

(No Model.)

2 Sheets—Sheet 1.

A. HEBERER.
STEAM GENERATOR.

No. 541,539.

Patented June 25, 1895.

FIG. 2.

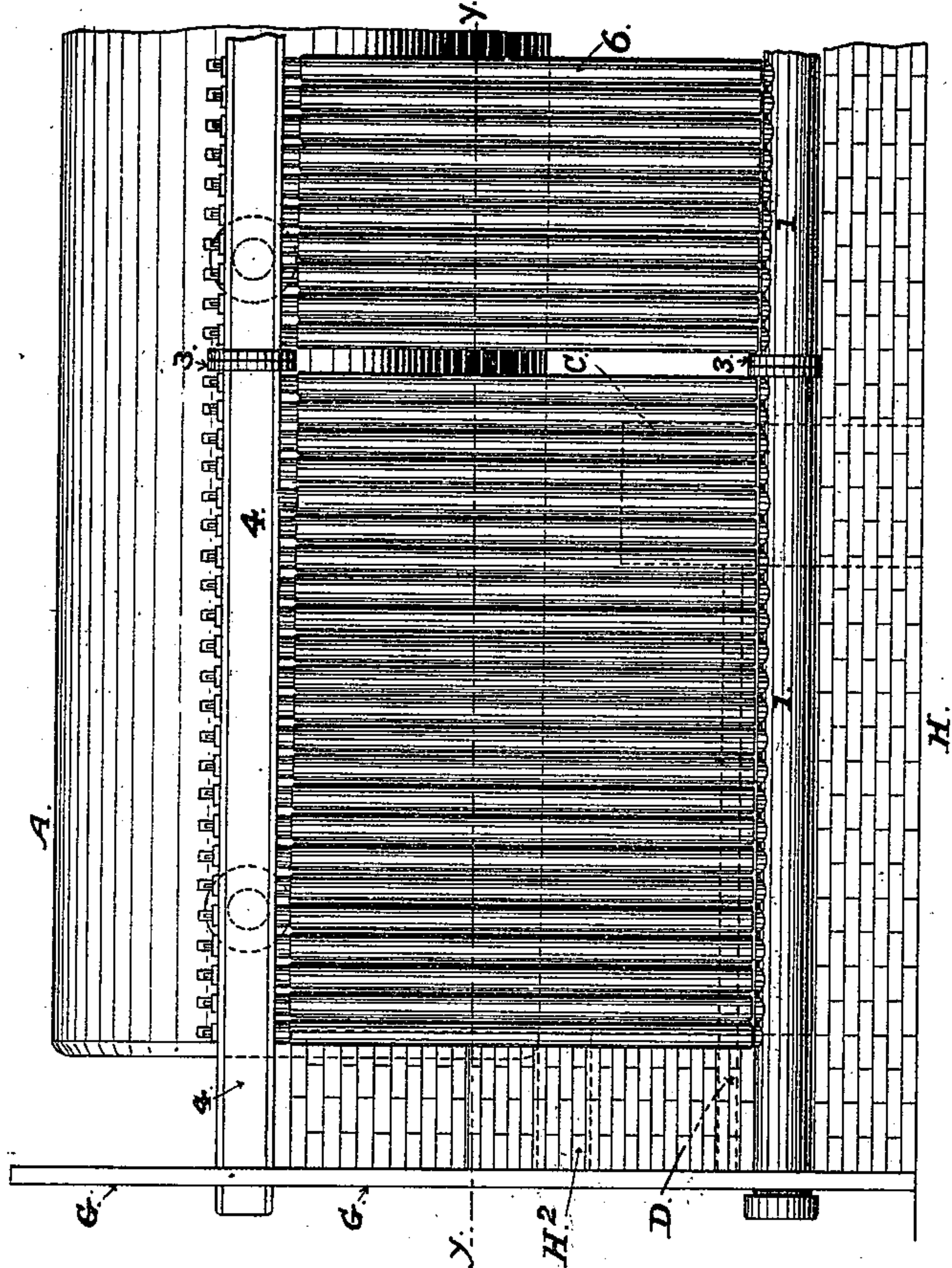
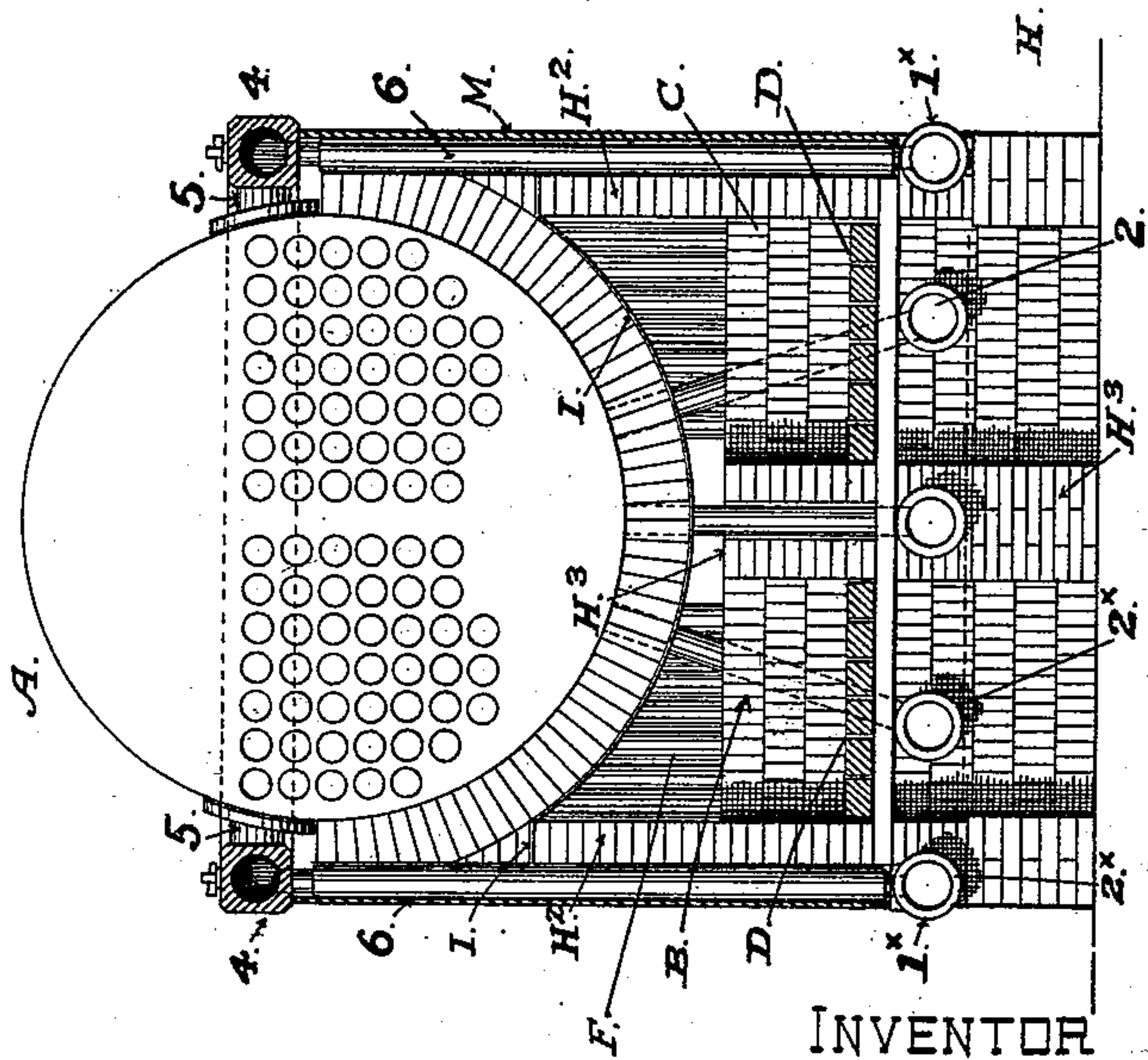


FIG. 1.



WITNESSES.

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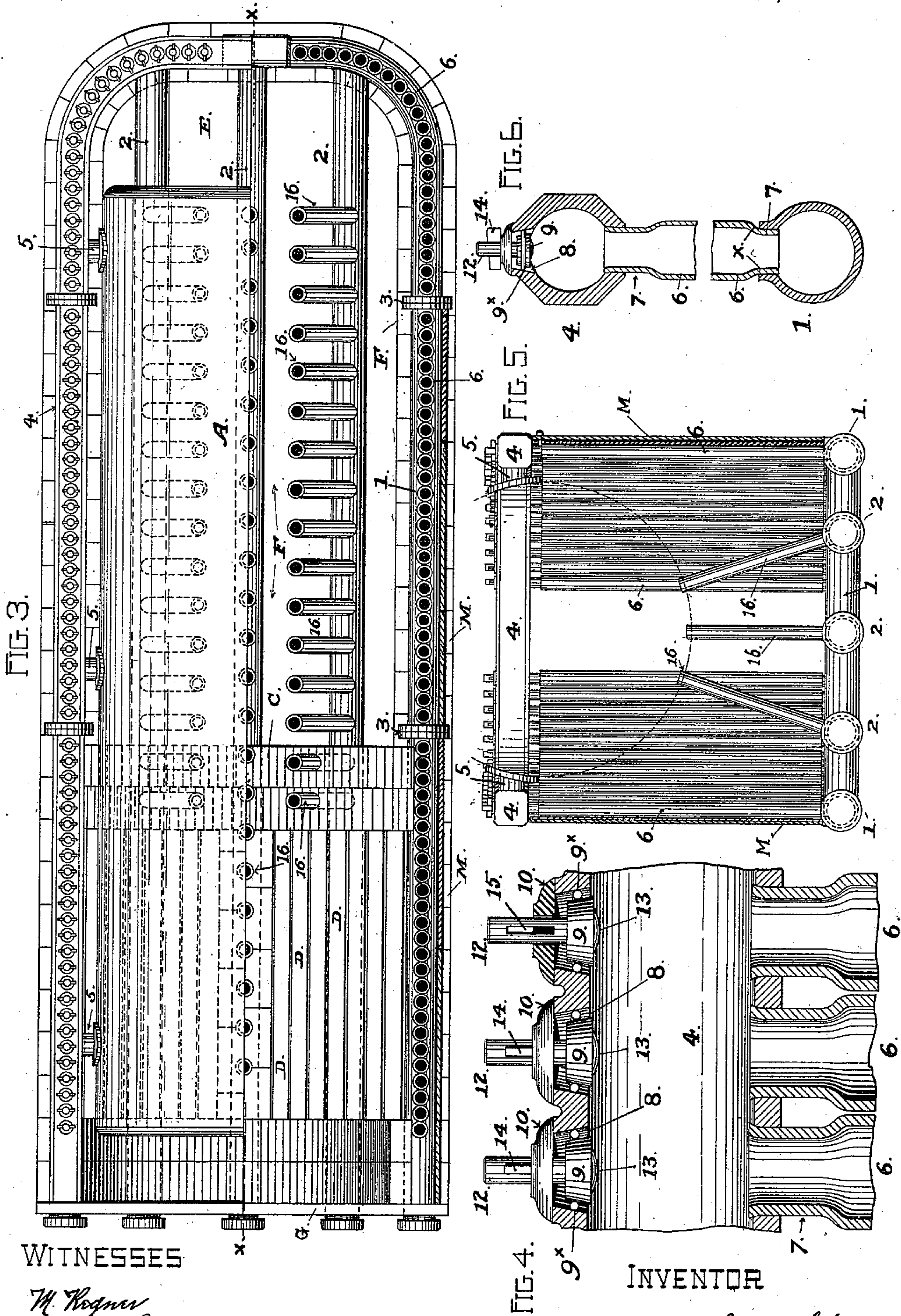
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2 Sheets—Sheet 2.

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WITNESSES

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UNITED STATES PATENT OFFICE.

ADAM HEBERER, OF ALAMEDA, CALIFORNIA.

STEAM-GENERATOR.

SPECIFICATION forming part of Letters Patent No. 541,539, dated June 25, 1895.

Application filed March 6, 1894. Serial No. 502,565. (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.

The object of my present invention is mainly to increase the water-space and the generating capacity of a horizontal steam-boiler without enlarging the grate-surface or changing the dimensions of the structure of the boiler itself; but in addition thereto I aim to construct a boiler-setting which shall be adapted to most all if not all the various styles of horizontal steam-boilers now in use, and which, taking the place of the brick-work setting heretofore used converts the space taken up by the brickwork into water-holding and steam-generating flues or passages; the structure being of such character also that it furnishes both the necessary support and setting for the boiler and forms closed sides or walls to the combustion-chamber and passages beneath and along the sides of the boiler.

To these ends and objects my invention consists in a boiler-setting constructed of water-tubes combined and arranged in perpendicular and horizontal sets so connected together and to the water-spaces and steam-spaces of the boiler that they form extensions thereof along the sides of, and around, the combustion-chamber, closing in the combustion-chamber and passages under the boiler and also constituting the outer walls or sides thereof.

These improvements and the manner in which I proceed to construct and apply the same are explained at length in the following description, reference being had to the accompanying drawings, forming part of this specification.

Figure 1 is a front elevation of a steam-generator embodying my improvements with the front of the fire-box and ash-pit removed and without the breeching on the end of the boiler. Fig. 2 is a side elevation showing a portion of the length from the front end along the fire-box and for a short distance beyond the bridge-wall. The outer metal doors or panels on the outside and the filling between the tubes are omitted in this figure. Fig. 3 is a top view with parts in horizontal section. The

boiler is removed from one side of the horizontal center line xx to expose a portion of the system which lies beneath the boiler, and the wall of the upright tubes, along one side of the fire-box and combustion-chamber, is cut away on a horizontal line, as at yy , Fig. 2. Fig. 4 represents, in longitudinal section and on an enlarged scale, a portion of one of the horizontal top tubes and the ends of the upright tubes seated in the horizontal tube, showing the manner of closing the hand-holes along the top of the horizontal tube and of fixing the ends of the upright tubes in place. Fig. 5 is a front elevation of the boiler-setting before the boiler and the fire-box are in place. Fig. 6 is a vertical cross-section of the top and bottom horizontal tubes and the ends of an upright tube set into them.

A— indicates the shell of an ordinary multiflue-boiler of the horizontal type with the breeching and up-take removed from the front end.

B— indicates the fire-box or fuel-chamber, —C— the bridge-wall and —D— the grate surface. E— is the smoke-box or space at the rear end where the flames and products of combustion from the fuel are returned through the boiler-flues.

The space —F— extending from the bridge-wall back to the smoke-box beneath and partly up the sides of the shell is the combustion-chamber.

G— indicates the cast-iron front in which are the usual fuel-openings, draft-openings, door-frames and hinged doors of the fire-box and ash-pit of the boiler. This front is shown in Figs. 2 and 3, but is omitted from Fig. 1.

H—H indicate courses of brick-work forming a foundation for the boiler-setting along the sides and under the boiler-shell at the front in an inverted arch over the grate surface.

—H²— —H²— are brick-work filling in the space between the cast-iron front and the end of the shell on the sides to close in the fire-box space.

I— is a strap or stirrup on which the brick-work arch rests.

The fire-box is divided by a partition wall —H³— into two parts of equal size; the wall being carried from the cast-iron front plate back to the bridge-wall.

Connected to the boiler-shell under the bottom or lowest part of the water-space and also to the upper part of the same space is a system of water-tubes composed principally of horizontal tubes —1, 2, 4— and upright tubes —6—6— of which the latter are arranged in close order on the sides of the fire-box along the combustion-chamber and around or across the rear end, so that they close in the sides of these chambers and are exposed to the flame and heat, while the former set join and connect these upright tubes at top and bottom into a general circulating system and also with the water-space of the boiler.

The bottom set of the horizontal tubes is composed of the outer tubes —1— supported by the courses of brick-work along both sides of the boiler and across the rear end, and the intermediate tubes —2— —2— also laid longitudinally from front to rear. The ends of these tubes —1— —1—2—2— are brought through the front-plate —G— and are provided with screw-caps —1^x—2^x or they are otherwise closed at the ends in such manner that they can be uncovered whenever it is desired to clean out the tubes. The intermediate tubes —2— —2— are joined at the rear ends to the outer tubes —1— —1— and the last mentioned tubes are connected also across the rear end of the boiler.

Ordinarily, I construct the outer tubes —1— of sections united by flanged joints —3—3, but the intermediate tubes —2— are continuous, or without joints. Such details of construction, however, are governed by the size of the boiler as well as other conditions which may be found to exist, as where this water-tube setting is being applied to a stationary-boiler already in place and the room around the boiler will not allow long tubes to be handled conveniently, and where such system of tubes is to be substituted for a brick-work setting in a confined space.

The top ones —4— of the horizontal tubes set directly above and parallel with the bottom tube —1— and extend in the same manner both along the sides from front to rear and across the back of the boiler.

On the inner side of the tubes —4, or that side next the boiler are short branches or unions —5— with flanged ends shaped to fit the curvature of the boiler-shell and fixed over openings cut in the shell; suitable fastenings being used, such as rivets, or other means to secure tight-joints.

The upright tubes —6— of the system are fixed at the ends in the tubes —2— and —4— in close order and even row along the side of the fuel-chamber —B— and the combustion-chamber —F. A row of holes is made along the top of the lower horizontal tube —1— and a similar row is made along the under side of the top tube —4, those in the one tube being in line with those in the other tube to receive the before-mentioned tubes —6— in upright position. The manner of setting the upright tubes is shown in Figs. 4 and 6. The

tubes are contracted at both ends so that a neck —7— of suitable diameter to enter the opening in the horizontal tube is formed on each end for a short distance.

The tubes —6— are set in place by inserting the upper end into the top tube —4— and pressing it upward until the lower end clears the bottom horizontal tube, and afterward bringing the tube toward a perpendicular position until the contracted lower end comes in line with the opening in the bottom tube —2— and then dropping that end into place. The shoulder —x— on the lower end of the tube then comes to a seat on the rim around the opening as shown in Fig. 5 and holds the tube from dropping any lower. The ends of the upright tubes are fixed in the openings in the two tubes —1— and 2 and tight joints are produced by expanding or flanging the ends of the tubes from the inside.

Hand-holes —8— in the top of the horizontal tube —4— afford access to the tubes for this purpose; one of the openings being located over and in line with the end of every upright tube; so that a suitable tool can be inserted and worked from the outside through the hand-hole and through the upright tube to flange or expand the lower end as well as the upper end of the tube. Through these hand-holes, also, the interior of the upright tubes can be cleaned from time to time by means of scrapers and other tools inserted through these openings and worked from the outside.

Each hand-hole is closed by a hand-hole plate or stopper and fastening composed of a conical stopper —9— having taper-sides, a copper packing ring —9^x— inserted between the conical stopper and the surrounding walls of the hand-hole or opening, a circular cap or top-plate —10— setting upon the rim of the hand-hole and a bolt —12— with a head 13 on the lower end and a slot 15 through the shank near the upper end to which is fitted a wedge or taper-key —14.

The inner face or walls of the hand-hole and the adjacent surface of the stopper —9— are made with the same degree of taper or inclination, and the bottom or greatest diameter of the stopper is somewhat smaller than the smallest diameter of the hand-hole at the top, so that the stopper can be withdrawn from the hand-hole when the packing ring —9^x— is removed. These parts constitute a simple and effective means of closing the hand-hole and of obtaining a steam-tight joint at these openings; and as the stopper and the other parts of the fastening can be removed and withdrawn from the hand-hole it will be seen that a clear passage and unobstructed access to the interior of the tubes is afforded for purposes of cleaning or for repairs. A stopper and fastening of this character is an important feature in this system of water-circulating tubes, as it not only enables steam-tight joints to be maintained un-

der any pressure, but it also allows the parts to be removed and replaced with ease and without loss of time and is much less expensive and more readily managed than where screw-joints and nuts are employed.

The upright tubes —6— fixed in close order between the top and bottom horizontal tubes as before described are exposed on the one side for the full length and for about one half the circumference to the direct heat in the fire-chamber and the combustion-chamber, but on the outer side they would be exposed to the atmosphere and considerable loss of heat would ensue unless covered or jacketed in some manner to prevent such radiation. Therefore, to avoid this loss and secure the best results in the operation of these auxiliary steam-making passages I cover with some non-conducting substance or material those sides or surfaces of the upright tubes —6— which are farthest from the flame and heat-conducting spaces and passages and which are not directly exposed to the heat. All the crevices and spaces between the upright tubes are tamped and packed with cement or some composition capable of standing the heat such as asbestos or magnesia and the exposed sides of the tubes can be covered also with such composition. I prefer, however, to protect such outer faces or sides of the wall of tubes by sheet iron doors or panels —M— set between the upper horizontal tube and the lower horizontal tube, as shown in Fig. 5; because in case of repairs or to give access to the interior spaces beneath the boiler the upright tubes can be taken out by cutting them off at the neck. These doors or panels are placed all around the wall of upright tubes or fastened by bolts or other suitable means the bottom edge resting on the lower horizontal tube or upon the foundation support under that tube, and the top edge setting under or against the top horizontal tube. If the surface of the tube last mentioned be finished with flat faces, as shown in Figs. 3, 5 and 6, the panels before mentioned can be set against the outer perpendicular flat face of the tube. Care should be taken in closing the joints and covering the tubes on the outside to secure tight joints.

The openings between the tubes where the contracted portions or necks are situated along the perpendicular sides of the setting are filled in with tiles suitably shaped for that purpose, and in like manner the opening or space between the inner side of the horizontal tubes —4— and the shell of the boiler are filled in and closed by tiling fitted to both surfaces. It should be mentioned, also, that the upper part of the boiler-shell from the top horizontal tubes of the boiler-setting over the entire length of the shell is usually jacketed with boiler-covering material or composition of some kind.

As the top tubes —4— of the system of tubes already described are connected with the upper part of the boiler-shell by the

branches or couplings so also are the bottom horizontal tubes connected to the lowest part of the water space of the boiler by a series of hollow legs or tubes —16— —16— so that the water stands at all times at the same level in the surrounding outer tubes as it does in the boiler and active circulation through all the tubes of the system is also secured.

I set the connecting tubes —16— beneath the boiler in number and also in position to secure the best results in these respects, and also to brace and steady the boiler. Thus for instance the central row of tubes that connect the boiler with the central one of the intermediate tubes —2— being directly under the shell are placed perpendicularly while the outer rows are set diagonally or with an inclination toward the center from bottom to top. In most cases these tubes will carry and support a horizontal boiler without other means, but the construction affords room beneath the boiler and between the tubes to run stays and brace-rods from one side to the other, and also from the sides down to the bottom horizontal tubes for additional stiffness.

Several of the upright tubes are left out at the rear end and a door frame with a hinged door is set into the opening to afford ready access to the smoke-box for cleaning out the boiler flues and for other purposes. The openings in the top and bottom horizontal tubes for setting the upright tubes and the hand-holes are omitted at the rear as shown in Fig. 3 when a door is fixed in the setting.

All the above described tubes and connections that form the boiler-setting are seen in Fig. 5 of the drawings and the details of construction with respect to the joints and manner of connecting the horizontal and upright tubes and the means of closing the hand-holes are given in Figs. 4 and 6. A setting of this character can be applied to considerable advantage to a horizontal boiler of most any of the types now in use in place of the ordinary boiler-setting and with considerable gain in steam-making capacity without increasing the grate-surface and combustion-chamber.

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

1. The improved steam-generator, comprising a horizontal boiler shell having return fire-tubes, the external water-tubes extending horizontally from front to rear and across the end both at the top, and at the bottom, and along the sides of the fire-chamber and the combustion-chamber at the bottom; intermediate water-tubes between and parallel with the lower course of outer tubes, extending longitudinally from front to rear under the boiler and united at the rear to the external bottom-tubes; standing-tubes connecting the said intermediate tubes with the lower part of the water-space of the boiler-shell; the upright tubes arranged in close order along the

sides of the fire-chamber and the combustion-chamber and forming the perpendicular outer walls or sides thereof; couplings or branches connecting the top longitudinal tubes with the boiler-shell; removable panels or doors against the outside of the said wall of upright tubes fitted to close the spaces between the tubes, and a fire-chamber having fuel and ash-pit openings in the front, constructed substantially as hereinbefore described.

2. A boiler-setting for a horizontal steam-boiler consisting of the upright, circulating tubes connected in close order at top and bottom by continuous horizontal tubes; intermediate tubes laid horizontally through the center of the space inclosed by the said upright tubes and connected at one end to the bottom set of the horizontal tubes, the said bottom tubes presenting open ends to the front of the setting and having means to close them; standing tubes or legs adapted to connect the bottom tubes with the lowest part of the water space of the boiler; and horizontal top-tubes connecting all the upright tubes together and having along the top a hand-hole with a tapering inner surface over the top of

each upright tube, a tapering hand-hole plate with a soft-metal packing-ring and a slotted bolt and key as a means to hold the said plate in place, as hereinbefore described.

3. The combination, with a horizontal steam-boiler, of the upright water-circulating tubes forming the sides or walls of the fire-chamber and the combustion-chamber of the boiler, the horizontal top tubes extending around the boiler and connecting the upper ends of all the upright tubes with the water-space of the boiler, the horizontal bottom tube connecting the lower ends of all the upright tubes together and the intermediate horizontal tubes and series of short upright tubes connecting the said bottom tubes with the lowest part of the water-space of the boiler; the said intermediate tubes and short connecting tubes extending through the fire and combustion chambers, as described.

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

ADAM HEBERER. [L. S.]

Witnesses:

EDWARD E. OSBORN,
R. M. EDWARDS.