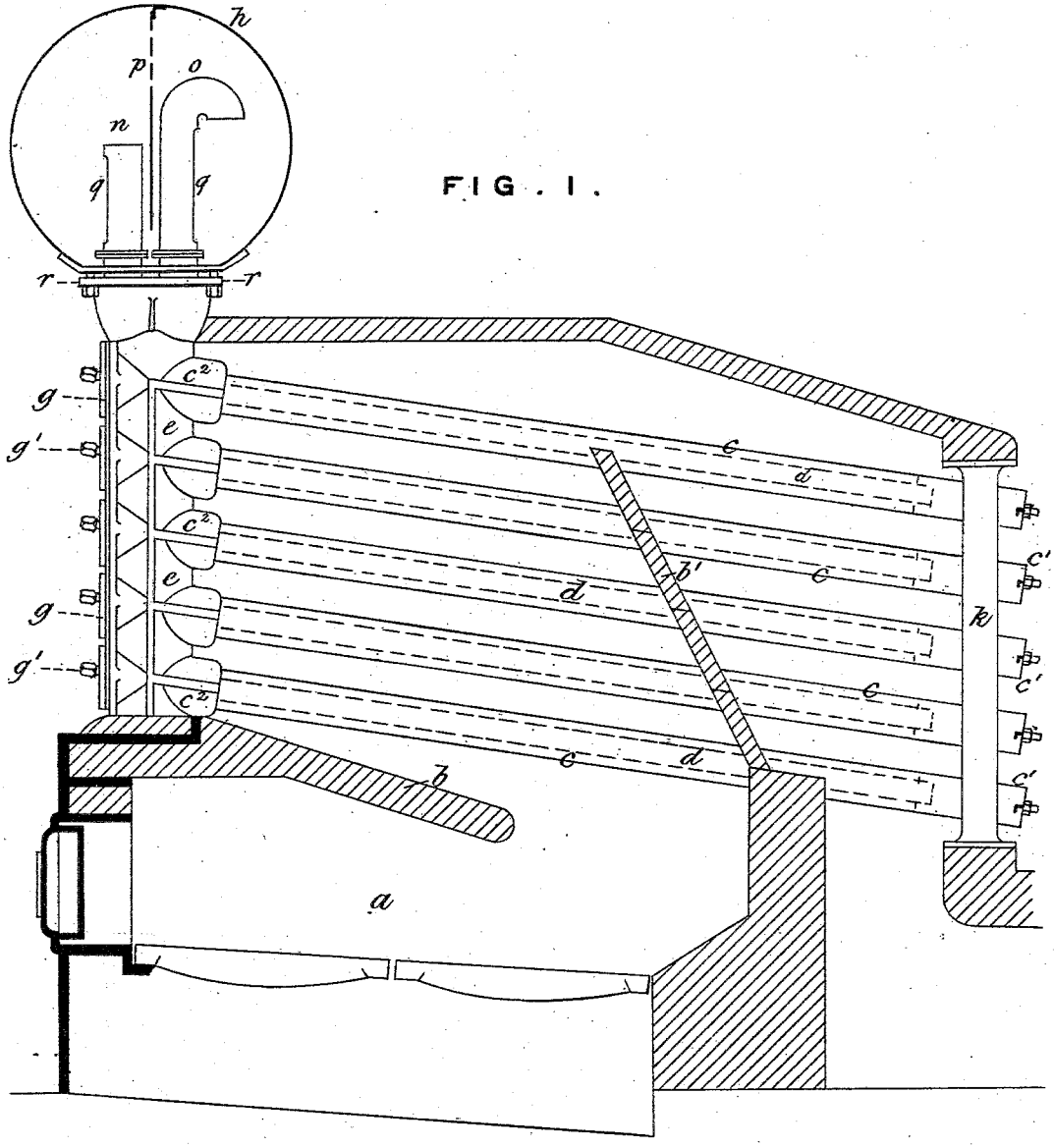
(No Model.) 3 Sheets—Sheet 1.

H. LANE.

STEAM BOILER.

No. 301,374. Patented July 1, 1884.

FIG. 1.



Witnesses.
Vinton Boucher
Robert Everett.

Inventor.
Howard Lane.
By James L. Norris.
Atty.

(No Model.) 3 Sheets—Sheet 2.

H. LANE.

STEAM BOILER.

No. 301,374. Patented July 1, 1884.

FIG. 2.

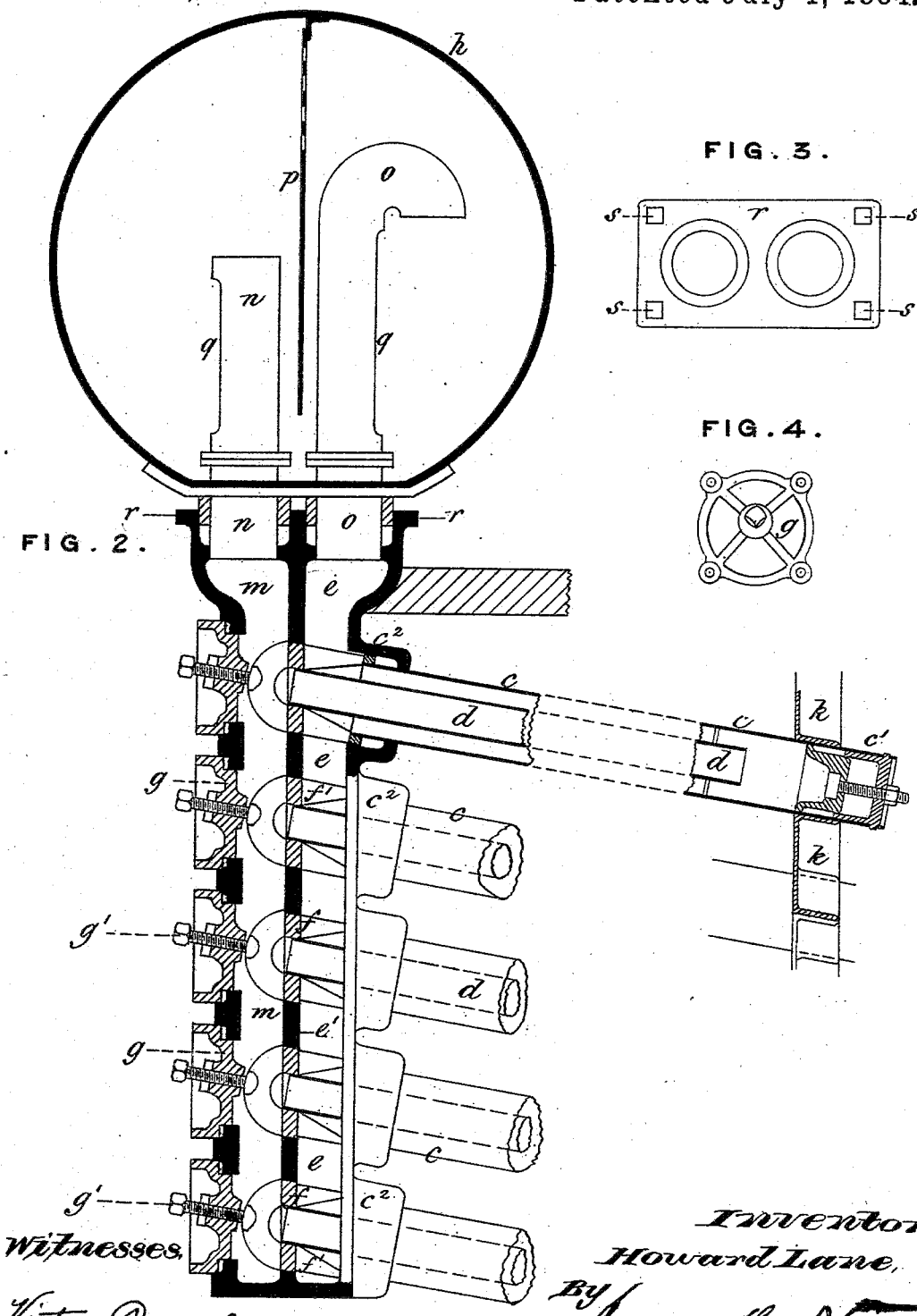


FIG. 3.

FIG. 4.

Witnesses,
Victor Lemoine
Robert Everett

Inventor,
Howard Lane,
By James L. Norris.
Atty.

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H. LANE.

STEAM BOILER.

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Fig. 5.

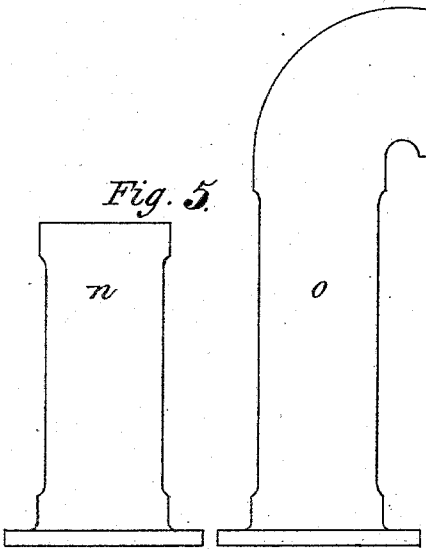


Fig. 6.

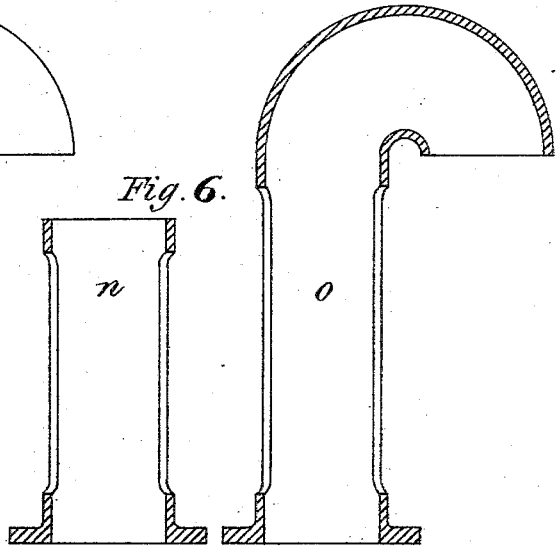
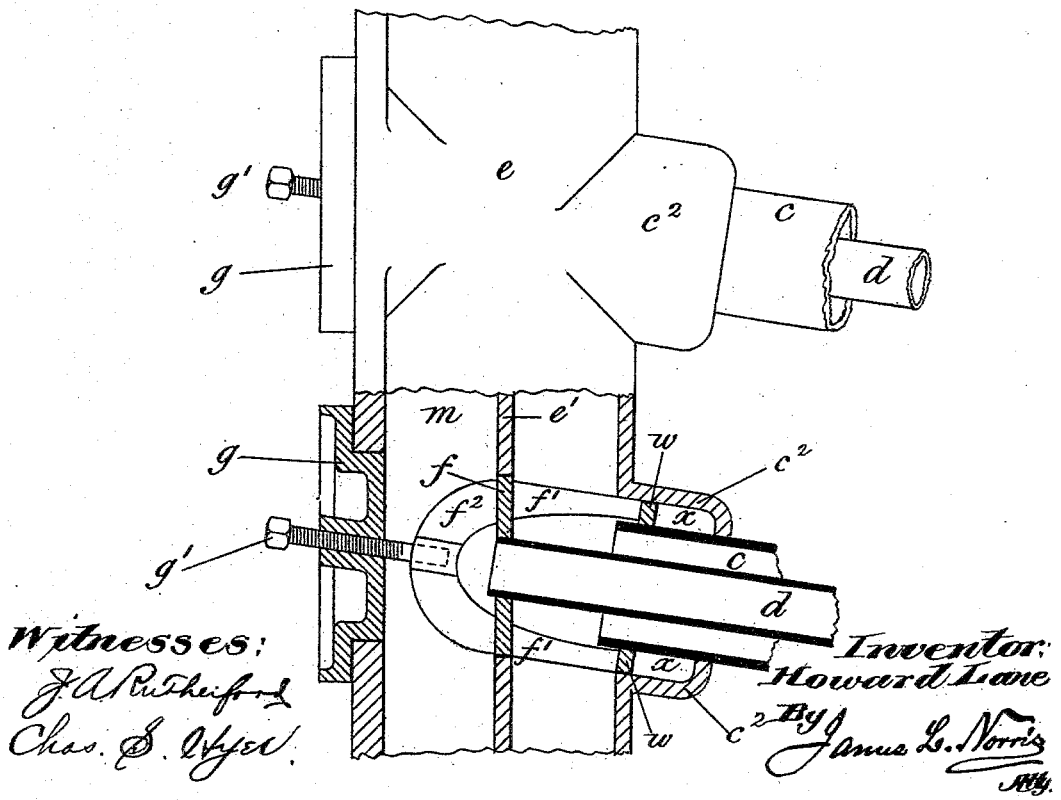


Fig. 7.



Witnesses:
J. A. Rutherford
Chas. S. Offutt.

Inventor:
Howard Lane
By James L. Norris
Atty.

UNITED STATES PATENT OFFICE.

HOWARD LANE, OF LONDON, ENGLAND.

STEAM-BOILER.

SPECIFICATION forming part of Letters Patent No. 301,374, dated July 1, 1884.

Application filed December 26, 1883. (No model.) Patented in England May 11, 1883, No. 2,405.

To all whom it may concern:

Be it known that I, HOWARD LANE, a subject of the Queen of Great Britain, residing at 117 Palmerston Buildings, old Broad Street, in the city of London, civil engineer, have invented certain new and useful Improvements in Steam-Boilers, (for which I have obtained a patent in Great Britain, No. 2,405, bearing date May 11, 1883,) of which the following is a specification.

The object of my said invention is to effect improvements in the construction of steam-boilers, such improvements relating to "sectional steam-boilers," such as that known as "Root's Boiler." In these boilers the heating-surface consists of inclined tubes which contain water only, or water and steam, the ends thereof being fitted with means and arrangements for the circulation of the water and passage of the steam. Many practical difficulties have arisen in connecting the tubes of such boilers, owing chiefly to unequal expansion and contraction, causing leaks, thus entailing much delay and expense in their use. The circulation of the water in these boilers is also very imperfect. These difficulties and effects are overcome entirely in my improved boiler by so arranging the tubes that each tube is free to expand independently, and the expansion of each and all the tubes may vary indefinitely without causing leaks. The inclined tubes are closed at one end, the other end being fitted to and opening into a vertical or nearly vertical receiving-tube. This receiving-tube is either circular or elliptical, or of other convenient form, and has a division plate or diaphragm in a longitudinal direction dividing the same into two parts. A number of these receiving-tubes are arranged side by side, and a number of inclined tubes are fitted to each of the receiving-tubes, according to the respective diameters and lengths of the tubes. The diaphragm in each receiving-tube is fitted with as many inner circulating-tubes as there are outer inclined water-tubes. Each circulating-tube traverses an inclined water-tube nearly its entire length. Opposite the end of each inner tube there is a plugged opening in the receiving-tube, each plug being removable for the purpose of fitting, renewing, or cleansing the inclined and circulating tubes. The upper ends of the series of receiving-tubes are connected with a general receiver, which forms a reservoir of water and a steam-chest. The usual fittings are added—such as feed-pipes, water and steam gages, blow-off cocks, safety-valves, &c. The entire boiler is set in brick-work or other suitable casing, and a furnace or furnaces is or are fitted below the inclined tubes with suitable bafflers for usefully directing the currents of heated gases on their passage to the flues. The steam-chest and general receiver is so arranged that whatever deposit arises from the water is retained therein and prevented from taking place in the inclined tubes, and the water flows therefrom to the several receiving-tubes, from whence it gains access to the inclined tubes by means of the inner circulating-tubes, from the farther ends of which the water enters the inclined tubes. Part of the water is then formed into steam, and the steam and heated water travel together to the receiving-tubes, and thence to the general receiver, where the steam separates from the water and collects in the steam-chest, the water again returning, as before, to the inclined tubes.

In order that my said invention may be clearly understood, reference is hereby made to the accompanying drawings, in which similar letters of reference indicate corresponding parts in the several figures.

Figure 1 is an elevation, partly in section, of my improved steam-boiler. Fig. 2 is a detail sectional view, showing the tube system, diaphragm, annular plate, and plugs on a larger scale than in Fig. 1. Fig. 3 is a plan view of the apertured flange which receives the steam and water tubes that extend into the general steam-receiver. Fig. 4 is a front view of one of the covers that fit into the end wall of the boiler. Figs. 5 and 6 are diagrams in elevation and section of the slotted steam and water pipes. Fig. 7 is an enlarged diagram of a portion of the receiving-tube, partly in section, showing the construction thereof.

The letter *a* denotes the furnace, and *b* the first baffler, formed of fire-brick or fire-clay or other refractory materials. *b'* is a second baffler of similar materials to *b*. *c c* are the outer steam-generating tubes, closed at the

ends c' by removable plugs, as shown at c' in Fig. 2. d d are the inner circulating-tubes which supply the tubes c c with water.

The tubes c c are fitted into bosses c^2, formed on the receiving-tube e. The ends of the tubes c c are open to the tube e, and packed to form a steam-tight joint, as shown in Fig. 2. The receiving-tube e has a vertical diaphragm, e', extending from side to side and from end to end. This diaphragm has as many openings as there are generating-tubes. The front of the receiving-tube has also as many openings as there are generating-tubes fitted thereto.

The inner tubes, d d, are fitted into flanges f f, which also have distance-pieces f'. These distance-pieces are formed in one piece with the flanges f and front bows, f^2, against which bear screws g', as is clearly shown in Fig. 7. The distance-pieces bear against the packing-rings w, which are arranged in the chambers x of the bosses c^2, and by pressing against said rings by means of said distance-pieces and their screws the packing, which will be in the stuffing-boxes c^2 back of said rings, will be compressed and a steam-tight joint be formed around the tubes c.

Covers g g are fitted to the front openings, as shown, which have central screws, g', to press inward the distance-pieces f'.

A general receiver, h, is placed above the vertical receiving-tubes, where the steam accumulates, and from whence it is withdrawn as required.

The end wall, k k, is preferably built up of iron castings made to fit and support the tubes, as shown in Fig. 2.

The putting together of the boiler is effected by first passing the tubes c c through the openings at g g, resting the closed end on and in the wall k and the other (open) end resting in the boss or stuffing-box c^2. The flanges f f, with the distance-pieces f' and inner tubes, d, are then inserted and fitted into the diaphragm e', as shown. The covers g g being then placed in position and screwed up, the central screw, g', is used to compress the packing in c^2, similar packing being placed under the flange of the covers g g.

The upper end of the receiving-tube is suitably attached to the steam-chest, having an uptake-pipe, o, for steam and any water which may be carried therewith, and a downtake-tube, n, for conveying the surplus water downward. Slots q are formed in o and n, to let the water pass when it is below the level of the top of n.

It will be seen that all the steam necessarily rises to the space e, and therefrom, by the pipe o, to the steam-chest; also, that the water in the steam-chest descends by the pipe n into the space m, and thence by means of the inner circulating-tubes, d, to the ends of the generating-tubes c at or near c'.

A diaphragm, p, is fitted in the steam-chest to assist in separating the steam from the water, such diaphragm having a few holes in the upper portion to preserve the equilibrium of pressure and the normal water-level.

In constructing the several parts of my improved boilers more or less of wrought-iron the tubes are screwed into sockets, and I use screwed plugs instead of the covers g, the stuffing-boxes shown in the drawings being dispensed with and the receiving-tube e being built up of as many separate parts as may be necessary.

Having thus particularly described the nature of my said invention and in what manner the same is to be performed, I claim—

1. In sectional boilers, the combination of the inner circulating-tubes, d, receiving-tube e, flanges f, distance-pieces f', parts f^2, and screws g', substantially as described.

2. In sectional boilers, the combination of receiving-tubes e, provided with bosses c^2, tubes c and d, packing-rings w, flanges f, and distance-pieces f', substantially as described.

3. The combination, with receiving-tube e, provided with diaphragm e', to form the additional space m, and the tubes c and d, of the general receiver b, slotted tubes n o, and separating-plates p, substantially as described.

In testimony whereof I have hereunto set my hand this 28th day of November, 1883.

HOWARD LANE.

Witnesses:

GEO. C. DOWNING,
8 *Quality Ct., London.*

G. W. WESTLEY,
17 *Gracechurch Street, London.*