2 Sheets—Sheet 1.

S. J. HAYES, E. T. JEFFERY & H. SCHLACKS.

Purifying the Feed-Water in Steam-Boilers.

No. 211,326. **Patented Jan. 14, 1879.**

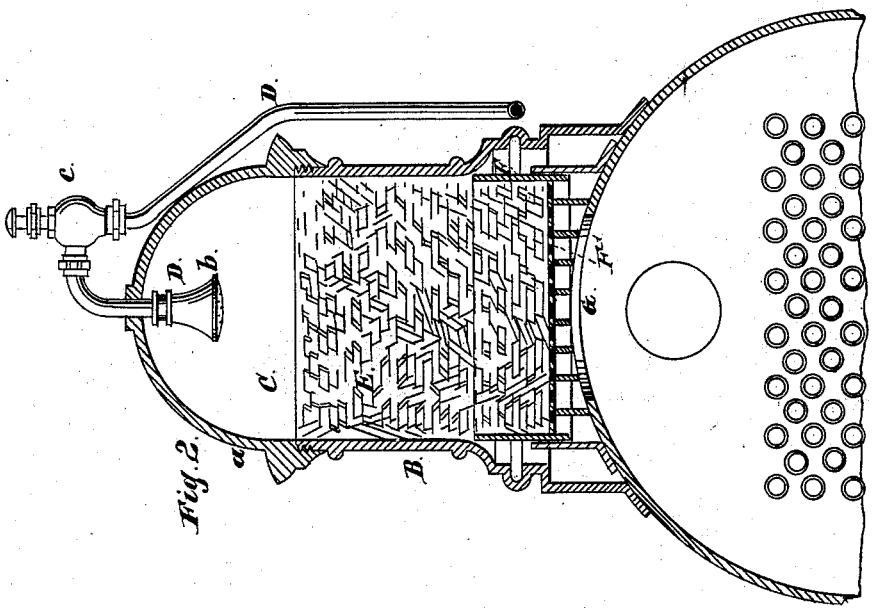

Fig. 2.

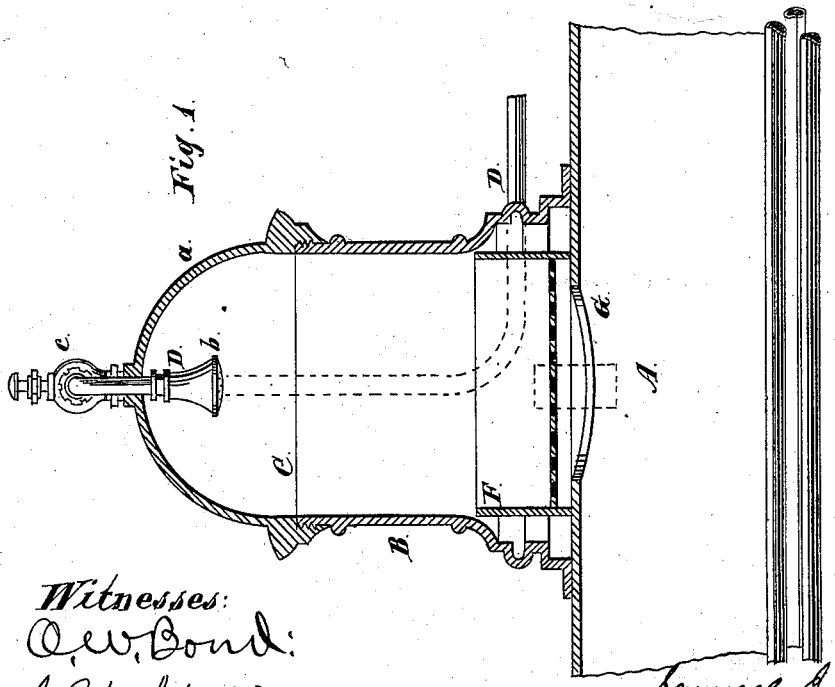

Fig. 1.

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2 Sheets—Sheet 2.

S. J. HAYES, E. T. JEFFERY & H. SCHLACKS.

Purifying the Feed-Water in Steam-Boilers.

No. 211,326. **Patented Jan. 14, 1879.**

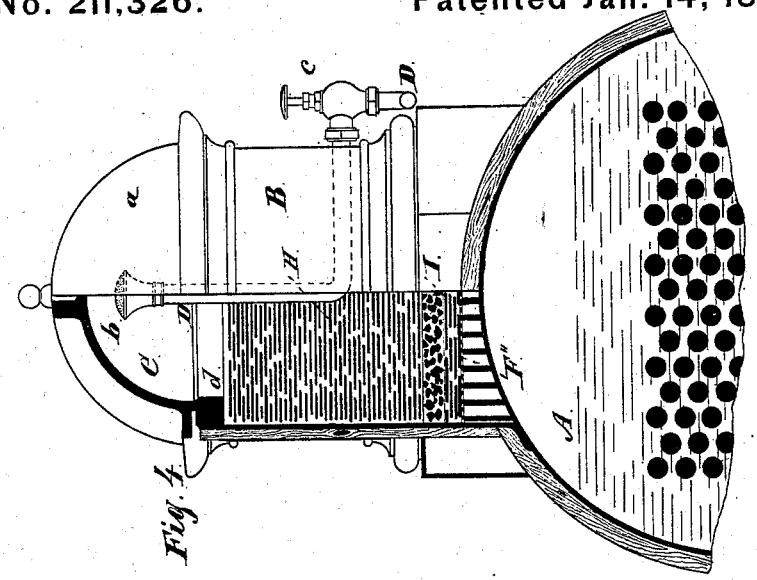

Fig. 4.

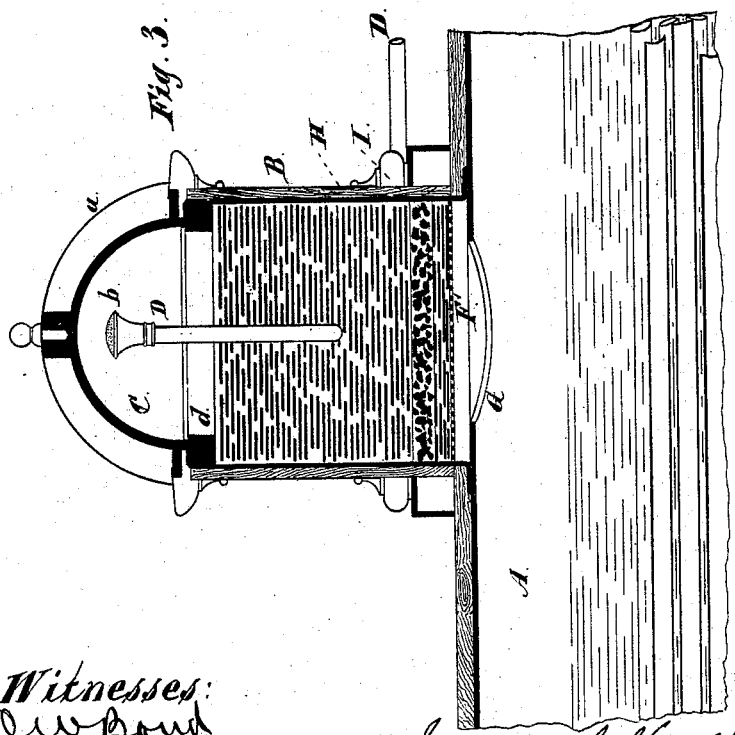

Fig. 3.

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UNITED STATES PATENT OFFICE.

SAMUEL J. HAYES, EDWARD T. JEFFERY, AND HENRY SCHLACKS, OF CHICAGO, ILLINOIS.

IMPROVEMENT IN PURIFYING THE FEED-WATER IN STEAM-BOILERS.

Specification forming part of Letters Patent No. **211,326**, dated January 14, 1879; application filed June 4, 1878.

To all whom it may concern:

Be it known that we, SAMUEL J. HAYES, EDWARD T. JEFFERY, and HENRY SCHLACKS, of the city of Chicago, Cook county, State of Illinois, have invented new and useful Improvements in Devices for Purifying the Feed-Water in Steam-Boilers, of which the following is a full description, reference being had to the accompanying drawing, in which—

Figure 1 is a vertical section lengthwise of the boiler; Fig. 2, a half-section across the boiler, which in both figures is partly broken away. Figs. 3 and 4 are similar figures, showing another form of construction and arrangement of the purifying devices.

The object of this invention is the purifica- of the feed-water of locomotive, marine, stationary, and other steam-boilers before the feed-water is allowed to mix with the water in the boiler, by the removal of the lime, magnesia, and other impurities which form scale or incrustations upon the flues, crown-sheets, and other sheets of steam-boilers.

It is well known that in the use of steam-boilers these incrustations retard the transmission of heat through the furnace, sheets, and flues, and thus increase the consumption of fuel used in generating steam, besides having very injurious effects upon these sheets and flues, and largely increasing the cost of repairing the boilers. Devices have heretofore been in use for removing these impurities from the feed-water supplied to stationary boilers by causing the water to be brought into contact with the exhaust-steam from the engine in a tank or vessel separate from the boiler, in which tank were shelves or plates of metal, upon which the impurities were deposited, the purified water being then pumped from such tank or vessel into the steam-boiler.

In our invention we do not use exhaust-steam in purifying the feed-water, but such purification is effected by the use of live steam.

Heretofore it has been, as we believe, the universal custom or practice to introduce the feed-water into steam-boilers at some point below the working-level of the water in the boiler. In our invention we introduce the water into the steam-space of the boiler, either into the dome or domes of the boiler, or into a tank or vessel conveniently located and directly connected with the boiler by suitable steam-pipes, so that the steam may pass freely into this tank or vessel, and the water may flow from this tank into the boiler, or be forced into it by a pump or other suitable means. In forcing the feed-water into the dome or tank where the purification is effected a pump, injector, or other suitable appliance may be used; but we prefer an injector.

In the drawings we have represented two forms of construction and arrangement of the purifying devices.

In the form shown in Sheet 1 of the drawings, A represents the boiler, provided with suitable flues; B, the steam-dome; C, the steam and water space; D, the water pipe or tube; E, the metal scraps or other suitable material for collecting the lime, which scraps, &c., extend nearly to the top of the dome; F, the receptacle to receive the metal scraps, &c., E, located at the bottom of the dome. As shown, this receptacle is not very deep; but the sides thereof might be extended up nearly to the top of the dome, if desired, and a bail or handle provided at the top, so as to form a bucket for the easy removal of the scraps or other substances contained therein. F′, the perforated plate forming the bottom of the receptacle F; G, the opening in the boiler; *a*, the dome-covering; *b*, the rose or perforated head of the tube D. *c* is a check or stop valve; *d*, the ring for connecting the top of the dome with the body. (Shown in Sheet 2.) As shown, this ring is on the inside; but for using a basket or bucket in the dome to contain the plates and charcoal, or either, the ring will be placed outside, and the water admitted within the dome through a pipe at the top of the cover *a*, having an inverted rose or sprinkler attached thereto, as shown in Figs. 1 and 2.

In the form shown in Sheet 2 of the drawings, A B C D G and *a b c* represent corresponding parts to those indicated by similar letters in Sheet 1. H, the metal plates, taking the place of the metal scraps E, for collecting the lime; I, charcoal, placed, as shown, between the metal plates H and above the perforated plate F″, to act as a filter.

In this form of construction a receptacle for the plates H is not shown; but a perforated

plate, F″, is placed at the bottom of the steam-dome to retain the plates in position above the boiler. A receptacle having a perforated bottom, similar to F′, may be used, if desired.

In Sheet 1 the pipe D for the water enters the top of the dome and projects down into the steam-space C, while in the form shown in Sheet 2 the pipe D for the water enters near the bottom of the dome B and extends up into the steam-space; but in both cases the water is delivered at a point above the working-level of the water in the boiler, and in direct contact with the live steam in C.

In either form of construction the plates H or the metal scraps or other substance, E, may be used, as desired.

Other forms of arrangement and construction might be used; but in all of them the water must be delivered above the working-level of the water in the boiler and in direct contact with live steam from the boiler.

Within the dome B of the boiler is placed a quantity of metal scraps or pieces of iron, steel, tile, charcoal, or any other substance, E, or metal plates H, to which the lime or deposit in the water will adhere or upon which it will collect.

The pipe D for the feed-water terminates in the steam-space C within the dome and, as shown, its end is provided with a rose or perforated head, *b*, so that when the water is injected into the upper part of the dome it will be thrown from the pipe in the form of thin sheets or spray, and will pass by its own gravity over and among the scraps or pieces of metal or other substance, E, or the plates H, and after passing between and around such substances it will pass through a suitable opening, G, and mix with the water in the boiler.

In passing over and among the metal scraps or other substance, E, or the plates H, the lime, magnesia, and other impurities will be separated from the water, and deposited on the metal scraps, plate, or other substance placed within the dome.

The scraps or plates or other substances can be removed whenever desired, cleaned, and put back, or be replaced by others.

A convenient arrangement for removing the scraps or plates H will be to form the receptacle F (shown in Figs. 1 and 2) into a bucket, as before described, (or a separate bucket may be constructed of thin iron, having a perforated bottom,) and to place in such bucket or receptacle the plates, pieces of metal, or other substance, so that when the bucket or receptacle is lifted out the contents will also be lifted out. The water, in this form of construction, will be received in the top of the bucket or receptacle, and, being compelled to pass downward to escape through the perforated bottom, will come in contact with the plates or other substance, and be acted upon as before described.

By the use of our device the separation of the impurities from the water is very thorough and complete, as it is brought into contact with the live steam, which has a much higher temperature than exhaust-steam, and is therefore quicker and more effective in its action.

When a form of boiler is used where it is not desirable or convenient to employ a dome, the metal scraps or other substance, E, or plates H can be placed in a suitable tank or vessel, so located and arranged with reference to the boiler as to permit the passage of live steam directly from the boiler into the tank or vessel, and the escape of the water into the boiler, the water being injected into the top of the tank or vessel, and passing down and escaping at the bottom.

What we claim as new, and desire to secure by Letters Patent, is—

1. The herein-described method of purifying feed-water for boilers by admitting or injecting it above the water-line into direct contact with the live or boiler steam, and into contact with the removable steam-heated plates or other suitable substance before descending into or mixing with the boiler-water, substantially as specified.

2. The combination of the dome or tank B, injection-pipe D, and plates E, or other suitable substance, with a boiler, A, substantially as and for the purposes specified.

3. The dome B, pipe D, and plates E, or other suitable substance, in combination with the perforated plate G, opening H, and boiler A, substantially as and for the purposes specified.

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