

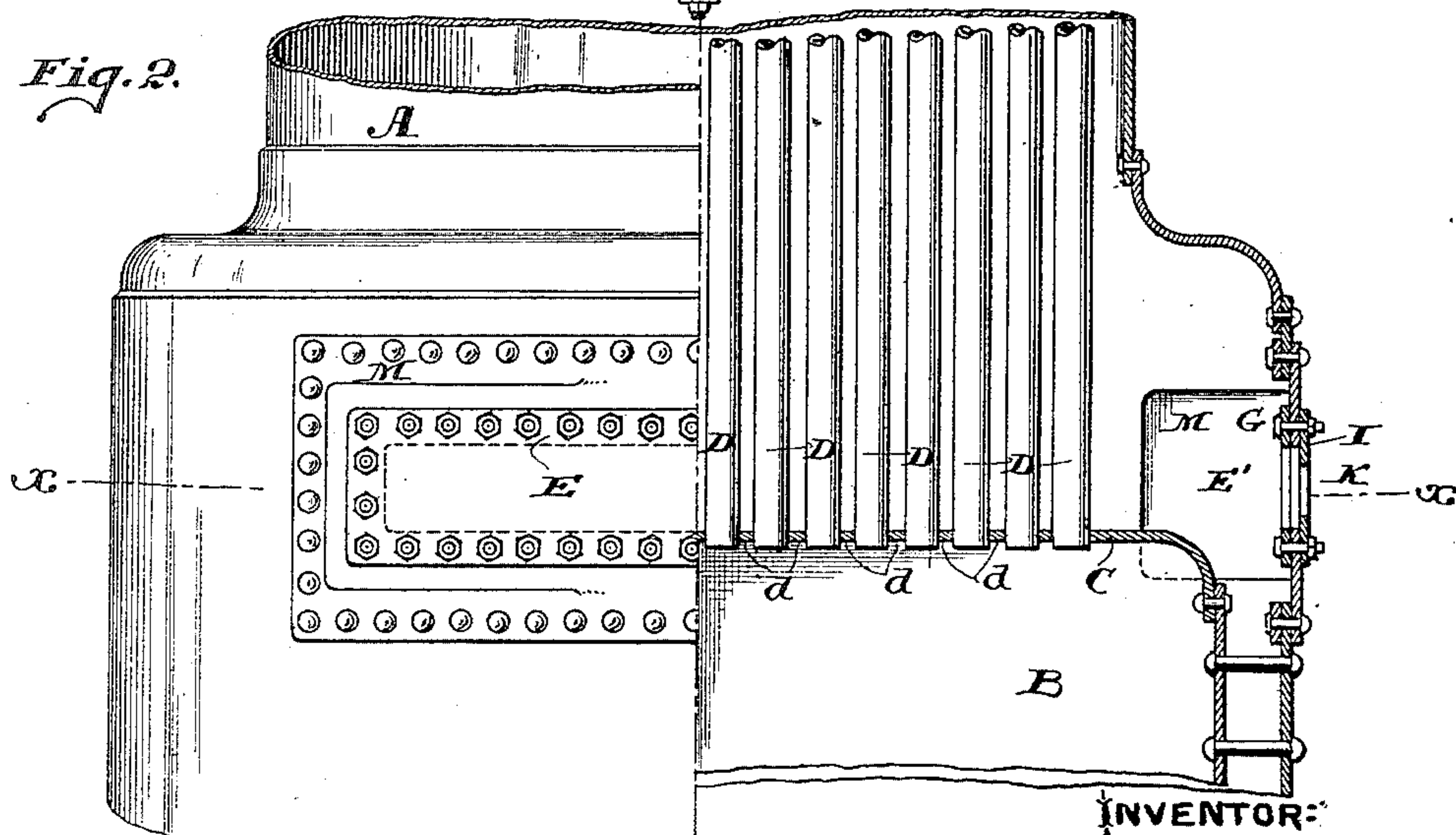
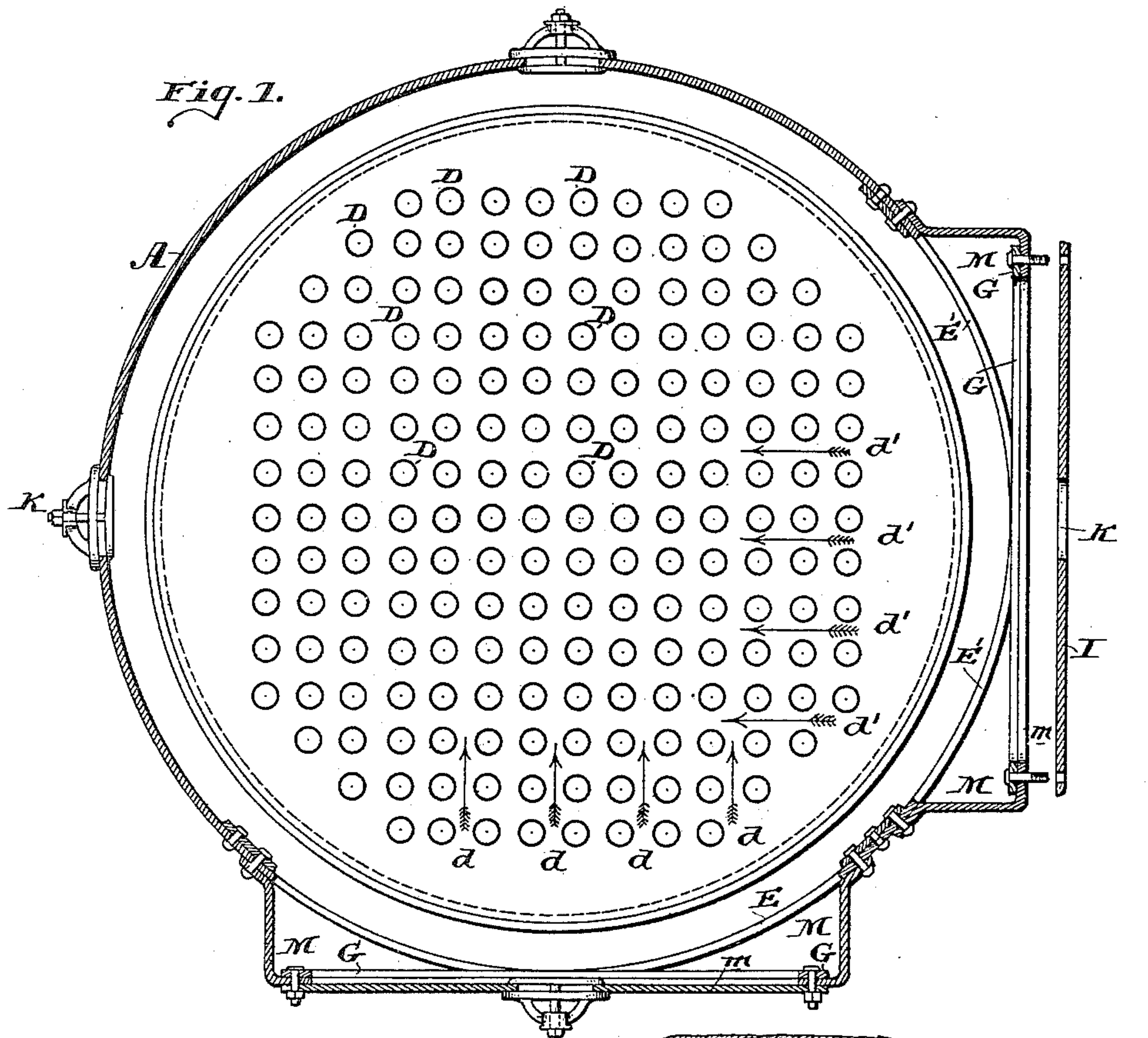
(No Model.)

2 Sheets—Sheet 1.

H. WARDEN.
TUBULAR BOILER.

No. 442,156.

Patented Dec. 9, 1890.



WITNESSES: { Walter Farnsworth,
Joshua Matlack, Jr.

INVENTOR:
Henry Warden
by his attorney
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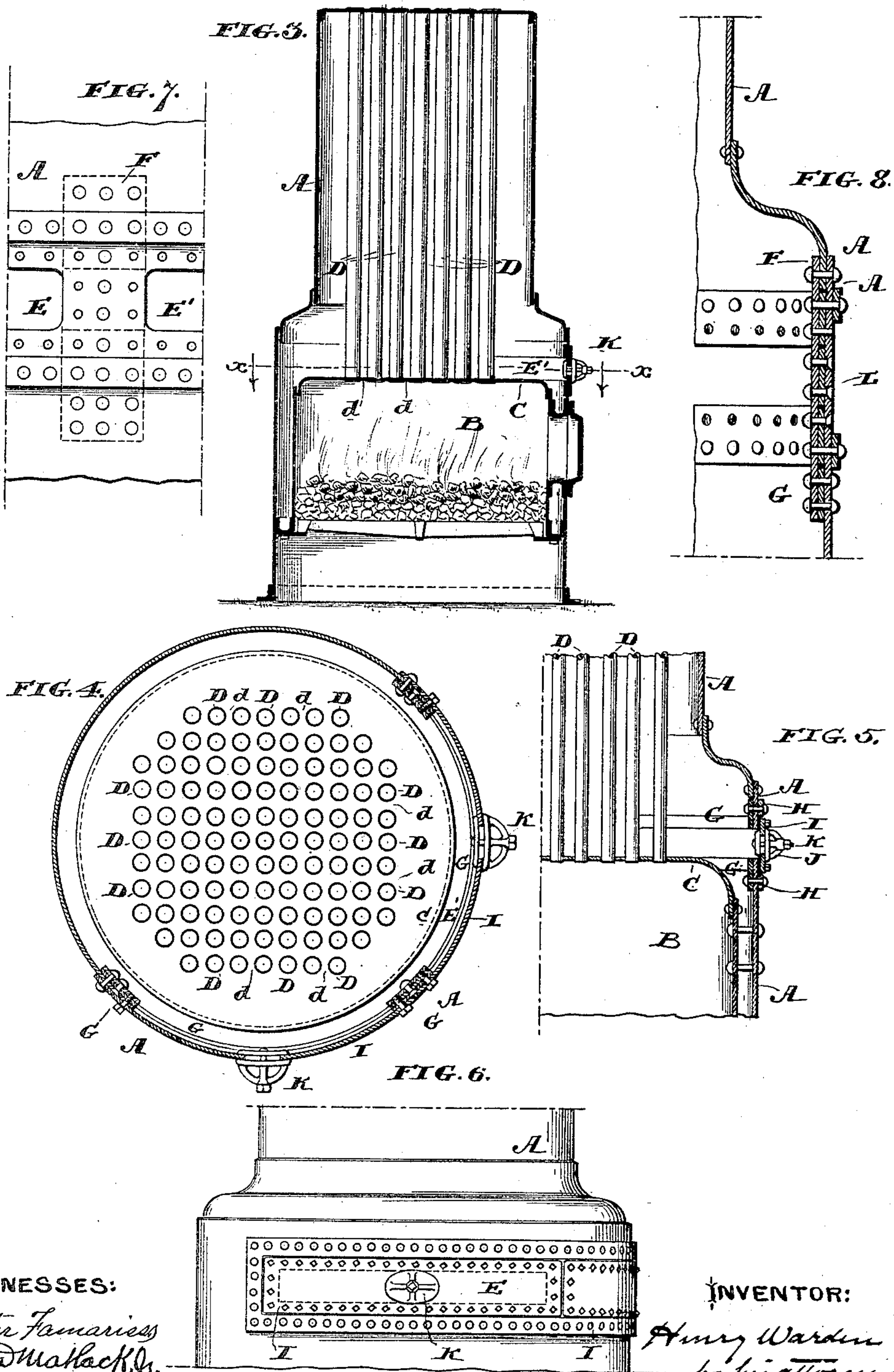
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UNITED STATES PATENT OFFICE.

HENRY WARDEN, OF PHILADELPHIA, PENNSYLVANIA.

TUBULAR BOILER.

SPECIFICATION forming part of Letters Patent No. 442,156, dated December 9, 1890.

Application filed July 10, 1890. Serial No. 358,315. (No model.)

To all whom it may concern:

Be it known that I, HENRY WARDEN, of the city and county of Philadelphia, State of Pennsylvania, have invented a new and useful Improvement in Tubular Boilers, of which the following is a true and exact description, reference being had to the accompanying drawings, which form a part of this specification.

My invention relates to tubular boilers, and has for its object to provide improved means whereby access can be had to the tube and tube-sheets for the purpose of cleansing them from scale.

My invention will be best understood as described in connection with the drawings in which it is illustrated, and the novel features which I desire to protect by Letters Patent are hereinafter pointed out in the claims.

Reference is now had to the drawings, in which—

Figure 1 is a plan view of a boiler constructed in accordance with my invention, said view being taken on the sectional line x of Fig. 2. Fig. 2 is an elevation of the lower part of the tubular boiler, shown partly in section. Fig. 3 is a sectional elevation of another boiler embodying my invention in a somewhat modified form; Fig. 4, a cross-sectional plan view taken on the line $x x$ of Fig. 3; Fig. 5, a sectional plan view showing a portion of the construction shown in Fig. 3 on a somewhat enlarged scale; Fig. 6, an elevation of the lower part of the boiler; and Figs. 7 and 8 are views showing details of construction.

A is the outer shell of the boiler; B, the fire-box; C, the tube-sheet; D D D, &c., the tubes. Through the shell of the boiler and at substantially right angles to each other I form slots or openings E and E', and I arrange the tubes D so that they will fall into rest, running substantially at right angles to each opening—as is indicated, for instance, at d and d' .

I I are plates or covers by which the openings or slots in the boiler are closed when the boiler is in use. Where the slots are formed in a circular boiler, such as is shown in Figs. 3 to 8, inclusive, the lids are of course

curved, and as they are merely bolted to the shell of the boiler it is necessary to use packing to prevent leakage, and the compression of the packing results in the lid, as it were, moving on the face of the boiler shell, so that the bolt-holes in the shell or in the lid would have to be slotted in order to enable the bolts to act properly. To avoid this difficulty I prefer to secure around the openings E and E' an extension, such as M M, having a flat outer face, in which an opening m is formed, corresponding in position and size to the curved opening E or E', above which it is situated. When so constructed, as shown in Figs. 1 and 2, a flat lid or plate I can be used to close the opening, and the difficulty above noted is thus avoided.

F F, &c., are strengthening-plates, which are riveted inside of the boiler, at the ends of the openings E and E'. G G, &c., are strengthening-rings, also riveted on the inside of the openings E and E', so as to surround the same.

H H (see Fig. 5) are metal bars riveted to the shell of the boiler and forming, as it were, a seat in which the lid I rests. The particular function of these bars H is to prevent the packing (indicated by letter J) from being forced out of place by the pressure in the boiler.

K K, &c., are man-holes.

The particular advantage of my construction is that by arranging the tubes and slots in the way shown and described access can readily be had to all parts of the tube-sheet and tubes adjacent to the tube-sheet, while in all similar devices by which I have knowledge it has only been practicable to partially clean the tube-sheets—that is to say, the tool of the cleaner could pass freely in one direction across the tube-sheet, but not in a direction at right angles thereto.

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

1. A tubular boiler having transverse slots arranged above the tube-sheet over the fire-box and substantially at right angles to each other, and having its tubes arranged so that the rows will run at right angles to each slot,

all substantially as described, and so that ready access is had to the tubes and tube-sheets.

2. A tubular boiler having transverse slots
; arranged above the tube-sheet over the fire-box and substantially at right angles to each other, extensions *M*, secured around said openings and provided with openings *m*, arranged

in a vertical plane, and tubes arranged in the boiler so that the rows will run substantially at right angles to the slots, all substantially as and for the purpose specified.

HENRY WARDEN.

Witnesses:

LEWIS R. DICK,
JOSHUA MATLACK, Jr.