, together with the appurtenant mechanism for holding the coils and their component parts in position. Each bracket is in the form of an arm bent off at one end and having a series of recesses *w* (each shaped to fit the cross sectional contour of the tubing forming the heater) extending along said arm. To the free end of the bracket is pivoted a clamp *x* whose free end receives a bolt *y* extending through a projection *z* on the bracket and provided with a nut 2; this clamp is formed with recesses 3 similar to the recesses *w* of the bracket.

4 designates spacers having recesses 5 on their upper and lower surfaces corresponding to the recesses of the bracket and its clamp. The sectional view, Fig. 4, shows that each of the parts *v*, *x* and 4 has an I-shaped cross-section, so as to afford a broad seat for each convolution of the heater without unduly weighting the parts of the heater supporting means.

As shown in Fig. 1, the several brackets *v* bear against the outside of the outermost coil, receiving its several convolutions in their recesses *w*; the clamps *x* bear against the inside of the innermost coil, receiving the convolutions of such coil in its recesses; the spacers 4 are arranged between the outermost and intermediate coils on the one hand and the innermost and intermediate coils on the other hand, receiving their convolutions in their recesses. When the parts have been thus assembled, the nuts 2 are tightened, causing opposite radial pressures to be imposed on each convolution, so that each coil and its component portions are rigidly held in place.

Two of the described coil-supporters are placed in spaced relation to each other so as to sustain the upper part of the coils, while the third holds centrally the lower part of the coils (Fig. 2).

The heater being annular in form and having the passage therethrough of appreciable diameter and substantially opposed

to the door *n*, access through the heater to the interior of the fire-box for ordinary purposes may readily be had by simply opening the door *n*. In this way, also, the connections at 6 and 7 between the heater and its supply and discharge means can be established after the heater structure has been attached to the door *l* and the latter closed. In extraordinary instances, having disestablished the connections 6 and 7, the door *l* may be swung outwardly on its hinges, carrying the heater structure with it, to afford access to the interior of the smoke-box.

Having thus fully described my invention, what I claim as new and desire to secure by Letters Patent is:—

1. In combination, with a smoke-box having an opening in its wall-structure affording access to the interior of the smoke-box and a removable closure member for said opening, a feed water heater carried by said closure member, substantially as described.

2. In combination, with a smoke-box having an opening in its wall-structure affording access to the interior of the smoke-box and a removable closure member for said opening, said closure member itself having an opening, a feed water heater carried by the closure member and having a passage opposed to the opening therein, and a removable closure member for the latter opening, substantially as described.

3. In combination, with a smoke-box having an opening in its wall-structure affording access to the interior of the smoke-box and a removable closure member for said opening, a tubular structure coiled to form a passage therethrough and arranged within the smoke-box relatively close to, and with the passage thereof opposed to, said opening, substantially as described.

4. In combination, with a smoke-box structure having an opening in one of its walls affording access to the interior of the smoke-box and a removable closure member for said opening, a feed-water heater carried by said closure, and supply and discharge means attached to said structure and removably connected with the heater, substantially as described.

5. In combination, with a locomotive smoke-box structure, the front wall of said structure having an opening affording access to the interior thereof, a removable closure member for said opening, and a feed-water heater carried by said closure member, substantially as described.

6. In combination, with a locomotive smoke-box structure, the front wall of said structure having an opening affording access to the interior thereof, a removable closure member for said opening, said clo-

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sure member itself having an opening, a  
feed-water heater carried by the closure  
member and having a passage opposed to  
the opening therein, and a removable closure  
5 member for the latter opening, substantially  
as described.

In testimony whereof I affix my signature  
in presence of two witnesses.

DAVID T. WILLIAMS.

Witnesses:

WM. D. BELL,

JOHN W. STEWARD.

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