J. B. HERRESHOFF.

STEAM GENERATOR.

No. 183,054. Patented Oct. 10, 1876.

Fig. 1.

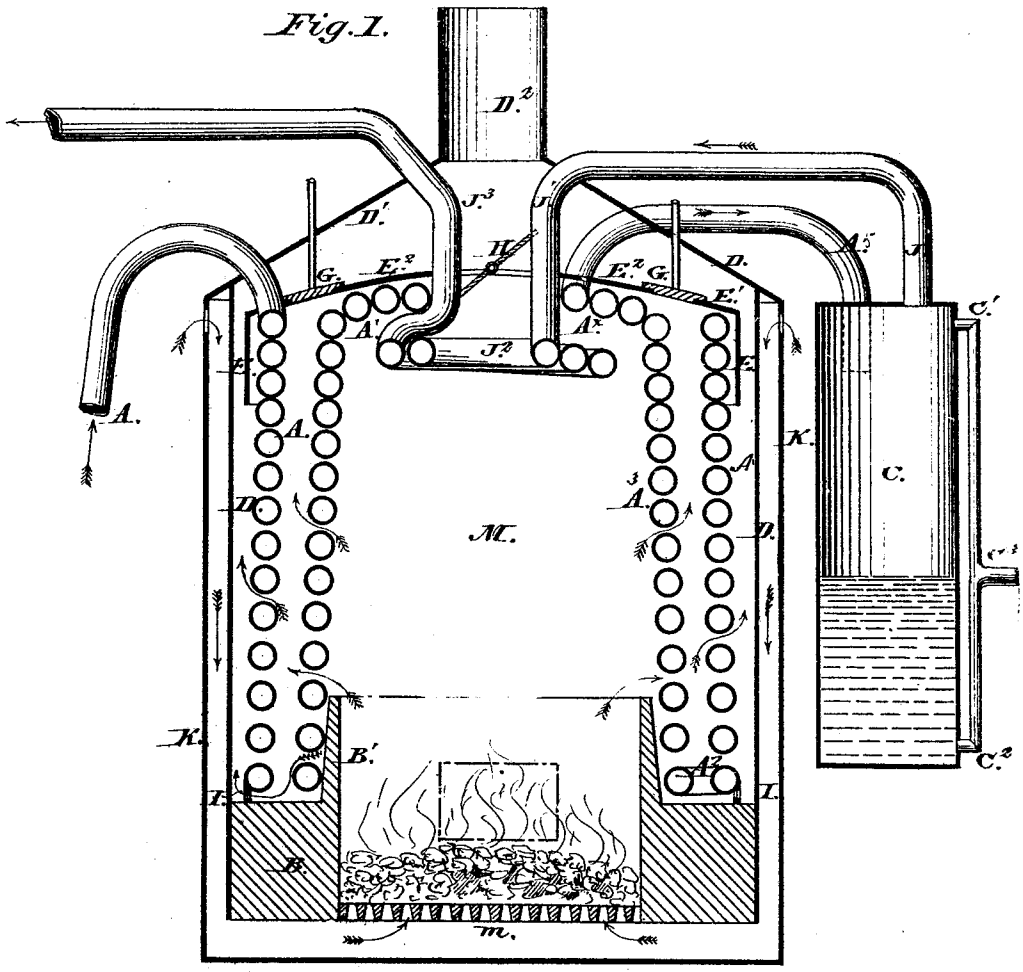
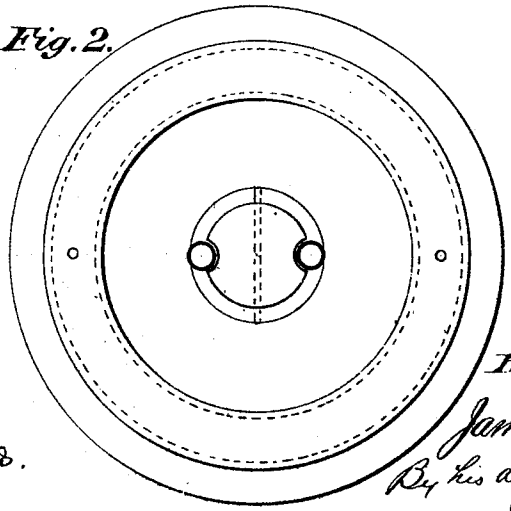


Fig. 2.



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UNITED STATES PATENT OFFICE.

JAMES B. HERRESHOFF, OF BRISTOL, RHODE ISLAND, ASSIGNOR TO HIMSELF AND SARAH L. HERRESHOFF, OF SAME PLACE.

IMPROVEMENT IN STEAM-GENERATORS.

Specification forming part of Letters Patent No. **183,054**, dated October 10, 1876; application filed March 20, 1876.

To all whom it may concern:

Be it known that I, JAMES B. HERRESHOFF, of Bristol, in the county of Bristol and State of Rhode Island, have invented certain new and useful Improvements in Steam-Generators; 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 pertains to make and use the same, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification, and with the accompanying detailed description, set forth what I consider the best means of carrying out my invention.

Figure 1 is a central vertical section, and Fig. 2 is a plan view with the top parts removed.

Similar letters of reference indicate like parts in both the figures.

A^1 is a continuous coil of lap-welded iron or other pipe, supplied with water through an end, A. A^3 is a coil, mounted concentrically within the other, and receiving the water therefrom through a connection, A^2, at the bottom. At the top the coil is continued inward, as indicated by A^4, and discharges its mingled steam and water through a pipe, A^5, into a tall drum or separating-vessel, C. Below the bottom of the coils is a circle of fire-brick, B, held in an ordinary cast-iron frame, and which need differ in no respect from the ordinary fire-brick work around a circular grate, except in a considerable extension upward at the inner edge, as indicated by B′.

The masonry B is of a greater diameter than the exterior coil A′. A cylindrical casing of stout sheet-iron incloses both with a considerable space for an annular up-flue between it and the outer coil. The casing is marked D, a conical extension thereof at the top, D^1, and a chimney, D^2. Within the casing D, near the top, is a curtain or cylinder of little depth, E, with its upper edge E^1 formed inward over the coil A^1. E^2 is an annular plate, slightly domed, covering the top coil A^4. G is a ring valve or cover, which stops the aperture between E^1 and E^2, and H is a turning-valve, which stops the apertures in the center of E^2.

When the valves H and G are closed, the hot products of combustion rising from the fire on the grate *m*, are imprisoned and prevented from any egress at the upper part of my coils, and are compelled to dive under the lower edge of the curtain E. Furthermore, the coils are made quite close, or with the convolutions almost touching each other at the top, but more open below, the spaces between each convolution and the next gradually increasing downward. A still greater space exists between the lowermost convolution of each coil and the top of the brick-work, which latter space is controlled by a movable valve or register-ring, I, capable of being turned or moved to open it by means of suitable connection to the exterior. (Not represented.) When this valve I is open, the products of combustion find their easiest exit below the entire coils, and pass up between the outer coil A^1 and the casing D; but small quantities of the gases may flow out through the considerable openings between the lower convolutions, and less and less through the spaces above.

When the valve I is closed, the gases can only escape through those limited openings. When the valves H and G are opened the gases can escape freely from the top without realizing any of the reverberatory-furnace effect otherwise due to the proportioning of the spaces, and to the close top and hanging curtain.

The mingled steam and water thrown from the coils into the drum C separate in the latter, and the steam taken from the top is further treated by passing through the return-pipe J J^1 into a coil or series of convolutions, J^2, in the upper part of the combustion-chamber M, from which it rises again through the pipe J^3, and is conducted away to the engine in a fully-dried and slightly-superheated condition.

The valve H should be shaped to match to the form of the pipes, so as, when closed, to make a nearly tight joint.

The valve G may be simply lifted and lowered bodily by the rods *g*, or may be in several pieces, and be simply moved outward or inward.

The valve H may be of sufficient area to afford all the draft required in kindling a fire,

in which case the valve G need be opened only for cleaning the spaces between the coils A^1 and A^3. It should be sufficiently large to allow the introduction of a comb-like device for removing soot from the spaces between the convolutions.

K is an outer casing, of thin metal, exterior to D, and within which the air for the furnace is drawn down from a series of holes near the top. This casing may be continued farther up, and the air received through holes around the chimney. The casing K and the current of descending cold air within it protect persons and objects near the boiler from the heat, and utilize the heat in warming the blast for the fire. The whole or a considerable portion of the top of the casing, whether double or single, should be easily removable.

The water should be nearly all evaporated in being driven through the coils. In using very pure water the small quantity accumulating in the bottom of the vessel C may be taken into the feed-pump (not represented) and compelled to repeat its round several times. With hard or muddy water, and especially with sea-water, it should be allowed to escape and waste.

C^1 is a pipe from the top, and C^2 a pipe from the bottom, of the vessel C. These join in a single pipe, C^3, leading to the steam cylinder or cylinders of an independent feed-pump. (Not represented.) So long as the water is nearly all evaporated in the coils steam from the pipe C^1 will flow through the pipe C^3, and the feed-pump will operate vigorously. The moment too much water comes over, raising the level in C, water from C^2 will choke the pumping mechanism, and the feed will almost stop. Under ordinary conditions a just sufficient quantity of water will work off to maintain the water-level in C even with C^3.

Many modifications may be made in the details of the apparatus, and some of the features of the invention may be used without the whole. I attach importance to the form of the separating-vessel C, as a tall chamber or stand-pipe, and to the extension of the pipe A^5 considerably down into the same, to diminish the chances of the water moving across and escaping with the current of outgoing steam. I attach importance to the opening of the spaces between the circuits or convolutions near the bottom of the coils, to make it easier for the gases to descend and pass out through the same than to pass at higher points, because it gives to the structure a character analogous to the reverberatory furnace. I attach importance to the curtain E and cover E^1 E^2, as further means to the same end, and to the valves G H I, as means for modifying the action. I attach importance to the shield B^1, as a means of protecting the lower part of the coils from too intense heat, which might be destructive, especially when the engine is stopped and the fire is in full glow. I attach importance to the provisions for driving the feed-pump by steam, in which water is mingled from the bottom of the separating-chamber in varying proportions, so as to effect both the automatic control of the quantity discharged, and the automatic control of the feed, according to the evaporative efficiency of the fire at the time. I attach importance to the superheating-pipe J^2 as an adjunct of the separating-vessel C, drying the previously purified steam; and I attach importance to the inward contraction A^4 of the coil as a means of efficiently utilizing, with or without the superheating-pipe, both the radiant heat and the heat derivable from connection.

In some situations I propose to use only one coil, but always with the feed by preference introduced at the top, or wherever the heat is least, and subjecting the mingled steam and water in the last of its rapid passage, as also the steam alone in the superheating, where the pipes are exposed to a higher temperature, but never to exposure to contact with the intensely burning fuel.

It is important to take the water to drive the pump from a point above the bottom of the vessel C, so that a sufficient quantity will be constantly retained in the latter to dissolve any solid matter, as crystals of salt, which is liable to be thrown into it under some conditions.

I can, if preferred, in boilers of sufficient magnitude, greatly elongate the feed-pipe A, and coil it in the space above the close top E^2, so that the water on entering the outer coil A^1 shall have been warmed by the gases there; but I do not esteem it generally expedient.

I claim as my invention—

1. The curtain E, and top E^1 E^2, with means H for opening and closing the same, in combination with a coil boiler, and a flue for the rising of the gases around the same, as herein specified.

2. The construction of a coil boiler, with the openings or spaces between the convolutions increasing gradually from the top downward, as and for the purposes specified.

3. In combination with one or more inclosing-coils, A^1 A^3, the top coil A^4 adapted to serve therewith, as herein specified.

4. The valve H, in combination with the top coil A^4, and one or more inclosing-coils below, as herein specified.

5. The ring-valve G in the close top E E^1 E^2, arranged as shown, to allow not only the escape of the products of combustion, but also the cleaning of the coils A^1 A^3 by reaching downward through the opening, as herein specified.

6. The valve or register I, controlling the space below one or more inclosing-coils, in combination with the casing D, and means for closing the top of the combustion-chamber, as specified.

7. In combination with one or more inclos-

ing-coils, A^1 A^3, the shield B^1 within the base, as and for the purposes specified.

8. In combination with a coil boiler and a separating-vessel, C, the pipes C^3, adapted to lead the mingled water and steam to an independent feeding apparatus, as and for the purposes specified.

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

JAMES B. HERRESHOFF.

Witnesses:

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FREDERIC CARD.