

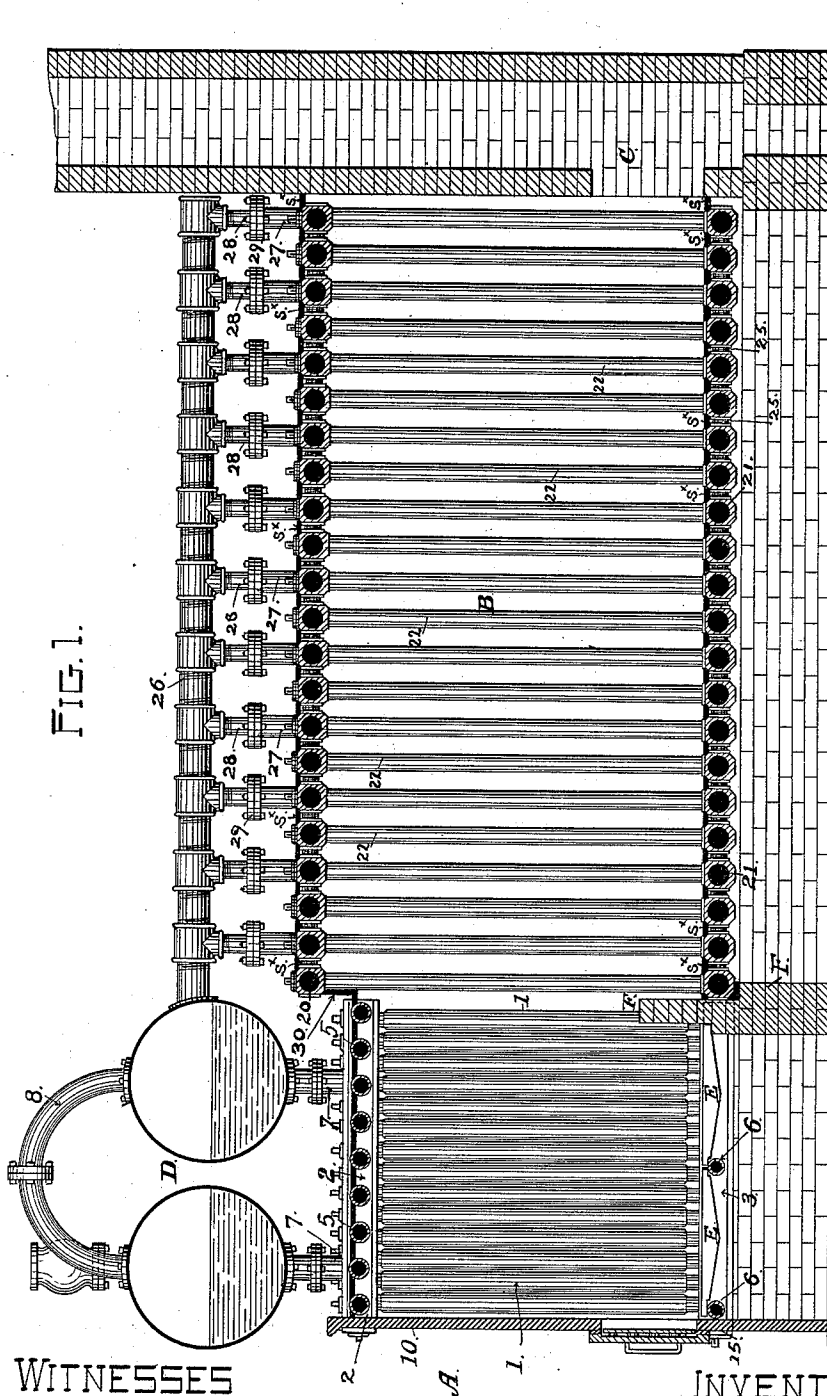
(No Model.)

3 Sheets—Sheet 1.

A. HEBERER.
STEAM GENERATOR.

No. 566,395.

Patented Aug. 25, 1896.



(No Model.)

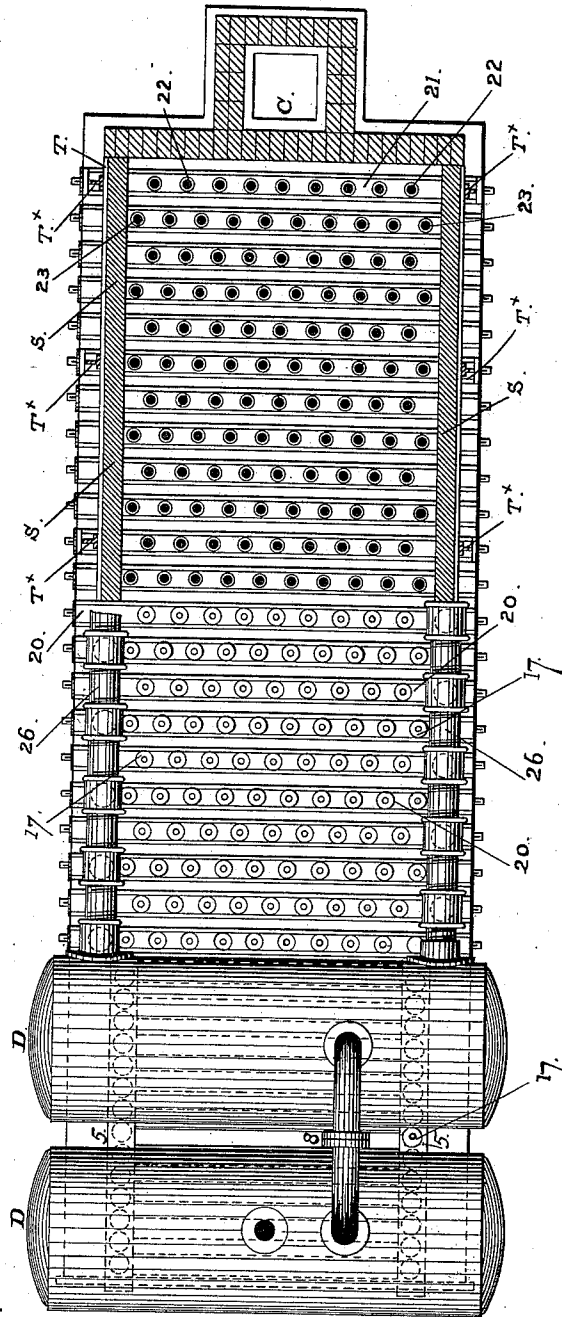
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FIG. 2.



WITNESSES

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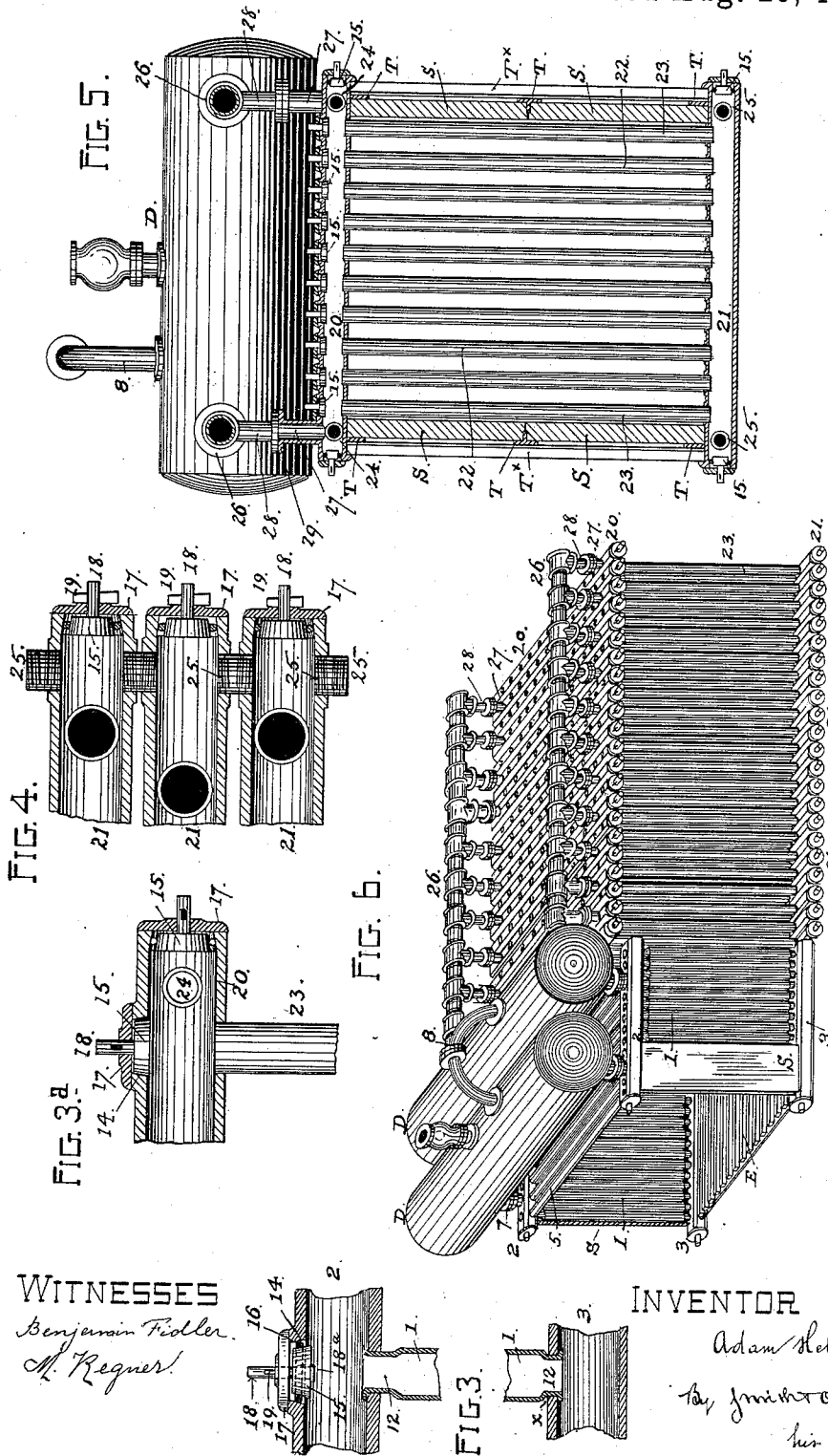
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UNITED STATES PATENT OFFICE.

ADAM HEBERER, OF ALAMEDA, CALIFORNIA.

STEAM-GENERATOR.

SPECIFICATION forming part of Letters Patent No. 566,395, dated August 25, 1896.

Application filed June 22, 1895. Serial No. 553,689. (No model.)

To all whom it may concern:

Be it known that I, ADAM HEBERER, a citizen of the United States, residing in Alameda, in the county of Alameda and State of California, have invented certain new and useful Improvements in Steam-Generators, of which the following is a specification.

My invention relates to improvements made in steam boilers or generators of the kind known as "multitubular" generators; and my invention comprises a certain novel construction and combination and arrangement of perpendicular and horizontal tubes and connections producing an improved generator in which the walls or inclosing sides of the fire-chamber or furnace portion and the combustion-chamber or body are composed of water-tubes, together with certain novel details of construction having for their object to simplify the manufacture, to increase the steam-generating capacity, and to facilitate access to the tubes for cleaning out scale and sediment and for making repairs, all as hereinafter fully explained, and pointed out in the claims.

The novel points and features of my said invention and the manner in which I proceed to produce, apply, and carry out the same will be understood from the following description, in which reference is had by figures and letters to the accompanying drawings, forming part of this specification.

Figure 1 of the said drawings represents in longitudinal section a stationary steam-generator embodying my said improvements. Fig. 2 is a top view with the rear half shown in horizontal section. Fig. 3 is a longitudinal section of one of the horizontal tubes and the vertical tubes composing the top, bottom, and sides of the combustion-chamber. Fig. 3^a represents the outer end portion of one of the transverse top tubes in longitudinal section. Fig. 4 represents in longitudinal section the outer end portions of three of the transverse bottom tubes. Fig. 5 is a vertical transverse section taken through the generator just behind the steam-drum and looking toward the front. Fig. 6 is a perspective view illustrating the relative position and general arrangement of the several systems of tubes that compose the steam-generating body and form the outer walls or sides of the

furnace and the combustion-chamber, the smoke chamber and chimney, as well as the front plate of the furnace and the tiling or plates that inclose the perpendicular exterior tubes, being omitted.

A indicates the furnace portion at the front of the generator; B, the combustion space or chamber; C, the smoke-chamber at the rear, and D the steam-drum, of which there are one or more coupled together, as required by the size and steam-making capacity of the generator.

The perpendicular sides of the furnace A are formed of the vertical tubes 1 1, connected together at the top upper ends by headers or horizontal tubes 2 and at their lower ends by the horizontal tubes 3. The vertical tubes open into these horizontal tubes, so that there is common communication between the whole set of tubes. The construction is the same for both sides of the fire-box or furnace, and the tubes that go to form one side and those forming the other side are connected by the tubes 5 6, extending horizontally across the top between the tubes 2 2, and by the tubes 6 at the bottom. The last-mentioned tubes are set across the space beneath the grate-bars E at the front and rear ends and at the middle of the longitudinal tubes 3, as seen in Fig. 1, leaving open space between them for the grate-bars, but at the top of the furnace the number of transverse tubes is increased. This system of upright and horizontal water-tubes is connected directly with the steam-drums by short necks or couplings 7 7 on the top of the longitudinal tubes 2, provided with flanged joints. These standing necks carry the drums, of which there are two in the present construction placed across the top of the fire-box and connected together by the steam-pipe 8.

The front of the fire-box is inclosed by a front plate 10 of the usual construction provided with the necessary fuel and draft openings, and the sides are closed in by panels T, fitted against the vertical tubes and between the top and the bottom tubes 2 3, there being a sufficient ledge afforded by the projection of these horizontal tubes to support such panels and let them in between the tubes 2 3 about flush on the outside. These panels may be either tiles or metal plates.

The manner of setting and fixing the vertical tubes will be understood from Figs. 1, 3, and 6 of the drawings. A portion of the tubes at both ends is contracted, so that a neck 12 of smaller diameter is produced, and this bottle-neck portion is fitted tightly in the opening formed to take it in the horizontal tube. The tubes 1 are set in place by inserting the upper end into the top tube 2 and pressing it upward until the lower bottle-neck end clears the bottom tube 3, and finally bringing the tube to a vertical position and pressing the lower end down into the opening provided for it in the upper side of the bottom tube 3. The shoulder X on the vertically-set tube then comes to a seat on the top of the tube 3, as shown in Fig. 3.

The ends of the vertical tubes are fixed in the longitudinal tubes and tight joints are obtained by expanding or flanging the ends of the tubes from the inside. The object of this construction is to bring the vertical tubes closely together and form a tight wall or side and at the same time to leave sufficient amount of metal in the horizontal tubes between the apertures for the vertical tubes.

Hand-holes 14 in the top side of the horizontally-set tubes 2 afford access to the ends of the tubes for flanging them, and one of such openings is located directly over and in line with every vertical tube, so that a suitable flanging-tool can be inserted and worked from the outside through such opening and also be passed downward through the vertical tube to reach and expand the lower bottle-neck end of the tube; but these hand-holes are provided also to give access to the vertical tubes for cleaning their internal surfaces from time to time by means of suitable scrapers or clearing-tools inserted from the outside through such openings at the front of the furnace for the same purpose. All these openings are closed by hand-hole plates 15 of such construction that the steam-pressure acts against the plates or stoppers from the inside with the effect to hold them tightly to their seats, so that the security and completeness of the joint does not depend on the fastenings that hold the stopper, and the strain on such fastenings is entirely removed. To this end a conical stopper having taper sides and capable of being inserted from the outside is used in connection with a soft-copper packing-ring 16, which, being interposed between the stopper and the walls of the opening in the tube, is compressed between the stopper and the rim of the opening as the former is drawn up to its place from the inside, and being so compressed forms a steam-tight joint.

The conical stopper is drawn up to place by a circular top plate 17, sitting on the rim of the hand-hole opening, a bolt 18, inserted through the stopper and having a head 18^a on the lower end, and a slot through the shank near the upper end, to which is fitted a wedge or taper key 19.

The inner wall of the hand-hole and the adjacent face of the stopper have the same degree of taper, and the bottom or greatest diameter of the stopper is somewhat less than the diameter of the hand-hole at the top, whereby the stopper can be withdrawn by first taking out the packing-ring.

The side walls and the top of the combustion-chamber behind the furnace are constructed of a number of transverse top tubes 20, a corresponding number of transverse bottom tubes 21, and the vertical inner and outer tubes 22 23, the former being set in rows across and through the combustion-chamber and the latter along the sides for the entire length of the chamber.

The horizontal tubes or headers are coupled together at the outer ends by screw-thimbles 24 25, and they are fixed in close parallel rows across the top and the bottom of the chamber. The narrow openings between the tubes in each set are closed by means of tiles properly shaped to fit the space, or in place of tiles the openings may be filled with cement. The header-tubes, if made of octagonal shape in cross-section, as represented in Figs. 1 and 2, furnish such flat surfaces to these openings left between the headers that triangular-shape tiles can be used to good advantage, or a cement filling applied in a soft state can be substituted for tiles. The top and bottom tubes in each pair or set of these headers are connected together by a number of vertical tubes spaced regularly from end to end; but so placed also with reference to the corresponding tubes in the adjacent sets in front and behind that the vertical tubes in one transverse row are directly opposite the spaces between the vertical tubes in the next row. This brings the whole number of vertical tubes in such position that open spaces running diagonally across the combustion-chamber alternate regularly with the diagonal rows of tubes and are accessible from the outside at both sides of the body. Scrapers, brushes, and other suitable tools are inserted from either side after removing the panels S S, and the external surfaces of all the tubes throughout the breadth and depth of the chamber are thus easily reached and cleaned. This arrangement, moreover, brings the vertical tubes in the most favorable position to receive on or against the front half of every tube the direct impact of the flames and burning gas from the furnace in their passage through the chamber.

In the upper side of every top header-tube, directly in line with the end of each vertical tube, is a hand-hole fitted with a removable stopper of the same construction as those employed for the openings in the longitudinal header 2 of the furnace, the object of which is to afford access to the interior of every vertical tube for detaching any scale or sediment that may be deposited in them. In addition to this the transverse tubes or headers have openings at both ends fitted

with the same character of stopper as seen in Fig. 3, and thus affording access from the outside to the interior of both the horizontal tubes and the vertical tubes of every set.

5 The steam connections between every such set of tubes and the steam-drum are shown in Figs. 1 and 2.

26 26 are steam-pipes formed of coupled sections and carried longitudinally over the combustion-chamber along both sides from the steam-drum at the front to the rearmost set of tubes.

Each top header is connected to one of the steam-pipes by a short standing neck 27, joined to a branch 28 on the steam-pipe by a flange-joint, such connection being designed to permit any one or more of the top tubes to be detached and removed in making repairs, as well as to facilitate the setting up. 20 The couplings 27 28 on one pipe alternate with those on the opposite side and connect every other top tube to the pipe on the same side of the generator, thus furnishing by the two pipes 26 ample steam-room for the generating-tubes and also spacing the upright connections, so that they are readily joined together in the work of setting up the apparatus.

Outside the outer row of vertical tubes the solid panels S S are placed between the ends of the transverse tubes that project at top and bottom, the lower edge of the panel resting on the bottom tubes and the upper edge fitting under the ends of the top tubes, as seen in Figs. 2 and 5 of the drawings. 35 Narrow slabs of tiling or metal plates are used for these panels, and they are secured in place by rails or flat bars T, laid horizontally at top and bottom and also over the joints between the panels and upright bars of T-iron placed at intervals on the outside against the rails. These parts are suitably fitted to secure close joints and, if necessary, the crevices are closed with cement where any exist. I prefer to use two short panels divided horizontally at the middle instead of one long panel extending from top to bottom for each section of these coverings on the outside of the chamber, as the same are more readily handled in setting and in removing to afford access to the chamber. 50

Below the horizontal bottom tubes, both in the furnace portion and in the combustion-chamber, several courses of brickwork G G close in the space and form a setting on which the structure of tubes is supported at desired height. The bridge-wall F, carried up at the back of the furnace across the front of the combustion-chamber, supports the rear end of the grate-surface and also the bottom header of the first set of tubes at the front of the combustion-chamber. 60

The opening at the top formed by the difference in height between the long vertical tubes 2 2 and the short tubes 1 is closed by an angle plate or apron 30, Fig. 1. 65

The object of making the furnace portion A less than the other part of the generator is mainly to reduce the height internally of the fire-chamber, but also to bring the steam-drum into position to connect the steam-pipes 26 on a straight line without turns or bends and reduce the total vertical height of the generator. The front and the rear portions can be made of equal height, however. 70 As thus constructed and arranged it will be seen that access is afforded to all the water-heating tubes both on the inside and on the exterior surfaces, and that any tube or set of tubes in the combustion-chamber can be readily removed and replaced by new tubes when repairs are necessary, and this without disturbing the other tubes. 75

By unscrewing the thimbles or couplings between the transverse tubes of any set of tubes of the combustion-chamber one set can be drawn out at the side, and the upright tubes of that set thus easily repaired. 80

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is— 90

1. In a steam-generator, a fire-box or furnace part having side walls and top formed of a plurality of water-tubes consisting of the longitudinally-set horizontal top header and bottom header on each side; the vertical tubes set in close order and having their ends inserted into the said top header and bottom header; hand-holes in the upper side of said top header located directly over the openings in the lower side of said header in which are inserted the ends of the vertical tubes, and removable stoppers closing each hand-hole; openings in the front ends of said top headers and bottom headers provided with removable stoppers; the transverse top tubes uniting said top headers and forming the top of the fire-box, and the transverse bottom tubes below the fuel-supporting surface uniting the bottom headers together, as shown and described. 95 100 105 110

2. The combination, of the top header having spaced openings in its lower side for the reception of vertical tubes, and a hand-hole opening in its upper side directly over each tube-opening in the lower side, a removable stopper to each hand-hole adapted to close the same, the bottom header having spaced openings in its upper side, and vertical tubes having bottle-neck ends or contracted ends which, when inserted into the openings in said headers are reached and flanged in said header through said hand-holes, and by virtue of such contracted ends the sides of said tubes are brought together in close contact, as shown and described. 115 120 125

3. A steam-generator body formed of a number of sets of transverse top headers and bottom headers and vertical tubes set between such headers, each set thereof being composed of a transverse top header, a transverse bottom header and the spaced vertical 130

tubes, and couplings joining the bottom tubes and the top tubes one to another on the outer ends.

4. In a steam-generator, the combination
5 of the transversely-set top headers and bot-
tom headers, united at their outer ends by
tubular couplings the spaced vertical tubes
connecting together every bottom header with
its corresponding top header, said tubes be-
10 ing disposed in alternate order throughout the
length and breadth of the combustion space
or chamber, apertures in the upper sides of
said top headers over the vertical tubes and
in the ends of both sets of headers, removable
15 stoppers adapted to close said apertures and
a steam-drum and steam-pipes horizontally
disposed over the outer ends of the top head-
ers having upright connections coupling
every top header with one of such steam-
20 pipes.

5. In a steam-generator, a fire-chamber
having the side walls formed of upright wa-
ter-tubes, connected at top and bottom by
longitudinal headers, transversely-set hori-
25 zontal tubes at top and bottom connecting
the said headers on the one side with the cor-

responding headers on the opposite side; the
panels fitted between the headers and clos-
ing in said side tubes; in combination with
the sets of water-tubes forming the body of 30
the generator, each set being composed of a
transverse top header, a transverse bottom
header and spaced water-tubes set vertically
along the headers and connecting the top
header of the set with its corresponding bot- 35
tom header, couplings uniting each header
with the adjacent headers on each side at top
and bottom, a steam-drum arranged above
the top headers, a steam-pipe horizontally set
over the outer ends of the top headers at each 40
side and connecting-couplings between each
top header and one of said steam-pipes, and
the removable panels adapted to close in the
sides of the chamber or body formed of said
coupled sets of headers and vertical tubes. 45

In testimony that I claim the foregoing I
have hereunto set my hand and seal.

ADAM HEBERER. [L. S.]

Witnesses:

CHAS. E. KELLY,
S. H. SHERROTT.