

(No Model.)

3 Sheets—Sheet 1.

T. F. MORRIN.
STEAM GENERATOR.

No. 463,307.

Patented Nov. 17, 1891.

Fig. 1.

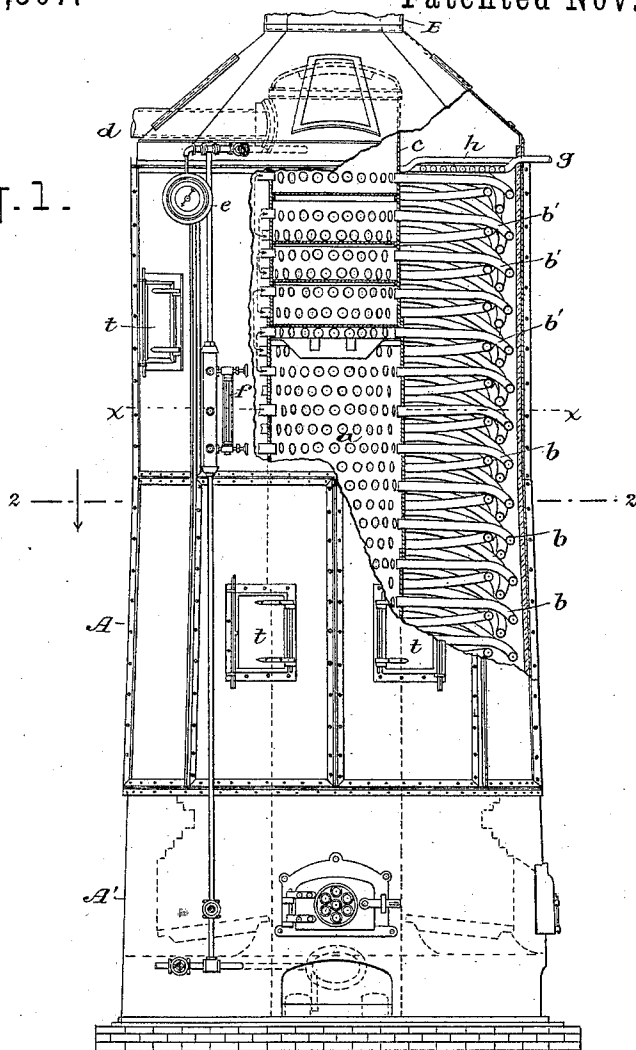
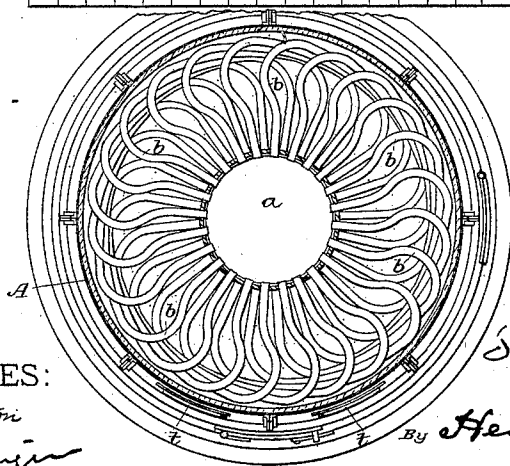


Fig. 2.



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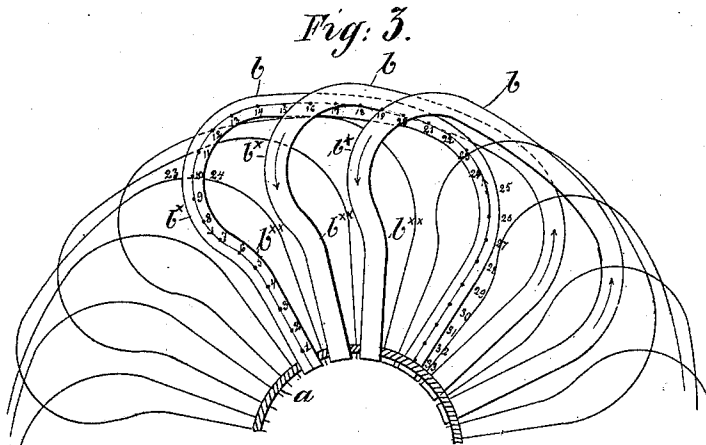
(No Model.)

3 Sheets—Sheet 2.

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Patented Nov. 17, 1891.



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3 Sheets—Sheet 3.

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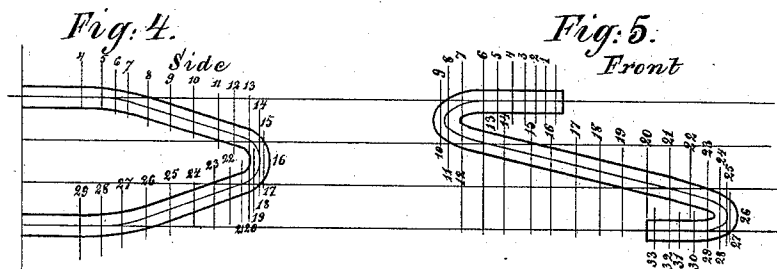


Fig. 6.

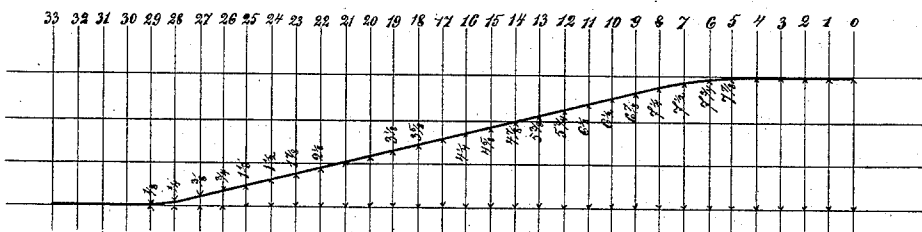
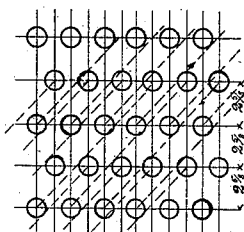


Fig. 7.



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UNITED STATES PATENT OFFICE.

THOMAS F. MORRIN, OF JERSEY CITY, NEW JERSEY.

STEAM-GENERATOR.

SPECIFICATION forming part of Letters Patent No. 463,307, dated November 17, 1891.

Application filed May 10, 1890. Serial No. 351,321. (No model.)

To all whom it may concern:

Be it known that I, THOMAS F. MORRIN, a citizen of the United States, residing at Jersey City, Hudson county, New Jersey, have invented certain Improvements in Steam-Generators, of which the following is a specification.

My invention relates to that class of steam-generators, mainly, wherein the steam is generated in tubes which project outwardly from an upright generating-chamber; and its object is to improve the construction, shape, and setting of the generating-tubes.

My invention will be fully described hereinafter, and its novel features carefully defined in the claims.

In the accompanying drawings, which serve to illustrate my invention, Figure 1 is an elevation of the generator, the upper part being partly in mid-section. Fig. 2 is a horizontal section in the plane of the line 2 2 in Fig. 1. Figs. 3, 4, 5, 6, and 7 are somewhat diagrammatic views illustrating the manner of obtaining the proper curved form of the bent generating-tubes and the manner of setting them in the wall of the cylinder.

I have shown my improvements embodied in a steam-generator of the class illustrated in the patent of Morrin and Scott, No. 309,727, of December 23, 1884, and in that granted to myself, No. 407,940, dated July 30, 1889. In both of these generators an inner cylinder is set concentrically in the upright generator-cylinder, thus providing an annular water-space between them, and one extremity of each of the bent generating-tubes passes through the shell of the generator-cylinder and is connected to this inner cylinder. Thus one end of each tube, or a thimble extension thereon, projects into the cylinder farther than the other end. In my present construction I employ no inner cylinder and no extensions and expand both extremities of the peculiarly-curved generating-tube in the shell of the generating-cylinder. I will describe this feature of the generator.

a represents the upright generator-cylinder, and *b* the curved or bent generating-tubes mounted therein below the water-line *x x*.

Figs. 3, 4, 5, 6, and 7 illustrate the manner of laying out the tubes *b*, in order that they

may have their maximum heating-surface exposed to the ascending gases, that they may lie as closely together as possible without interfering, and that the two extremities of each tube may enter and be expanded in the shell of the generator-cylinder *a* at different levels, so as to insure the proper circulation. Fig. 3 is a plan view of several of the tubes, showing how they overlap one another. Figs. 4, 5, and 6 are diagrams showing how the form of the tube is obtained by ordinates. Fig. 7 is a diagram showing the arrangement of the holes or apertures in the shell of the generator-cylinder to receive the ends of the tubes. The holes are arranged in tiers and equally spaced, and the holes in one row or tier are arranged opposite the spaces between those of the adjacent rows. As herein shown, the tube is expanded at its lower end in a hole of one of the tiers and ascends obliquely to the third tier above where its upper end is expanded in a hole in said third tier, the obliquity carrying it around to that hole of the upper tier which is directly over the space between the third and fourth holes of the tier from which it starts, counting from the hole in which its lower extremity is expanded. The form given to the loop of the tube, which is that of the outline of a pear with unequal lobes, as seen in plan in Fig. 3, enables it to avoid any interference with the adjacent tubes, all of which are spaced alike and mounted in the same manner. This arrangement of the tubes compels every portion of the ascending heated gases to come in contact with some portion of some one or more of the generating-tubes. In order to give the maximum length to the tube *b* and thus increase the heating-surface thereof, a short out curve or bend *b^x* and a short in-curve *b^{xx}* are formed in its loop, as seen in Fig. 3, which clearly illustrates the shape of the tube as seen in plan. Figs. 4 and 5 show the shape of the tube, as seen in side and front elevations, respectively. Fig. 6 shows the tube developed.

The tubes *b'* above the water-line have substantially the same form as the tubes *b*, and the construction whereby the steam is compelled to circulate through them from tier to tier is the same or may be the same as that described in my Patent No. 407,940.

c is the steam-dome at the upper part of the generator-cylinder, and *d* is the steam-pipe leading therefrom.

e is the steam-gage, and *f* the water-gage.

5 The water circulates through the generating-tubes *b*, flowing upward, and is converted into steam in its passage through said tubes. The saturated steam is dried in its passage upward to the steam-dome *e* through the tiers
10 of tubes *b'*. The feed-water enters at pipe *g* and flows through a heating-coil *h*, arranged above and over the tubes.

A is the exterior casing which houses the generator-cylinder and its tubes. The lower
15 drum A' of this casing houses the annular ash-pit and fire-box of the generator, (seen in dotted lines in Fig. 1,) and it is surmounted by the smoke outlet or stack B.

In Fig. 1 I have shown doors *t* in the casing
20 A. These furnish access to the interior for ordinary inspection of the tubes. A steam-jet may be directed in at these doors to clean the exterior surfaces of the tubes and on the generator-cylinder.

25 In Fig. 1 I have represented the casing A as made up of drums, each of which is composed of segments; but this feature is not claimed herein, it being embodied in another pending application of mine, Serial No.
30 380,904, filed February 10, 1891. Indeed my

present invention has no reference to any particular construction of the inclosing casing.

Having thus described my invention, I claim—

1. A steam-generator having an upright 35 generator-cylinder provided with tiers of double-branched radial obliquely-arranged generating-tubes, both branches of which are secured in the shell of said generator-cylinder and extend therein to an equal extent, 40 said tubes being arranged about the entire periphery of the cylinder and overlapping one another, as set forth.

2. A steam-generator having an upright 45 generator-cylinder provided with tiers of generating-tubes *b*, of loop-like form, said loop having a pear-shaped outline when seen in plan, and each loop having at one side a lobe formed by the short out-curve at *b^x* and the short in-curve at *b^{xx}*, the planes of the loops 50 in the tubes being set obliquely to the axis of the generator-cylinder, substantially as set forth.

In witness whereof I have hereunto signed my name in the presence of two subscribing 55 witnesses.

THOMAS F. MORRIN.

Witnesses:

HENRY CONNETT,
J. D. CAPLINGER.