H. HEINE.

Sectional Steam-Generator.

No. 200,294. Patented Feb. 12, 1878.

Fig. 1.

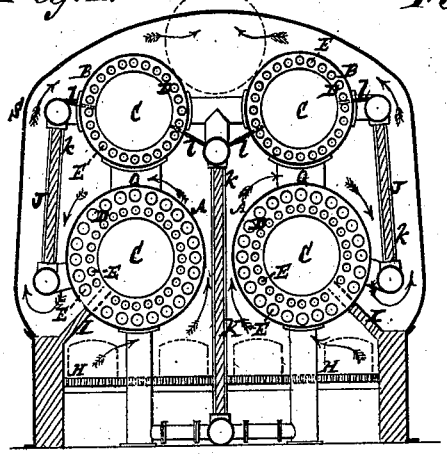


Fig. 2.

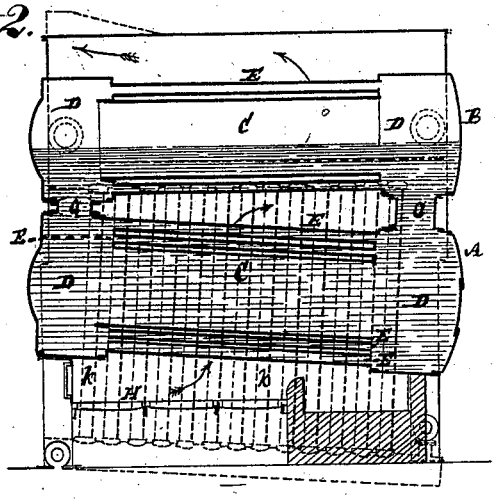


Fig. 3.

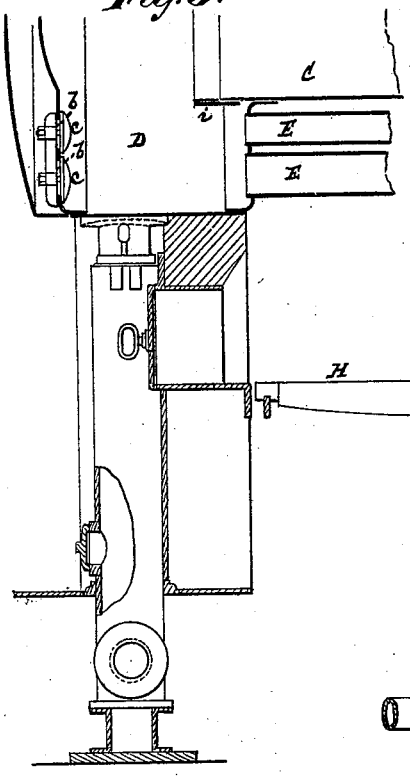


Fig. 5.

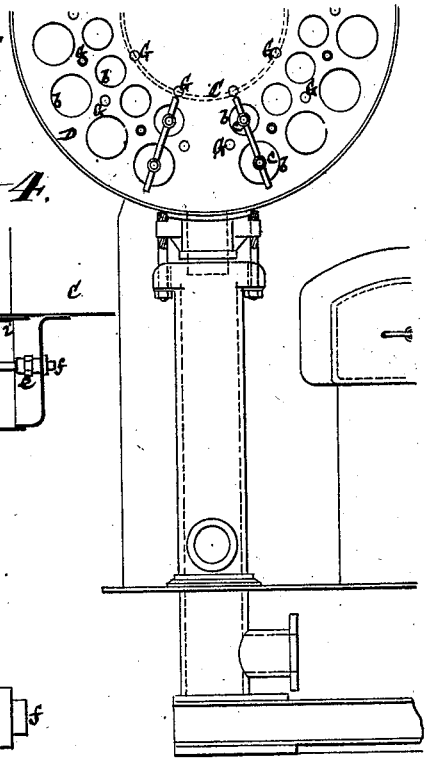


Fig. 4.

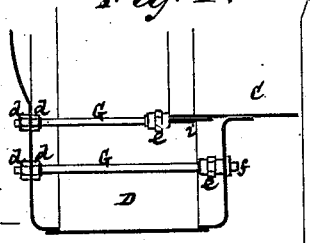


Fig. 6.

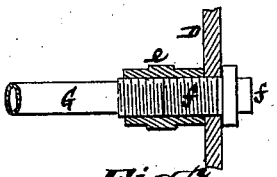


Fig. 9.

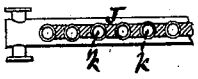


Fig. 7.

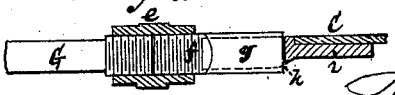
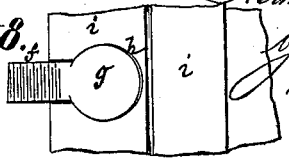


Fig. 8.



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HERMANN HEINE, OF BERLIN, PRUSSIA.

IMPROVEMENT IN SECTIONAL STEAM-GENERATORS.

Specification forming part of Letters Patent No. **200,294**, dated February 12, 1878; application filed December 15, 1877.

To all whom it may concern:

Be it known that I, HERMANN HEINE, of the city of Berlin, Prussia, have invented certain Improvements in Sectional Steam-Generators, of which the following is a description, reference being had to the accompanying drawing, forming part of this specification.

This invention relates to steam-generators or boilers in which the main portion or body of the boiler, which is made tubular, has combined with it one or more series of smaller water-tubes.

The invention consists of one or more series of upper and lower boiler-sections, the lower one of which—also the upper one, if desired—is composed of a tubular elongated waist having enlarged chambers or heads at its opposite ends, in combination with one or more series of surrounding smaller water-tubes, which also connect the opposite end heads outside of said waist or waists, and water necks or connections between the upper and lower boiler-sections, at their opposite ends or heads. The lower one of these boiler-sections should be set inclining from a horizontal position in direction of its length; also the upper boiler-section be similarly arranged, or horizontal, as desired.

The invention also consists in a combination with either section of the boiler composed of an elongated tubular waist and enlarged cylinders or heads at opposite ends of the latter, with one or more series of connecting water-tubes outside of said waists and between the heads, of a series of hand-holes and inside covers applied to one of said heads opposite said water-tubes, and removable stays connecting the opposite ends of the head, whereby increased facility is afforded for fitting up, cleaning, and repairing the boiler.

The invention furthermore consists in a novel combination and arrangement of the passages or diaphragms and partitions forming the same for the circulation and escape of the gaseous products of combustion, with a boiler composed of upper and lower connected sections, one or both of which is made up in part of one or more series of water-tubes outside of a waist or reduced portion of the main or larger part of the boiler-section, whereby an extended and thorough heating-surface is obtained. The invention likewise consists in a combination of two or more series of upper and lower tubular boiler-sections, arranged side by side and constructed substantially as hereinafter described, with a series of outside and inside water-walls or partitions and passages for the circulation and escape of the products of combustion, whereby the heating or steam-generating surface of the boiler is largely increased.

Figure 1 represents a transverse vertical section near the forward end of a boiler, having duplicate upper and lower sections; and Fig. 2 a longitudinal vertical section of the same. Figs. 3 and 4 are diagrams representing upon a larger scale vertical longitudinal sections, in part, of one of the lower boiler-sections, in illustration of the staying of the forward end or head of the lower section and means for reaching the interior thereof; and Fig. 5 is an exterior front view of the same in part. Fig. 6 is a longitudinal view, in part, of one of the outer series of stays used to brace a front head of a lower boiler-section, with means for connecting it to the inner plate of said head; Fig. 7, a similar view of one of the inner series of stays applied to said head, and showing its connection with the waist of a lower boiler-section; and Fig. 8 a view, at right angles to Fig. 7, of a screw-bolt used to connect each inner stay with said waist or ring-extension thereof. Fig. 9 is a horizontal section of one of the tubular walls, in part, used to extend the water-heating surface and to direct the products of combustion within or about the boiler.

A is the lower boiler-section, and B the upper section thereof. These two sections are shown in duplicate in Fig. 1—that is, two connected series of them arranged side by side, or there may be any number of such series.

The lower section A, which is set inclining downward from front to back, is composed, in part, of an elongated cylindrical waist, C, open at its ends, and in central free communication at its opposite ends with enlarged cylindrical chambers or heads D D. These heads D D are sufficiently larger in diameter than the waists C to admit of one or more concentrically-arranged rows of smaller water-tubes, E E, around each waist, and connecting the

opposite heads D D of either lower section of the boiler.

The upper section B of the boiler may be constructed in a similar manner to the lower section, being formed of a waist. C, enlarged cylindrical chambers or heads D D at the ends of said waist, and water and steam tubes E outside of the waists and connecting said heads. When the body of the boiler is thus constructed the upper and lower parts A B thereof have their respective and contiguous heads D D at their opposite ends connected by upright hollow necks O O, the longitudinal axes of the lower and upper sections of the boiler being in the same vertical plane, and both of said sections either being similarly inclined, so as to be parallel with one another, or the upper section B being horizontal and the lower section A only inclined.

In some cases, however, the upper boiler-section B may be a plain cylinder of uniform diameter throughout, and be connected near its ends by hollow necks with the cylindrical chambers or heads D D of the lower boiler-section A.

The tubular waist C of either boiler-section is generally sufficiently large to admit of a person's entry within it. The inner end plates of the heads D D, to which the waist C is connected, form also the tube-sheets of the outer water-tubes E E. When two concentric rows of outer tubes, E E, are used the inner ones may be in the same radial lines as a corresponding number of outer ones, the diameters of the latter being greater in proportion to their distance from the center of the waist.

In the outer end plate of either front chamber or head D, opposite the water-tubes E, (see Fig. 3,) are a series of hand-holes, *b*, of a diameter a little larger than that of said tubes. These holes, which are designed to facilitate cleaning or tightening the tubes E, are fitted with inside covers *c*, capable of being opened from the outside, and secured by bridges and central screw-bolts, as man-holes in boilers are secured.

The water-line in the boiler is such that the lower half or thereabout of the upper section B is filled with water.

In such boiler the internal pressure is wholly borne by cylindrical surfaces, with the exception of the end plates of the heads D D. The two inner end plates or tube-sheets of said heads pertaining to either boiler-section are stayed by the waist C and outer tubes E. The outer end plate of the back cylindrical chamber D being properly dished, there is no staying required for the inside of said chamber, which may therefore be entirely free, and large enough to admit of a man entering within it through a man-hole in the outer end thereof. The outer plate of the front cylindrical chamber D should be straight for a portion of its area, to provide for the hand-holes *b*, and the outer and inner end plates of said chamber are stayed, to strengthen this portion of the structure, by stays G, (see Figs. 4 and 5,) in such a manner that all of said stays, if necessary, can be easily removed to make the forward chamber D also free to facilitate repair. Certain of these stays, which may be termed the inner ones, are connected with the end of the waist C, while the balance of said stays, which may be termed the outer ones, are between the axial lines of the tubes E. These inner and outer stays have both inside and outside nuts *d* at their junction with the outer end plate of the head D, and the other ends of said stays enter coupling-nuts *e*, which unite them to short screw-bolts *f*. (See Figs. 4, 6, 7, and 8.) The inner ones of these screw-bolts, which connect with the inner stays G, are constructed with flat circular heads *g*, which are slipped into corresponding holes *h* in a ring-extension, *i*, of the waist C. (See Figs. 7 and 8.) The outer screw-bolts *f*, which connect with the outer stays G, are formed with shoulders, which are arranged to bear against the outside of the tube-sheet or inner plate of the head D, before the water-tubes E are inserted to their places. The threads of these screw-bolts project sufficiently within the chamber or head D to receive the coupling-nuts *e*. From this description it will be evident that the stays G may readily be detached to effect repair, and the interior of the boiler is readily accessible in every part.

The circulation of the gaseous products of combustion is as follows: The grate H is constructed to extend either wholly or only partially under the lower section A of the boiler. When extending the whole length of the boiler, then the firing is effected from both ends. The heated gases are mainly caused to circulate around that part of the lower section of the boiler which lies between the heads D, and also around or about a corresponding part of the upper section of the boiler. A diaphragm, I, applied to the under side of the lower section A, serves to cause the gases, as they rise from the grate, to pass first under and around one side of said boiler-section, and from thence said gases are caused to circulate, by means of upright inclosing walls or partitions J K, over the top of the under section and under the bottom of the upper section of the boiler, down to the opposite side of the diaphragm I, from which they started, and from thence up on the outside of the outer partition J over the upper section to the chimney. In some cases, however, where duplicate upper and lower boiler-sections A B are used to form but a single boiler, there may be only a grate under one of said lower sections, and the gases therefrom be caused to circulate first under and round one lower section, and under a corresponding upper section, back to the diaphragm under said lower section, and from thence through a lower passage in a partition separating the two upper and lower sections of the duplicate boiler, for similar circulation around or about the other lower and upper sections of the boiler.

By this circulation of the gases, the water-

tubes E lying on or over that side of the diaphragm I from which the circulation commences are exposed to the highest temperature, while those lying on the other side of the diaphragm are exposed to a lower temperature. The whole length of each tube, however, is exposed to an equal temperature. This is or may be insured by contracting the course of the gases at points around the lower section A, to effect a more thorough distribution of them. Said construction for circulating the heating gases also causes the latter, by their tendency to take the shortest route to the outlet, to hug the waist C, and at the same time to circulate about the tubes E, thus producing a very efficient heating effect.

The boiler, as constructed, also provides for a most perfect circulation of the water within it and escape of the steam as generated.

The stays G, or certain of them, may be tubular and open throughout, to provide for the blowing of steam through them, for the purpose of cleaning the outside surfaces of the boiler, which are exposed to accumulation of deposit on them by or from the products of combustion.

Each upper and lower section, A B, forms a boiler in itself, and there need not be any more sections, or there may be any number of such sections—that is, two or more—forming a compound boiler by the connection of the several sections together.

Fig. 1 of the drawing represents a construction in which the upper and lower boiler-sections are in duplicate; and the walls J K, which, in combination with branch partitions *l*, divide and inclose them, are composed or have combined with them a series of upright water-tubes, *k*, which are, in connection with the water-spaces of the sections of the boiler, to add to the capacity of the boiler and for the more perfect utilization of the escaping heat. The water is supplied to the boiler by suitable pipes and connections which need no explanation here.

A casing, S, may be used to inclose the whole boiler when constructed, as shown in Fig. 1 of the drawing.

The lower section of the boiler may rest upon suitably-connected water columns, to provide for feed of the boiler.

This invention is applicable to boilers for marine steam-engines and various kinds of stationary or locomotive engines, also to boilers for heating buildings and other purposes.

I claim—

1. The upper and lower sections A B of the boiler, either or both constructed of a tubular waist, C, heads or end cylindrical chambers D D, and water-tubes E connecting said heads outside of said waist, in combination with necks or connections O between the upper and lower sections of the boiler, at or near the opposite ends thereof, substantially as specified.

2. In a boiler having one or more sections, either of which is composed of an elongated tubular waist, C, and heads D D, with one or more series of water-tubes, E, outside of said waist and between the heads, the combination of the hand-holes *b*, the covers *c* thereto, arranged opposite said tubes at one end of the boiler, and one or more series of removable stays, G, bracing said end or head of the boiler, essentially as described.

3. The combination, with the lower section A and upper section B of the boiler, either or both of which are constructed of a waist connecting opposite end heads or ends, and having water-tubes connecting said heads outside of the waist, of the lower diaphragm I, the walls J K, and the grate H, essentially as described.

4. The tubular water-walls J K, in combination with the diaphragm I, and two or more series of upper and lower sections, A B, of the boiler constructed—that is, either or both of said sections—of hollow enlarged ends or heads, tubular connecting-waists between said heads, and water-connecting tubes outside of the waists and between the heads, substantially as specified.

This specification signed by me this 7th day of September, 1877.

HERMANN HEINE. [L. S.]

Witnesses:

C. LARENZ,

C. THOMAS.