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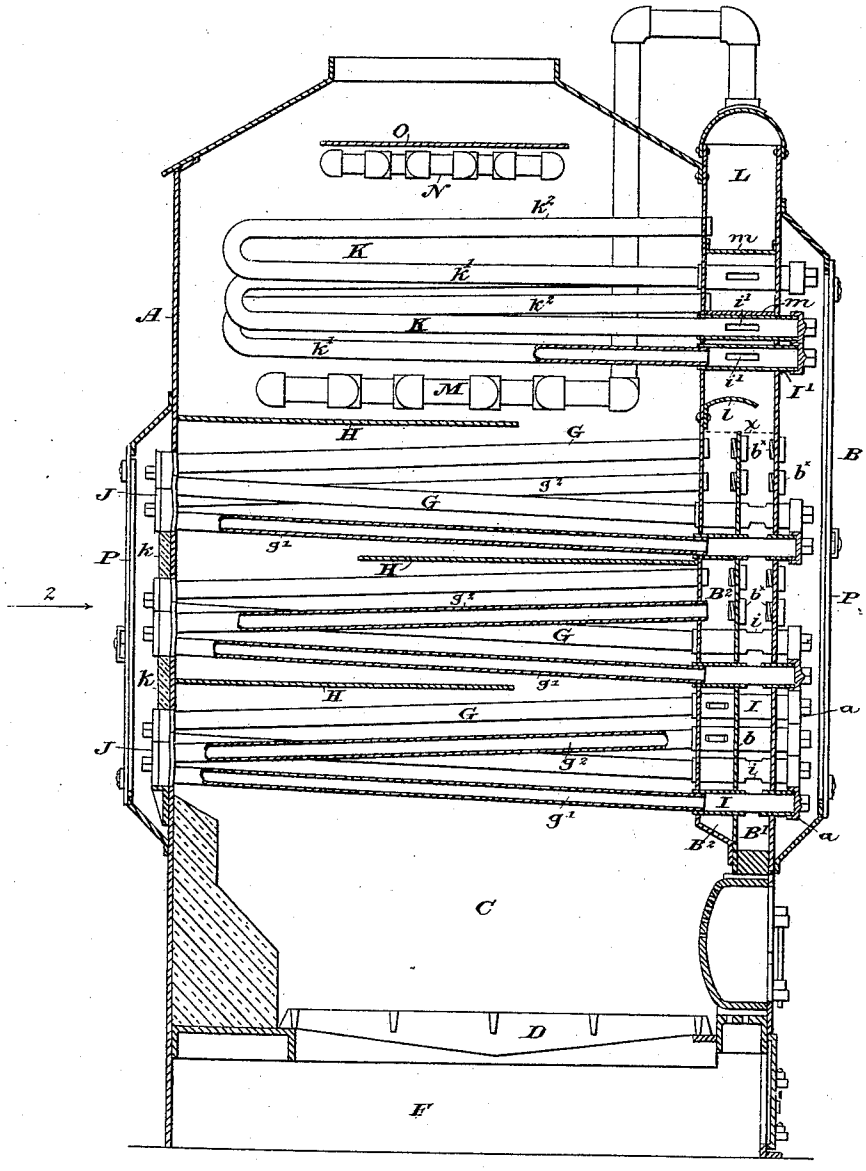
4 Sheets—Sheet 1.

T. F. MORRIN.

STEAM GENERATOR.

No. 387,100. Patented July 31, 1888.

Fig. 1.



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(No Model.) 4 Sheets—Sheet 2.

T. F. MORRIN.

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Fig. 9.

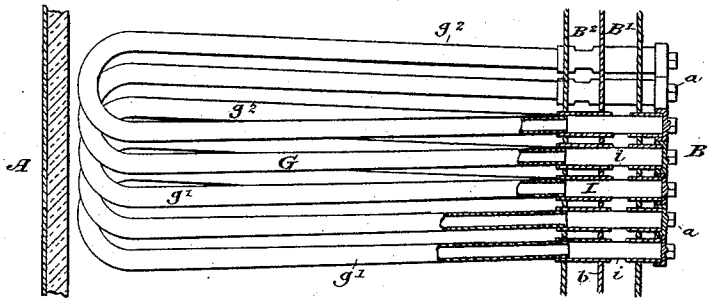


Fig. 6.

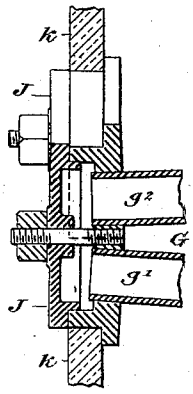


Fig. 10.

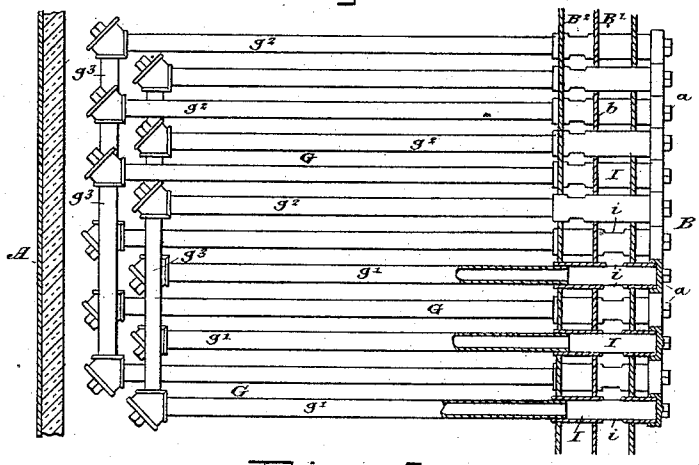


Fig. 2.

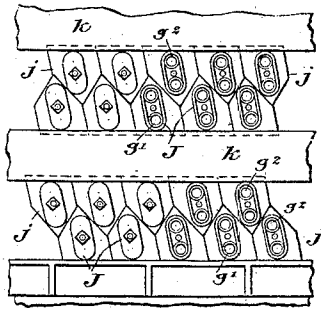


Fig. 3.

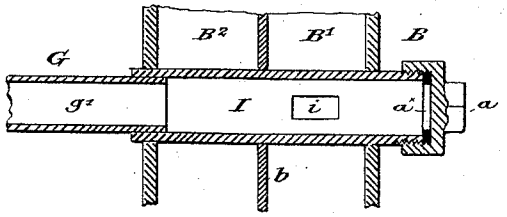


Fig. 5.

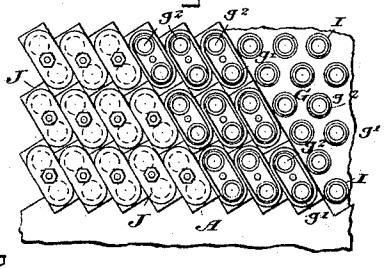


Fig. 8.

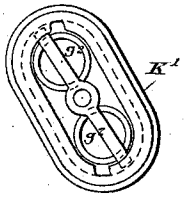
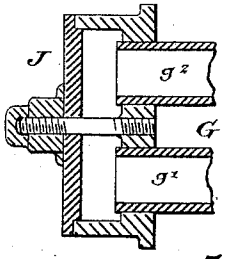


Fig. 7.



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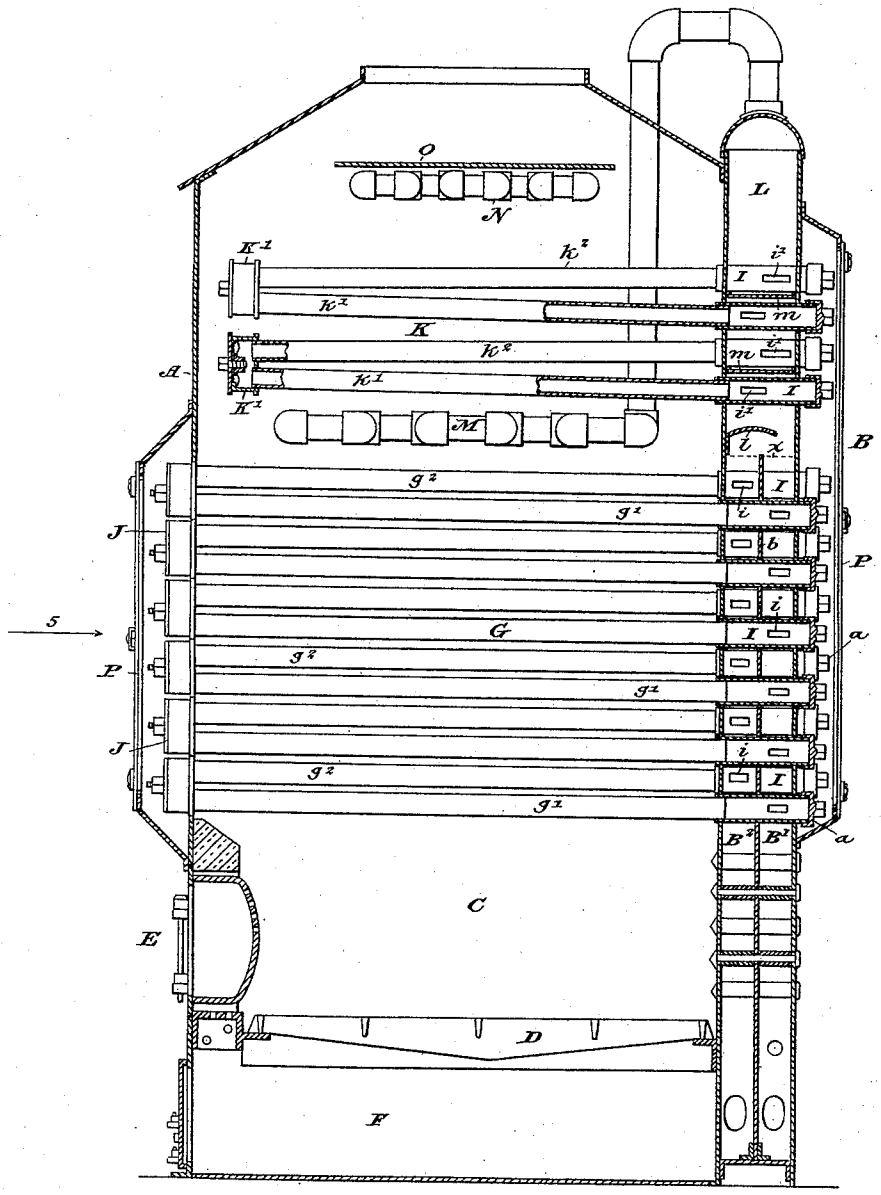
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Fig. 4.



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4 Sheets—Sheet 4.

T. F. MORRIN.

STEAM GENERATOR.

No. 387,100. Patented July 31, 1888.

Fig. 11.

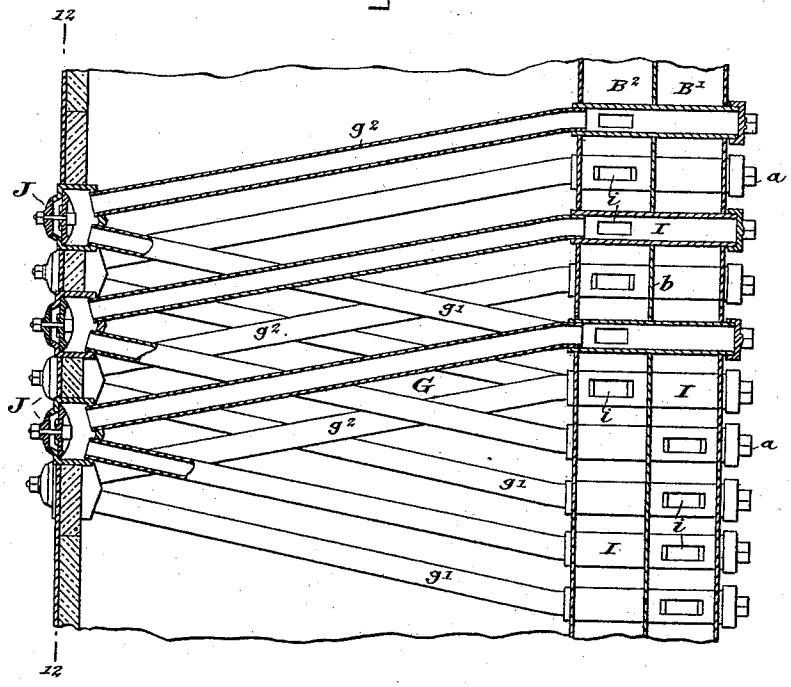


Fig. 12.

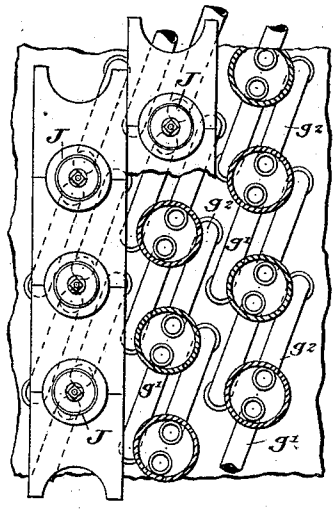
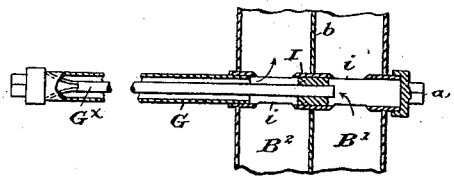


Fig. 13.



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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. 387,100, dated July 31, 1888.

Application filed April 9, 1888. Serial No. 270,137. (No model.)

To all whom it may concern:

Be it known that I, THOMAS F. MORRIN, a citizen of the United States, residing in 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 or boilers wherein the steam is generated in tubes which project from the generator chamber or shell into the combustion-chamber over the fire-bed and the flames and heated gases pass upward among said generating-tubes. A generator of this type is illustrated in my United States Patent No. 377,324, dated January 31, 1888. I find that in constructing a generator of this class that portion of the generating-tube which is exposed to the heat of the furnace, and which should be comparatively thin, is liable to deterioration, and the leaky tubes have to be removed and replaced by new ones. This is quite difficult to effect without incurring considerable expense and loss of time when such tubes are constructed and arranged in the usual way, and one of the principal objects of my present invention is to facilitate the removal and replacement of such defective tubes.

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

In the drawings which serve to illustrate my invention, Figure 1 is a sectional elevation of one form of steam-generator embodying the main features of my improvements. Fig. 2 is a fragmentary end elevation showing the arrangement of the tubes in this form of the generator and the headers for the tubes. Fig. 3 is an enlarged fragmentary axial section of a part of one of the generating-tubes and its tubular holder or thicker section. Fig. 4 is a sectional elevation, similar to Fig. 1, of another form of steam-generator embodying the main feature of my invention. Fig. 5 is a fragmentary end view illustrating the arrangement of the generator-tubes, as seen in Fig. 4, and their headers. Figs. 6 and 7 are enlarged sectional views of the headers seen, respectively, in Figs. 2 and 5. Fig. 8 is an enlarged detail view illustrating the construction of the header for the drying-tubes seen in Fig. 4. Figs. 9, 10, 11, 12, and 13 illustrate different modes of constructing and arranging generating-tubes embodying the leading features of my invention.

Referring first to Figs. 1, 2, 3, and 6, A represents the back plate or wall of the generator; B, the generator-chamber as a whole, which here forms the front wall; C, the combustion-chamber; D, the grate or fire-bed; E, the charging-door, and F the ash-box.

The generator-chamber extends down to the charging-door and comprises, as to its lower part, two chambers, B′ and B^2, which are separated by a partition, *b*, which extends up to the water-line *x* of the generator. Both of these chambers contain water. This generator-chamber B is constructed in all substantial respects like or similar to the corresponding chamber described in my Patent No. 377,324.

G G are the generating-tubes, which will usually be made of thin metal. I have shown these tubes in Fig. 1 as arranged in tiers, one set above another, with deflecting-plates H H between them, as shown, to compel the gases to take a zigzag path upward. Each tube G has a branch, g', to convey the water outward from chamber B′ across the fire-box, and a return branch, g^2, to convey the water back again across the fire-box to chamber B^2, into which it discharges at a point above where branch g' leaves the chamber. This return branch provides the necessary circulation. The end of the return branch of the tube is or may be simply expanded into the inner wall of chamber B^2, and to reach it from the front for inserting the tube-expander aligned holes may be provided in the outer wall of the chamber B and in the partition *b*, which holes may be afterward closed by screw plugs or caps, as $b^\times$. (Seen in Fig. 1.)

The end of branch g' of the generating-tube G is not expanded into the wall of the generator-chamber B, but in the end of a tubular section or holder, I, which is made of thicker metal than the tube G and extends across the chamber B, being expanded into the walls of same and into the partition *b* that divides it. This holder I is screw-threaded at its outer end, (see Fig. 3,) and is provided with a closing screw-cap, *a*, the joint being preferably closed by a packing-ring, $a^\times$, of "Jenkins" or other like packing. At their other or rear

ends the two branches g' g^2 of the generator-tube G are expanded into a header, J, provided with a cap and a screw for securing said cap on. The several headers have flanges j, of the form best illustrated in Fig. 2—that is to say, when the headers are arranged in tiers these flanges match together and properly arrange and distance the tubes. The tiers of tubes or headers thereon are separated by means of transversely-arranged slabs or strips, as k, of some refractory material, by preference.

The operation, so far as described, is as follows: The water from chamber B' enters the tubular holder I at slits or apertures i (one or more) in same, and flows out through branch g', impelled by the heat, and thence back to chamber B^2 through return branch g^2. The steam generated in the branches of tube G rises in chamber B^2, strikes a deflecting-plate, l, in chamber B above the water-level, discharges the water held in suspension, and then passes up to the drier. This drier consists of a series of bent or U-shaped tubes, K, each of which has a lower branch, k', and a return branch, k^2. The branch k' of tube K is expanded in a tubular holder, I', mounted in the upper part of chamber B in the same manner that the holders I are mounted in the same below the water-level, and partitions m m are arranged across the chamber B, between the receiving and discharging ends of said U-shaped tubes K, whereby the steam which passes through the drier is compelled to flow through each set of tubes in succession. Thus the steam in rising enters the lower tier of tubular holders I' at the slits i' therein, flows outward through branch k', and thence through branch k^2 back again. Then it enters the next tier of tubes K and passes through them, and finally enters the steam-dome L. There may be as many tiers of tubes K in the drier as desired. From the dome L the steam may be led through a superheating-coil, M, arranged in the combustion-chamber above the generating-tubes G.

In the upper part of the combustion-chamber I may arrange a coil, N, for heating feed-water, and above this a plate or slab, O, to serve as a baffle or deflecting-plate. The projecting ends of the tubes may be, and preferably will be, provided with housings P P, provided with suitable doors for convenience of access to the caps of the tubes and headers.

Fig. 4 illustrates a construction similar to that described, except in the following respects: In this figure the two branches g' and g^2 of the generating-tubes are both provided with tubular holders I, that for the return branch g^2 having its slits or slit i arranged to open into chamber B^2.

Figs. 5 and 6 illustrate the construction and arrangement of the flanged headers in this form of generator. I have also shown the U-shaped tubes K of the drier made each in two sections or branches, k' k^2, and these united by a header, K'. This header, with the cap removed, is shown enlarged in Fig. 8. The object of this special construction is to avoid exposing the nut and screw-thread to the flames of the combustion-chamber, the same being inclosed within the header.

In the construction shown in Fig. 4 the generator chamber B is at the back of the furnace or opposite the charging-door.

Fig. 9 illustrates a construction wherein the generator-tube G is bent into a U form and provided with tubular holders I on both branches. The tubes may have any desired degree of curvature at the bend.

Fig. 10 illustrates another construction wherein the two branches g' g^2 of the generating-tubes are arranged at very different levels, and are connected at their outer ends by upright tubes g^3. The inner ends of the said branches are connected with tubular holders I, as shown.

Fig. 11 is a fragmentary vertical section, and Fig. 12 a fragmentary end view, illustrating another arrangement of the generating-tubes. This arrangement is similar to that seen in Fig. 1, except that the tubes are not arranged in tiers or sets. The headers are set in specially-molded fire-tiles.

Fig. 13 is a view illustrating the tubular holder applied to a generating-tube similar to that illustrated in my Patent No. 377,324, where an inner tube, $G^\times$, is employed to insure the proper circulation. In this construction the holder I has apertures or slits i opening into both of the chambers B' B^2.

The object in employing a tubular holder, I, for the thin generating or drying tube is twofold: it enables me to employ a thicker tube, serving as a stay in the generator-chamber, and one that will bear screw-threading to receive the cap; but the most important advantage arises from the facilities it offers for driving out a leaky tube and replacing it with a new one. The tube I will not be exposed to intense heat, and, being usually thicker than the generator-tube, it will last a long time, and perhaps never have to be disturbed; but if the thinner generator-tube becomes leaky or unfit for use a tool may be introduced through the holder I to slit the end of the leaky tube, when it may readily be driven out. A new tube may then be placed and expanded in the holder by inserting the expanding-tool through the holder from the outside. The same may be done with tubes K of the drier. The various figures of the drawings illustrate how the holder I may be used in connection with generator-tubes of all kinds and arranged in various ways.

Having thus described my invention, I claim—

1. In a steam-generator having tubes projecting into the combustion-chamber from a generator-chamber, the combination, with the said chamber, of a tubular holder, as I, mounted in the walls of said chamber and having apertures in it for the passage of water and

steam, and a tube, as G, mounted in said holder and forming a prolongation of same, substantially as set forth.

2. In a steam-generator, the combination, with generator-chamber, as B, divided by a partition into the water-chambers, as B′ and B^2, of a tubular holder, as I, extending across said chamber and secured in the walls of same, and a generator-tube, as G, secured in and forming an extension of said holder, the latter being provided with an aperture where it crosses the chamber B′, substantially as and for the purposes set forth.

3. In a steam-generator, the combination, with a generator-chamber, as B, divided by a partition into two chambers, as B′ and B^2, of a tubular holder, as I, extending across said generator-chamber and secured at its ends in the walls of same, said holder having an aperture or apertures in it where it crosses the chamber B′, and the branched generator-tube, as G, the lower branch of which is secured in the inner end of said holder and the upper branch of which opens into the chamber B′, substantially as and for the purposes set forth.

4. In a steam-generator, the combination, with the generator-chamber forming one wall of same, of the apertured tubular holders extending across the said chamber and mounted in the walls of same, the lower branches of the generator-tubes secured at one end in the inner ends of said holders and in headers, as J, at their other ends, the upper branches of said generating-tubes secured at one end also in said headers and opening into the generator-chamber at their other ends, and the said headers, said tubular holders and headers having removable caps, substantially as and for the purposes set forth.

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

THOMAS F. MORRIN.

Witnesses:

HENRY CONNETT,

J. D. CAPLINGER.