J. ARMSTRONG.

Feed Water-Heaters and Filters.

No. 134,450. Patented Dec. 31, 1872.

Fig. 1

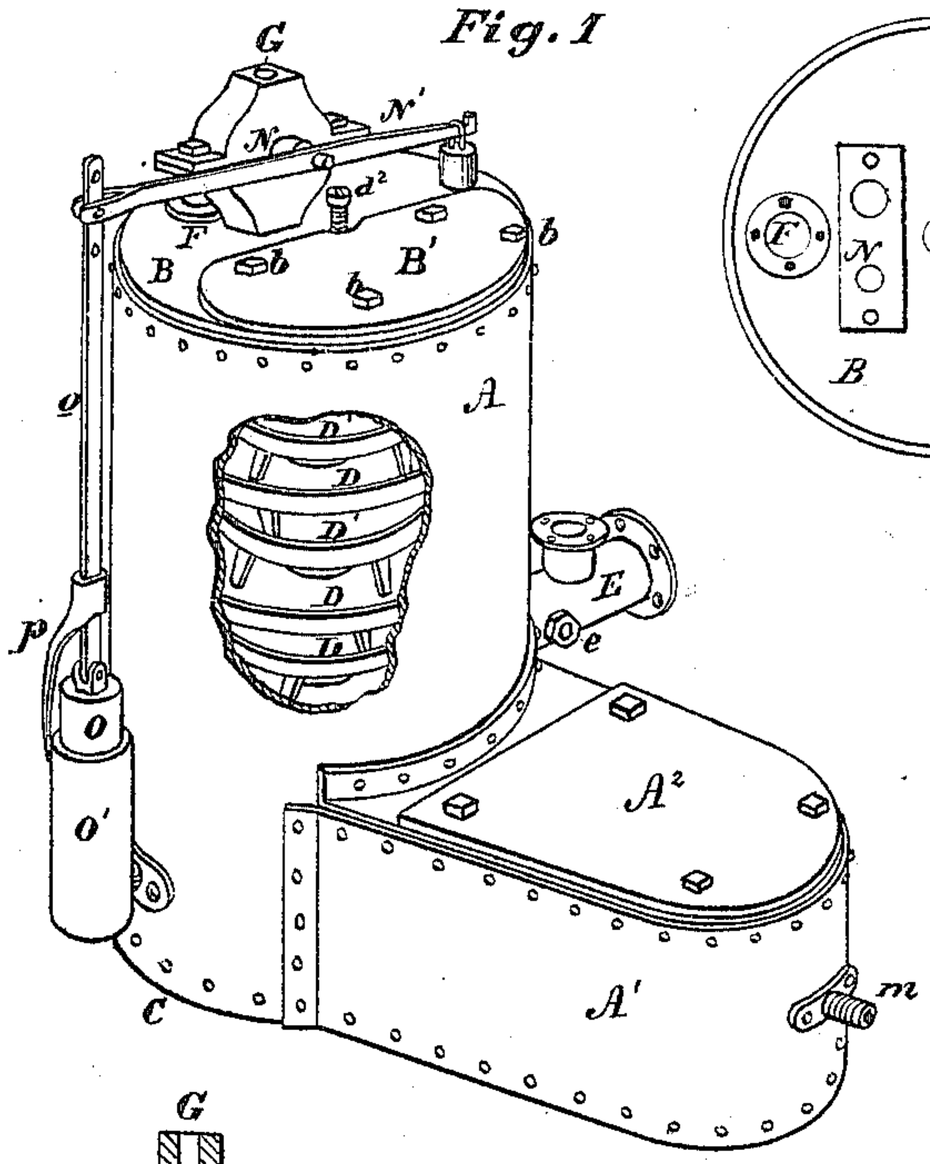


Fig. 4

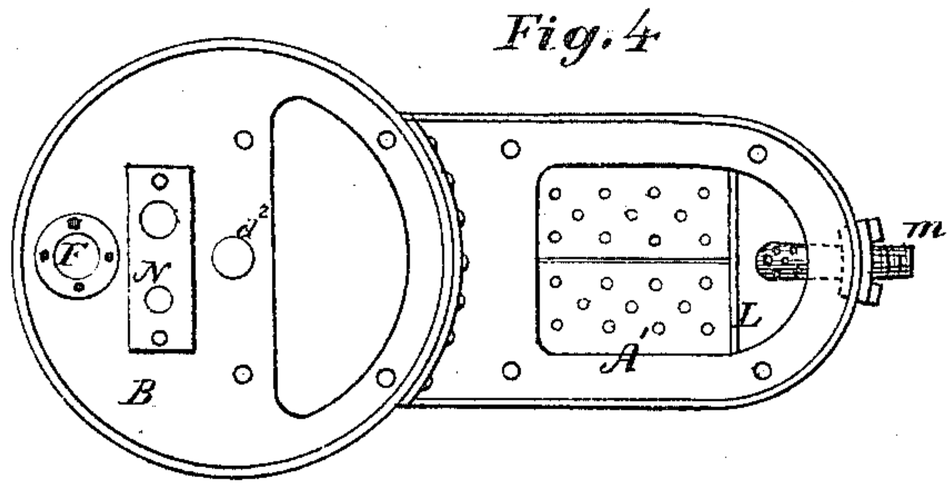


Fig. 3

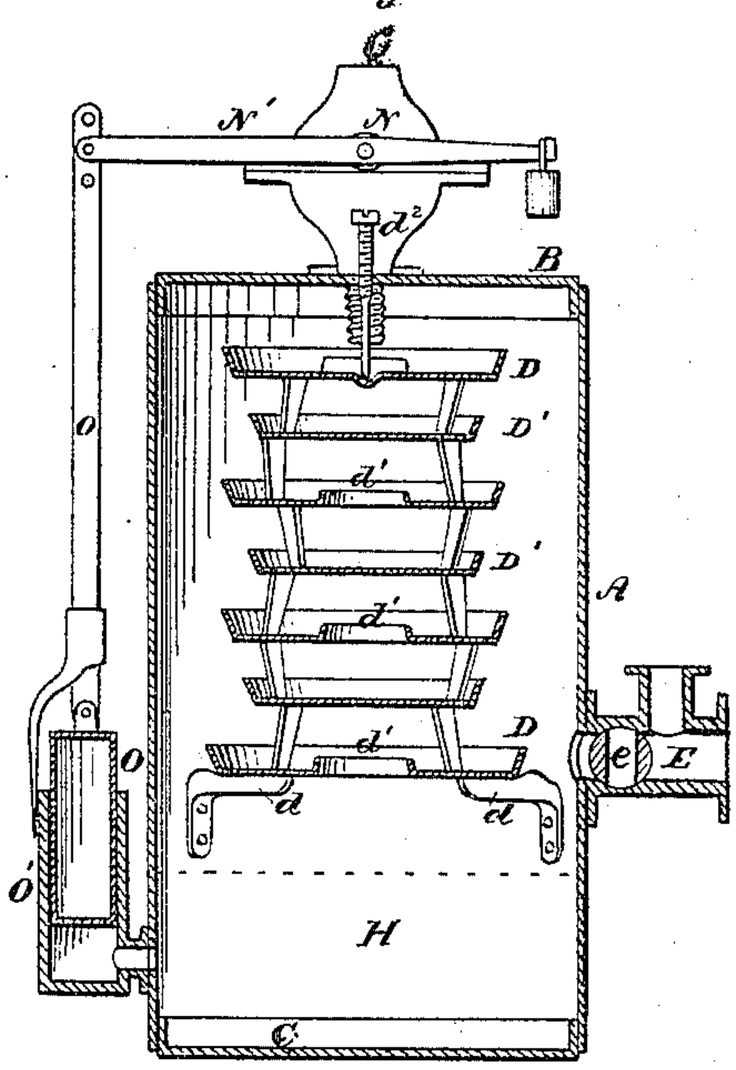


Fig. 2

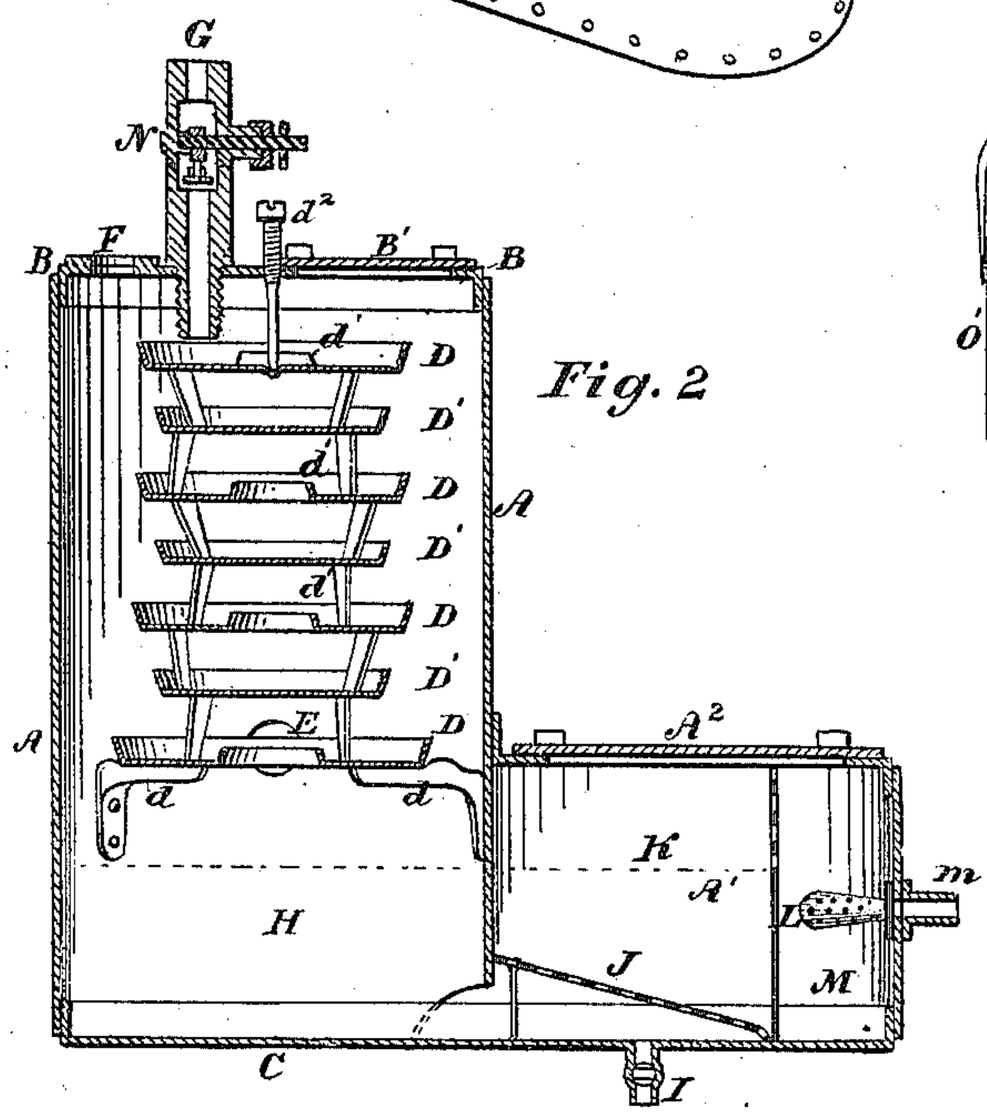
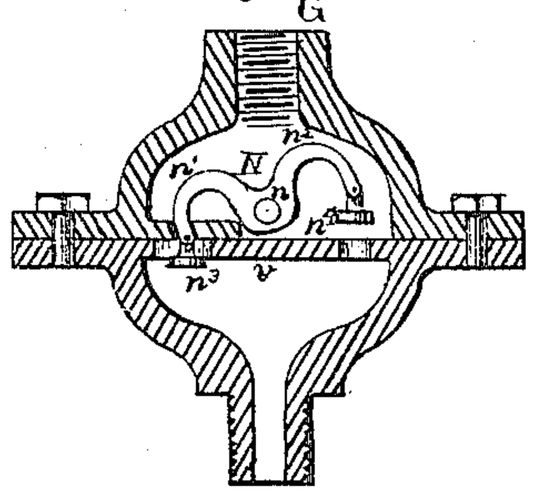


Fig. 5



Witnesses :-
Joel Dayton.
Ed Davidson

James Armstrong
by his Atty
Wm D. Baldwin

UNITED STATES PATENT OFFICE.

JAMES ARMSTRONG, OF TOLEDO, OHIO.

IMPROVEMENT IN FEED-WATER HEATERS AND FILTERS.

Specification forming part of Letters Patent No. **134,450**, dated December 31, 1872.

To all whom it may concern:

Be it known that I, JAMES ARMSTRONG, of Toledo, in the county of Lucas and State of Ohio, have invented certain new and useful Improvements in Feed-Water Heaters and Filters for Steam-Boilers, of which the following is a specification:

My invention relates to feed-water heaters of the class in which the inflowing current, passing over a series of shallow pans, and descending from one to the other in thin sheets, is acted upon by the exhaust steam from the engine and heated, and its impurities deposited, the heated water then rising, through a filter, to a hot well or reservoir, whence it is forced into the boiler. The invention herein claimed consists in certain improvements, hereinafter specified, upon the apparatus for which Letters Patent, respectively dated September 8, 1868, and June 22, 1869, have been granted to me.

In the accompanying drawing, which embodies my improvements in the best form now known to me, Figure 1 is a perspective view, with portions of the casing broken away to show the interior; Fig. 2, a vertical central longitudinal section therethrough; Fig. 3, a similar transverse section; Fig. 4, a plan or top view of the apparatus with the covers removed; and Fig. 5, a vertical section through the water-supply valve.

The heating-chamber is, by preference, made in the form of an upright cylinder, with a boiler-plate shell, A, and cast-iron heads B C. These heads are made small enough to fit snugly inside of the shell A, which is securely riveted to them. The heads project slightly above the shell, as shown in the drawing, by which mode of construction I am enabled to calk the joints securely, and thus prevent leakage. A series of shallow pans, D D′, are arranged, one above the other, within the heating-chamber. The bottom pan rests on brackets *d*, secured to and projecting inwardly from the shell at such a height that the bottom pan stands above the water-level of the reservoir. The pans are sustained at proper distances apart by suitable legs or supports; and each alternate pan of the series is of smaller size than the adjacent ones. The large pans D have a central hole, d^1, through them, surrounded by a flange of a height less than that of the edges of the pan, for a purpose hereinafter described. The pans rest loosely upon their supports, but may be clamped in position by a screw, d^2, working through the head B. As the pans frequently become filled with deposited matter they must be removed and cleansed. To provide for this necessity I arrange a man-hole in the upper head B′, and provide it with a removable cover, B′, held down by set-screws *b*. A rubber ring interposed between the cover and head packs the joint securely. The man-hole is of such size as readily to admit of the insertion, removal, or replacement of the pans. A reservoir or filtering-chamber, A^1, projects from the lower portion of the shell A, to which it is securely riveted; and is provided with a removable cover, A^2, similar to the cover B′ of the upper head B, to afford access to its interior.

The exhaust steam from the engine is admitted into the heating-chamber through a pipe, E provided with a suitable regulating-valve, *e*, passes up among the pans, and its uncondensed portion escapes through an exhaust-pipe, F. The feed-water enters through a pipe, G, which conducts it to the upper pan D of the series, the central collar of which it overflows into the next pan D′ below. It flows over the edge of this pan into the one below, and so on through the entire series, being heated in its descent by the escaping steam. Lime and other impurities are thus caused to be deposited in the pans. To cleanse the water from mud and such like impurities, a sediment chamber or space, H, is left below the pans, in which mud may settle, and be drawn off at intervals through a mud-valve, I, of suitable construction and sufficient area for the purpose. To prevent these impurities from rising into the reservoir or hot-well of the engine a filter, J, is arranged above the sediment-chamber in the filtering-chamber A^1. The inner walls of the shell A, it will be observed, extend nearly to the bottom of the sediment-chamber, and the filter is arranged above its lower edge so as to force the water to pass upward through the filter into the reservoir. The sediment is to be drawn off before it accumulates enough to come in contact with the filter. This downward projection of the inner portion of the shell also serves to prevent oil passing into the hot-well, as it floats on the surface of the water in the

sediment-chamber and remains therein. The filtered water rises into a filtering-chamber, K, which may be filled with hay or other well-known filtering material, by which it is still further purified. The removable cover A^2 affords ready access to this chamber. A partition, L, perforated at its top, separates the filtering-chamber from the reservoir or hot-well M. The filtered water is thus compelled to rise nearly to the top of the filtering-chamber before entering the reservoir or hot-well, whence it may be drawn through a pipe, *m*, by means of a suitable pump. I sometimes provide a stand-pipe between the hot-well and the pump, to permit steam to escape from the feed-water, which, owing to the perfect working of my apparatus, becomes more highly heated than is desirable. The stand-pipe is simply an open tube extending high enough to prevent the water from overflowing at its upper end. In order automatically to regulate the supply of feed-water I mount a balance-valve, N, on the water-supply pipe. A lever, N′, on the valve-spindle, has a counter-balance on one end, while the other is connected by a link, *o*, to a plunger, O, working in a cylinder, O′, communicating with the water-chamber; consequently the position of the plunger is regulated by the height of the water in the water-chamber, and thus the valve N is opened or closed as the water rises or falls. An indicator, *p*, on the link *o*, works on the outer side of the cylinder O′ and shows the height of the water in the chamber.

In order to obtain a valve which will readily respond to variations in the water-level of the reservoir, be operated by slight force, rapidly open and close, and yet at the same time afford a water-way of large area, I have devised a valve, shown in detail in Fig. 5.

As before explained, the balance-lever N′ is fastened to the rock-shaft *n* of the valve N, which consists of two arms, n^1 n^2, to which valves n^3 n^4 are pivoted. These arms vibrate with the rock-shaft. One, n^3, of the valves is suspended below the seat *v* of the valve, and works upward to close, while the other, n^4, is suspended above, and works downward in closing, consequently one valve counterbalances the other, and the two open or close with twice the capacity of a single valve, the advantage of which arrangement is obvious.

My improvements, as practice has proved, enable me to heat, purify, and filter the feed-water; to regulate the supply both of water and steam; and to remove or replace the parts with facility, the result being an apparatus practically of great value.

By the use of rigid cast heads with openings through them I am enabled readily to gain access to the interior of the heater and filter, and to secure a strong connection of the parts.

I sometimes use live steam direct from the boiler to work the heater, in which case I provide a safety-valve as a precaution against accidents.

I claim as my invention—

1. The combination of the cylinder forming a heating-chamber, water-chamber, and sediment-chamber, the pan-supporting brackets, and the separate filtering-chamber attached to said cylinder and forming an extension of the water-chamber, these parts being constructed as described, and operating as set forth.

2. The combination of the cylinder constructed as described, the extension filtering-chamber through which the water flows upwardly, the hot-well, and the partition between the filtering-chamber and hot-well, perforated near its top only, these parts being constructed as described and operating as set forth.

3. The combination of a counterbalanced water-supply valve, the link, the plunger, the pans, and the cylinder communicating with the water-chamber, these members being constructed substantially as described, and operating as set forth.

4. The indicator on the link, constructed as set forth, in combination with the reservoir, and operating as described, to mark the height of water in the same.

In testimony whereof I have hereunto subscribed my name.

JAMES ARMSTRONG.

Witnesses:
JOS. T. K. PLANT,
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