T. R. BUTMAN.

FEED-WATER HEATERS AND FILTERS FOR STEAM BOILERS.

No. 180,458. Patented Aug. 1, 1876.

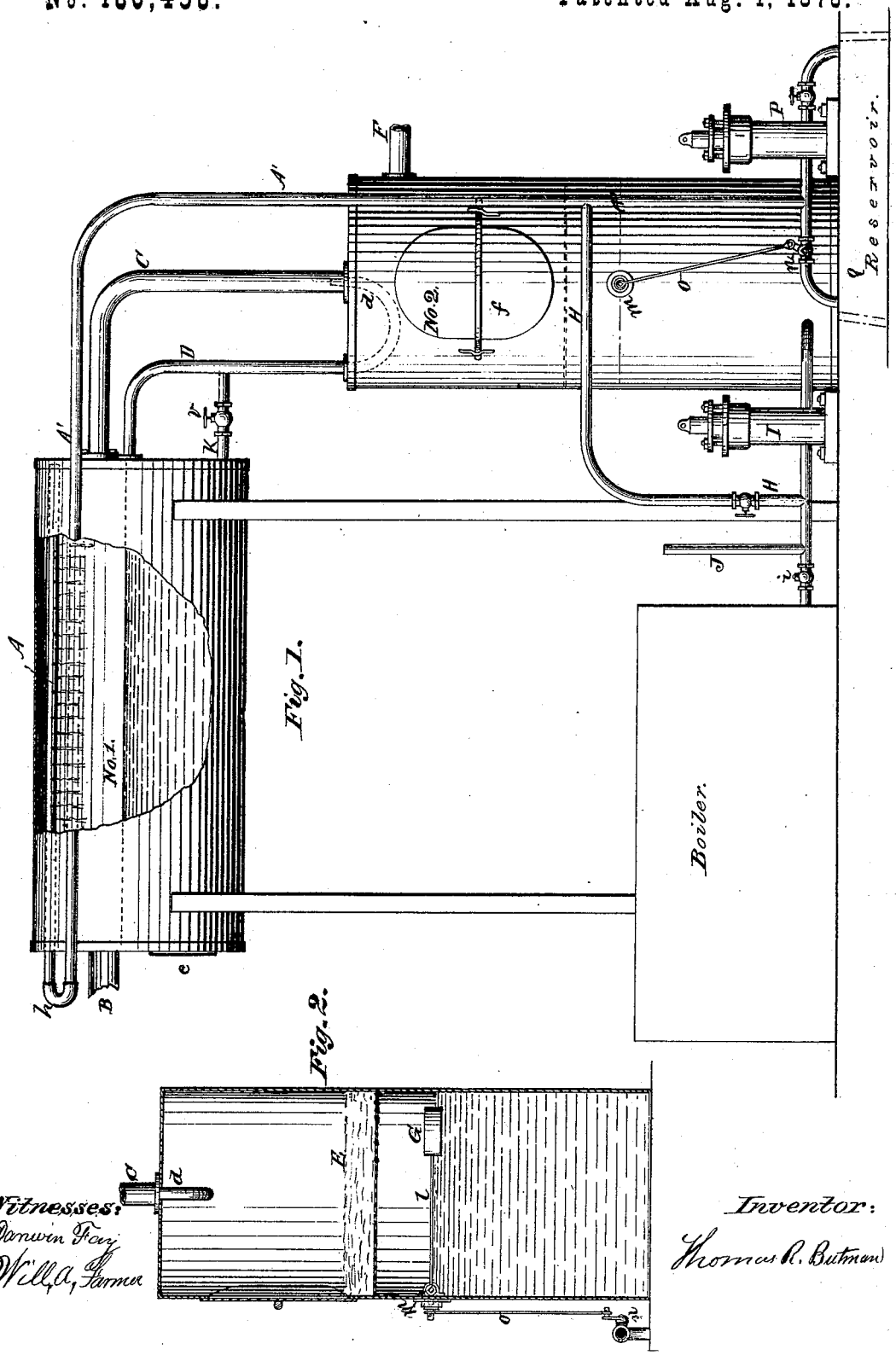

Fig. 1.

Fig. 2.

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THOMAS R. BUTMAN, OF MILAN, OHIO.

IMPROVEMENT IN FEED-WATER HEATERS AND FILTERS FOR STEAM-BOILERS.

Specification forming part of Letters Patent No. **180,458**, dated August 1, 1876; application filed June 12, 1876.

To all whom it may concern:

Be it known that I, THOMAS REED BUTMAN, of Milan, in the county of Erie and State of Ohio, have invented certain new and useful Improvements in Feed-Water Heaters and Filters for Steam-Boilers; and I do hereby declare that the following is a full, clear, and exact description thereof, which will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to letters of reference marked thereon, which form a part of this specification.

My invention consists in new and useful improvements in condensers, filtering and heating apparatus, by which the water from the undissolved particles floating in it are mechanically separated.

It is well understood that, as a general rule, the particles entering with the feed-water are small, the steam generated beneath and around them balloons them up to the surface of the water, where the steam will be liberated and the particles will descend, and the impalpable particles which, by their subsidence upon the boiler-plate, concrete into scale. The effect of this incrustation on the heating-surface is that in proportion to the amount of solid matter accumulated, combined with the non-conductive property, so will the evaporation be retarded.

Now, there is no difficulty in preventing incrustation entirely, simply by using surface condensed-steam water as feed-water, but when this is used alone the boiler suffers from the galvanic action of the mineral property and grease in the water, which the latter has taken from the condensers and cylinders.

As before stated, the incrustation formed by the water commonly used is almost a non-conductor of heat; it is also a non-conductor of galvanic action to some extent; therefore, by allowing a certain amount of water to mingle with the condensed feed-water, the soluble matter held in suspension is thereby precipitated or held in the filtering material, the water fed to the boiler being in a comparatively pure state. Thus pitting, burning, and oxidation of the boiler-plate is prevented, and the accumulation of calcareous deposit is entirely avoided.

It will also be observed that my apparatus possesses unusual facilities for examination and repairs, together with extreme simplicity and firmness of joints, which are, after all, the desideratum for all condensers, filters, and heaters. Thus I have practical simplicity, by which I produce the desired effect, viz., pure feed-water, the prevention of incrustation in boilers, facilities of repair and examination, and great saving in first cost.

It will be further seen that, by my arrangement, no air-pump is required. The remaining portion of the uncondensed exhaust-steam passes off into the atmosphere. I thus save the power used in working an air-pump, while I combine the advantages of the surface-condenser and the injection-condenser, without their great cost and disadvantages.

It will be further seen that the quantity of water required is automatically controlled by means which will be hereinafter described, and more fully set forth.

Many other advantages accruing from the use of my apparatus might be presented, such as creating a vacuum to assist the exhaust of the engine, &c., all of which will readily present themselves to the practical operator or engineer, and which apparatus is more particularly designed to be adapted to land-engines.

Engineers are well aware that pure land-water is almost unknown; that many of our largest manufacturing works are situated near the sea, or where the most serious effects are produced on the boilers from the use of impure feed-water; that boiler-incrustation is a constant source of complaint, and that the water in many of our rivers is little better than liquid mud or sand. These facts, with numberless others to the same effect, are well known to practical engineers.

Now, to remedy these defects, and those before mentioned, is the object of my invention, and which I will now proceed to describe, having reference to the accompanying drawings, and the letters of reference marked thereon.

I will designate the two vessels as No. 1 and No. 2, or heaters Nos. 1 and 2.

Figure 1 in the drawing represents an elevation of my improved apparatus in position, the vessel No. 1 being in a horizontal position, and partly in section, showing the perforated pipe, and vessel No. 2 being vertical and prop-

erly connected with the boiler-pumps, &c., by the various connecting-pipes.

Fig. 2 represents a vertical longitudinal section, showing the proper water-level, the position of the float governing the same, and the location of the filtering material, and the rack by which the said filtering material is maintained in position, the location of the pipes, &c., being shown in Fig. 1.

A in the drawing represents the perforated pipe, which is perforated on all sides, or on as many sides as may be desired. This pipe A runs through the entire length of the vessel or heater No. 1, and is supplied by a pipe, A, running from the cold-water pump, located in any desirable position. B is the exhaust-steam pipe from the engine, (the engine not shown,) and, as will be seen, the exhaust steam issues into the vessel immediately under the perforated water-pipe, and thus receives a drenching shower of water in the shape of jets or fine spray, which thoroughly saturates and condenses the steam, and the steam in its turn heats the water; but should any steam remain uncondensed, it is carried off by the pipe C, which runs from the upper portion of vessel No. 1 into the head of vessel No. 2, when the overflow-pipe D, also running from the level of the water in vessel No. 1, into vessel No. 2. Said pipe D, having a bend, and provided with a rose-head or perforated nozzle through which the water from vessel No. 1 rushes, and is again sprayed to meet the incoming non-condensed steam from vessel No. 1, the steam itself forcing the water into still finer spray, by which an intimate mixture of the steam and water is produced, and which falls in this condition upon the filtering material, by which any sediment, chloride of sodium, chloride of magnesium, sulphate of magnesium, sulphate of lime, &c., which water is well known to contain, is trapped. The water percolating down through the said filtering material E in a comparatively pure state. The exhaust steam, after passing through the ordeal above described, it would appear that but little of it would be left; however, should there be any, it is taken off through pipe F, with any air that might have entered with the feed-water, and escapes into the atmosphere. Thus, it will be seen, the feed-water is in a highly-heated state when introduced into the boiler. The water being pure and hot, the deleterious deposit is prevented, and a great economy in fuel gained, as well as the evil effects of introducing cold water into the boiler being avoided. The calcareous deposit in vessel No. 1 is removed through a man-hole, *e*, at the head of said vessel, and the filtering material in vessel No. 2 is removed or returned, by means of a man-hole, *f*, at the side of said vessel, but the man-holes may be located on any desirable place on the vessels. The sediment, should there be any, in bottom of vessel No. 2, may be removed by displacing the rack containing filtering material, or blown off by well-known devices.

It may be here remarked that either or both of the vessels may contain filtering material, and may contain one or more racks or basins for containing filtering material. The filtering material may be composed of hay, straw, sacking, tan-bark pulverized, or otherwise, or of other well known material, or of a combination of two or more. G represents a float. This float is connected by a stem passing through side of heater, by means of an elastic steam and water tight joint, *m*, and connected to a plug or other valve, *n*, in the waste-pipe leading from cold-water pump, by means of a rod, *o*, to operate so as to maintain a proper water-level in heater No. 1, consequently in heater No. 2, preventing the water in vessel No. 2 rising so high as to submerge the filtering material, thereby preventing or impairing its utility. When the water rises to its proper level, the float rises with it, and opens the valve *n*, allowing the water to escape into the reservoir Q from the cold-water pump P. This, of course, stops the partial supply to vessel No. 1, which, in consequence, stops supply to overflow-pipe D from No. 1 to No. 2. When the water falls, the float closes the escape-valve, and the water is again pumped into vessel No. 1.

H H show water-pipe to hot-water pump I, with valve *i*. When the boiler is receiving too much water the valve *i* may be partially or fully opened, by which means a part or all of the water, as may be desired, is forced through pipes H H to cold-water pipe A′ A′, when it is again returned through the heaters; or, if to heat buildings, is forced through the heating-coils, or may be used for distilling purposes. It will be seen by this device that the suction of both pumps is always free, and by which no vacuum is created under the pumps, and only sufficient to assist the exhaust of the engine by means of the vessels or condensers, and which is nearly equal to one atmosphere; thus a high-pressure engine may be adapted to a condenser with the advantages heretofore pointed out.

J represents a stand-pipe, by means of which the steam from the highly-heated water escapes instead of entering the pump, by which said pump is capable of pumping the highly-heated water with nearly the same facility as the cold. K represents a pipe provided with a stop-cock, *r*, which pipe connects the bottom of vessel No. 1 to the overflow-pipe D from the same vessel, by which said vessel No. 1 may be emptied of its contents into No. 2, or may be connected to any other pipes or vessel by which the water may be drawn off. This pipe is used only occasionally.

These vessels or heaters may be constructed of any suitable material, according to the purpose for which they are required, and of any capacity.

It will be observed that the cold-water pipe A is provided with a return bend or union joint, *h*, by which the perforated pipe may be

disconnected and readily withdrawn from the heater for the purpose of cleaning. The boiler and reservoir may be of any well-known pattern, as my invention may be applied to any of the boilers in general use.

While I am aware that heaters, filters, and condensers have been heretofore used, I am not aware that any have been constructed like mine, embodying the same function. I do not, therefore, desire to confine myself to the exact construction presented, as many other forms may be used without departing from the spirit of my invention.

Having now fully described my invention and the manner of operating the same, what I claim as new, and desire to secure by Letters Patent, is—

1. The combination, in a feed-water heater and filter, of the cold-water pipe A′ A′, the perforated pipe A, and the overflow-pipe D, having nozzle *d*, as described.

2. The combination of vessel No. 1, the perforated pipe A, exhaust-pipe B, and exhaust-steam pipe C, for carrying off the exhaust steam from vessel No. 1, and overflow-pipe D, bent up at the lower end, for the purpose as shown and set forth.

3. The combination of the two vessels, No. 1 and No. 2, with the cold-water pipe A′ A′, the exhaust-pipe B and C, the overflow-pipe, and the filtering material, in the manner and for the purpose set forth.

4. The combination of vessel No. 2, the filtering-rack, the float, and the cold-water pump, and their connections, substantially as described.

5. The combination of the cold-water pipe A′ A′, the pipes H H, stand-pipe J, cock *i*, and hot-water pump I, for the purpose and in the manner substantially as set forth and described.

6. The combination in a feed-water heater, filter, and condenser, the two vessels, the cold-water supply-pipe, the perforated pipe, the exhaust-pipes, the waste-steam pipe, the filtering material and rack, the float and hot-water pipes, and either or both the pumps, and the pipe J, substantially in the manner and for the purpose set forth.

7. The combination of the perforated pipe, the exhaust-pipes B and C, the subsidiary pipe K, and perforated nozzle, with the two vessels, substantially as set forth and described.

In testimony that I claim the foregoing as my own I affix my signature in presence of two witnesses.

THOMAS R. BUTMAN.

Witnesses:
DARWIN FAY,
MARSHALL K. AMES.