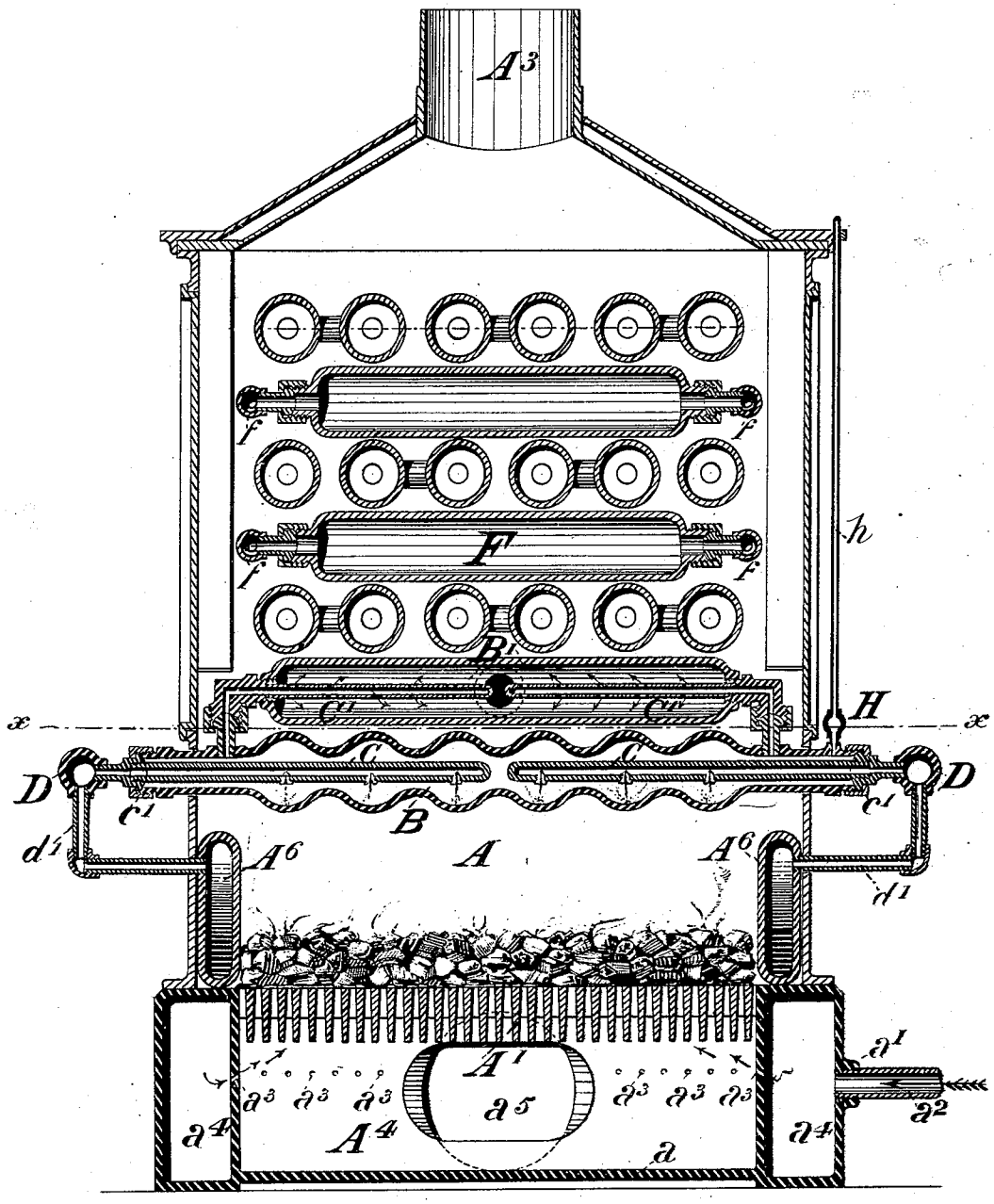
(No Model.) 2 Sheets—Sheet 1.

J. EVERDING.

Steam Generator.

No. 229,984. Patented July 13, 1880.

Fig. 1.



Witnesses:

Geo. A. Vaillant.

Wm. E. Morgan.

Inventor:

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(No Model.) 2 Sheets—Sheet 2.

J. EVERDING.

Steam Generator.

No. 229,984. Patented July 13, 1880.

Fig. 2.

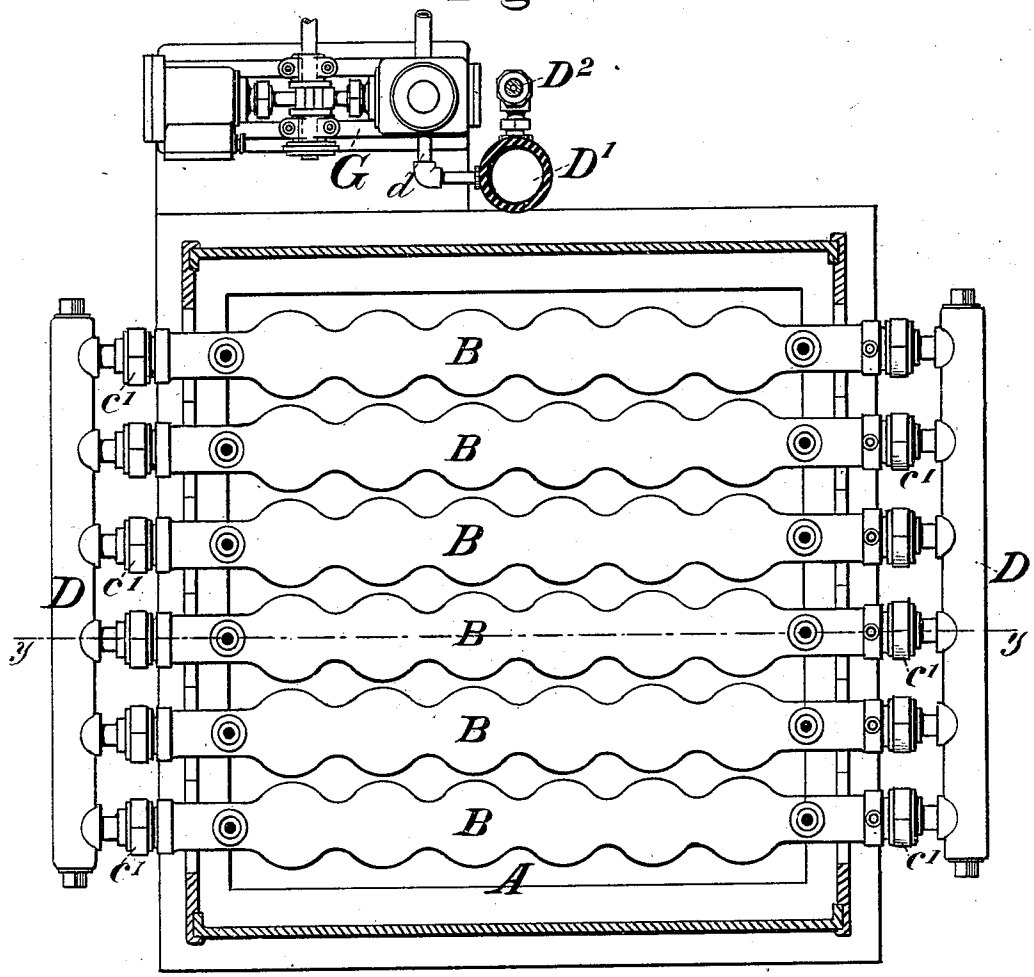
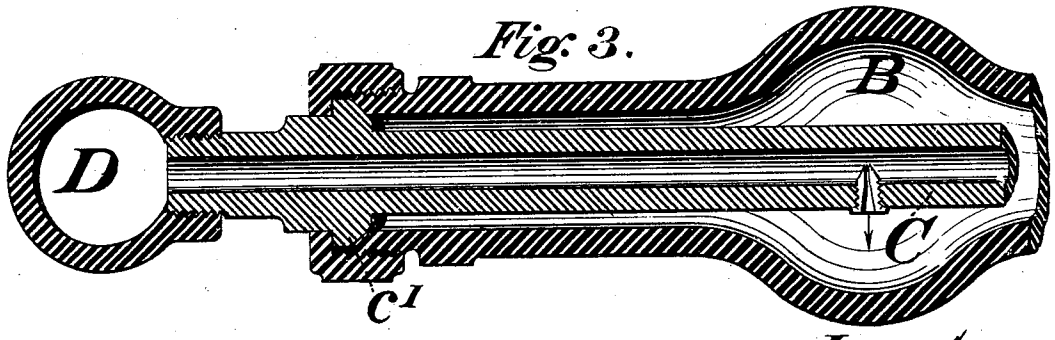


Fig. 3.



Witnesses:

Geo. H. Vaillant.

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Inventor:

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UNITED STATES PATENT OFFICE.

JOHN EVERDING, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNOR OF ONE-HALF OF HIS RIGHT TO ABRAHAM S. JENKS, OF SAME PLACE.

STEAM-GENERATOR.

SPECIFICATION forming part of Letters Patent No. 229,984, dated July 13, 1880.

Application filed April 22, 1880. (No model.)

To all whom it may concern:

Be it known that I, JOHN EVERDING, of the city and county of Philadelphia, in the State of Pennsylvania, have invented certain new and useful Improvements in Steam-Generators, of which improvements the following is a specification.

My invention relates to "instantaneous" or "injection" steam-generators, for certain improvements in which two several Letters Patent of the United States were granted and issued to myself and Abraham S. Jenks, (as my assignee,) said Letters Patent being respectively numbered and dated 213,556, March 25, 1879, and 220,712, October 21, 1879.

The objects of my present invention are to effect a greater economy in fuel by the utilization of an increased amount of furnace heating-surface relatively to a given grate area, to promote combustion and reduce the noise of the exhaust-steam, to promote equalization of temperature and uniform distribution of water in the several generating-chambers, and to facilitate the insertion and removal of the injection-pipes, and to simplify the construction.

The improvements claimed consist in certain novel devices and combinations hereinafter fully set forth.

In the accompanying drawings, Figure 1 is a vertical section through a steam-generator embodying my improvements at the line *y y* of Fig. 2; Fig. 2, a horizontal section at the line *x x* of Fig. 1; and Fig. 3, a longitudinal central section, on an enlarged scale, through a portion of one of the generating-vessels and its injection-pipe.

The furnace A is a vertical case or box of brick or metal properly lined or inclosed, or both, to prevent or reduce the escape of heat, and provided at its lower end with a fire-grate, A′, and at its top with a chimney or flue, A^3, and a fire-door for the supply of fuel to the grate is located in any convenient position adjacent thereto. A box bed-plate, A^4, which is entirely closed at bottom by a horizontal plate, *a*, and corresponds in outline with the furnace, serves as the support upon which the latter rests and forms its ash-pit, the space within the inner walls of the bed-plate being open at top, and the grate being located within or immediately above the same. The walls of the bed-plate are hollow or tubular, forming a space, a^4, entirely around it, which space is closed on all sides, except in so far as that a nozzle, *a*′, is formed upon one of its outer sides, to which the exhaust-pipe a^2 of the engine, or a branch thereof, may be connected, and its inner sides are perforated with a number of small openings, a^3, leading into the space beneath the grate. An air-passage, a^5, having a suitable valve or damper for regulating the supply, is formed in one side of the bed-plate, and connects the space included between its inner walls with the external atmosphere. The passage a^5 may be of suitable form and dimensions to admit of the removal of ashes and refuse from time to time, as required, or an additional passage having a tight door may be provided for the purpose.

A tubular feed-casing, A^6, formed of cast or wrought metal, of such strength as to withstand with ample safety the greatest working pressure designed to be carried in the apparatus, is located within the furnace immediately above the grate A′, and may extend either partially or entirely around the same, a suitable throat or passage to the fire-door being, in the latter case, formed in one of its sides.

The generating-vessels B (shown in Figs. 1, 2, and 3) are of substantially similar construction and location to those described in Letters Patent Nos. 213,556 and 220,712 aforesaid, each vessel being composed of a series of hollow spherical chambers connected by short reduced necks. In this instance, however, each vessel is provided with two internal water-supply pipes, C, projecting into it from opposite ends, each pipe having a series of injection-nozzles in line with the centers of the several chambers.

Two manifolds, D, are located upon the outside of the furnace, transversely to the series of generating-vessels, one at each end thereof, each being connected to the adjacent series of water-supply pipes C, which are, in turn, connected by unions *c*′ to the corresponding ends of the generating-vessels, as clearly shown in Fig. 1.

The pump G is connected by the pipe *d* with

the feed-casing A^6, from which pipes d' lead to each of the manifolds D, so that the feed-water, before passing to the manifolds and the connected pipes C, is forced into the casing A^6 and subjected therein to the direct heat of the burning fuel.

The steam generated in the vessels B passes therefrom, either directly or through perforated pipes C′ within a series of secondary vessels, B′, to a coiled or sectional reservoir or superheater, F, different forms of which are described and shown in Letters Patent Nos. 213,556 and 220,712 aforesaid, and others are to be presently described.

Each generating-vessel communicates with its corresponding secondary vessel by two perforated pipes, C′, projecting into the secondary vessel from opposite ends thereof, similarly to the internal water-supply pipes of the generating-vessels B.

By the intermediation of the feed-casing A^6 between the feed-pump G and the generating-vessels B the feed-water is highly heated before its entrance into the latter, and, in addition to the increased heating-surface thus rendered available in a furnace of given dimensions, the performance of the function of the generating-vessels is greatly promoted by supplying them with hot water or with a mixture of water and steam.

The injection of water to the generating-vessels from both ends, or, as in the case of a circular furnace, from all points toward a common center, tends, further, to a more uniform distribution of water and steam and equalization of temperature throughout their whole extent, thus correspondingly increasing their strength and durability in operation.

The amount of air requisite for proper draft may be accurately regulated by the damper governing the air-passage a^5 in the bed-plate, and by the discharge of the exhaust-steam from the engine into the chamber a^4, beneath and around the grate, through the numerous small openings in the inner walls of the bed-plate, the noise of the exhaust is effectually stifled, and combustion is promoted both by the induced blast-pressure and the decomposition of the steam in passing through the burning fuel.

The connection of the feed-manifolds and their injection-pipes to the generating-vessels by the union c' enables either or both series of injection-pipes to be readily removed and replaced when desired and renewal or repair of any of the pipes or nozzles to be made with convenience and dispatch.

The reservoir or superheater F is composed of a series of sections of cast or wrought metal of small diameter, and connected so as to form a continuous circuit from the generating or the secondary vessels to the supply-pipe leading to the engine.

In order to economize space it is desirable that the several sections of the superheater should be placed as closely together as may be consistent with the maintenance of proper draft in the furnace.

I claim as my invention and desire to secure by Letters Patent—

1. The combination, in a steam-generator, of a furnace, a series of generating vessels or chambers therein, and a series of internal water-supply pipes provided with injection-nozzles and projecting into the generating-vessels from both ends thereof, substantially as set forth.

2. In a steam-generator, an exhaust-chamber surrounding the ash-pit, perforated on its inner sides, and provided with an inlet air-opening and inlet exhaust-nozzle, the top plate of said chamber forming the support of a feed-water casing partially surrounding the furnace, substantially as set forth.

JOHN EVERDING.

Witnesses:

J. SNOWDEN BELL,

GEO. A. VAILLANT.