

No. 708,729.

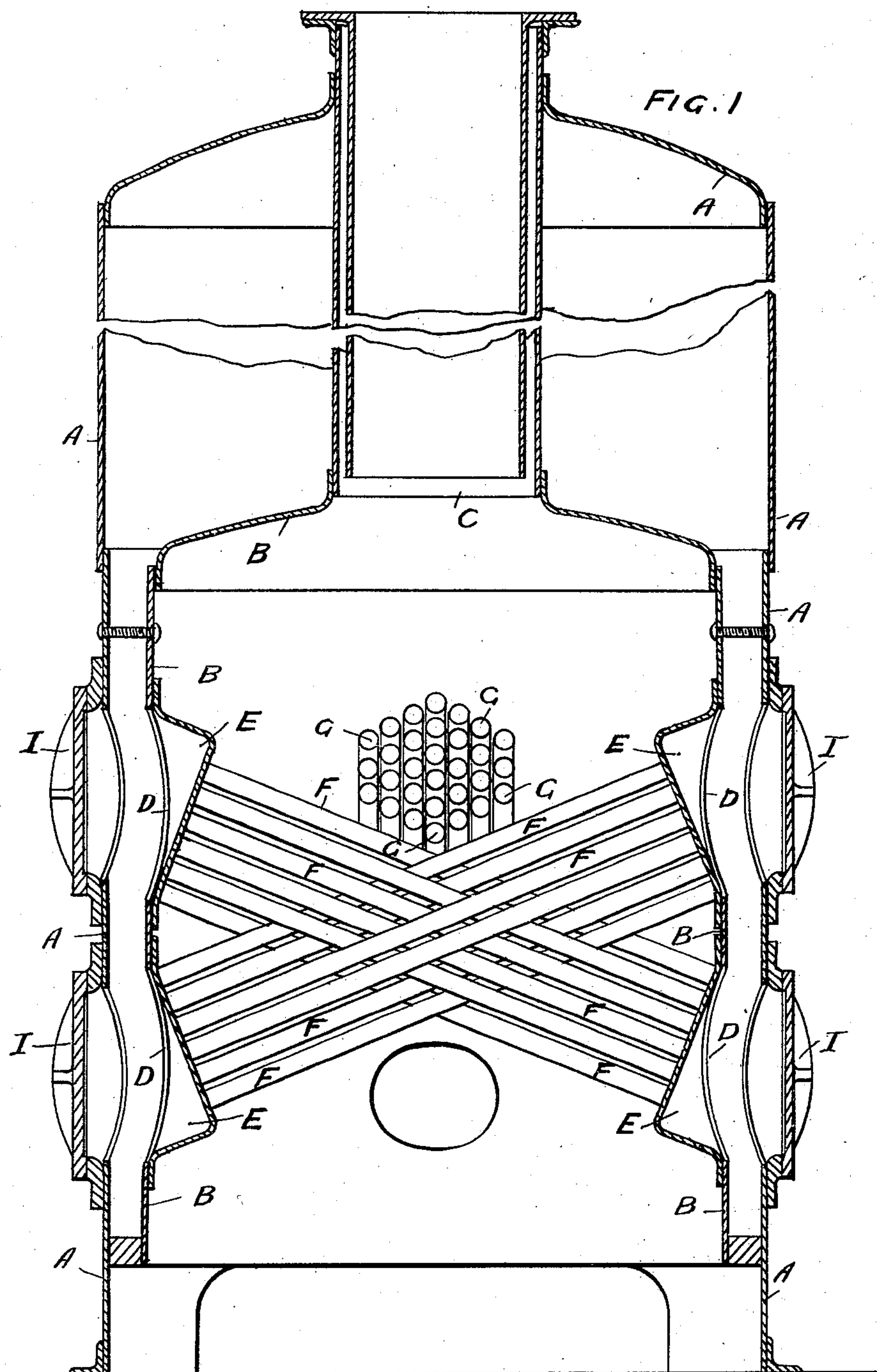
Patented Sept. 9, 1902.

W. PENMAN.
VERTICAL STEAM BOILER.

(Application filed Aug. 19, 1901.)

(No Model.)

2 Sheets—Sheet 1.



Witnesses:
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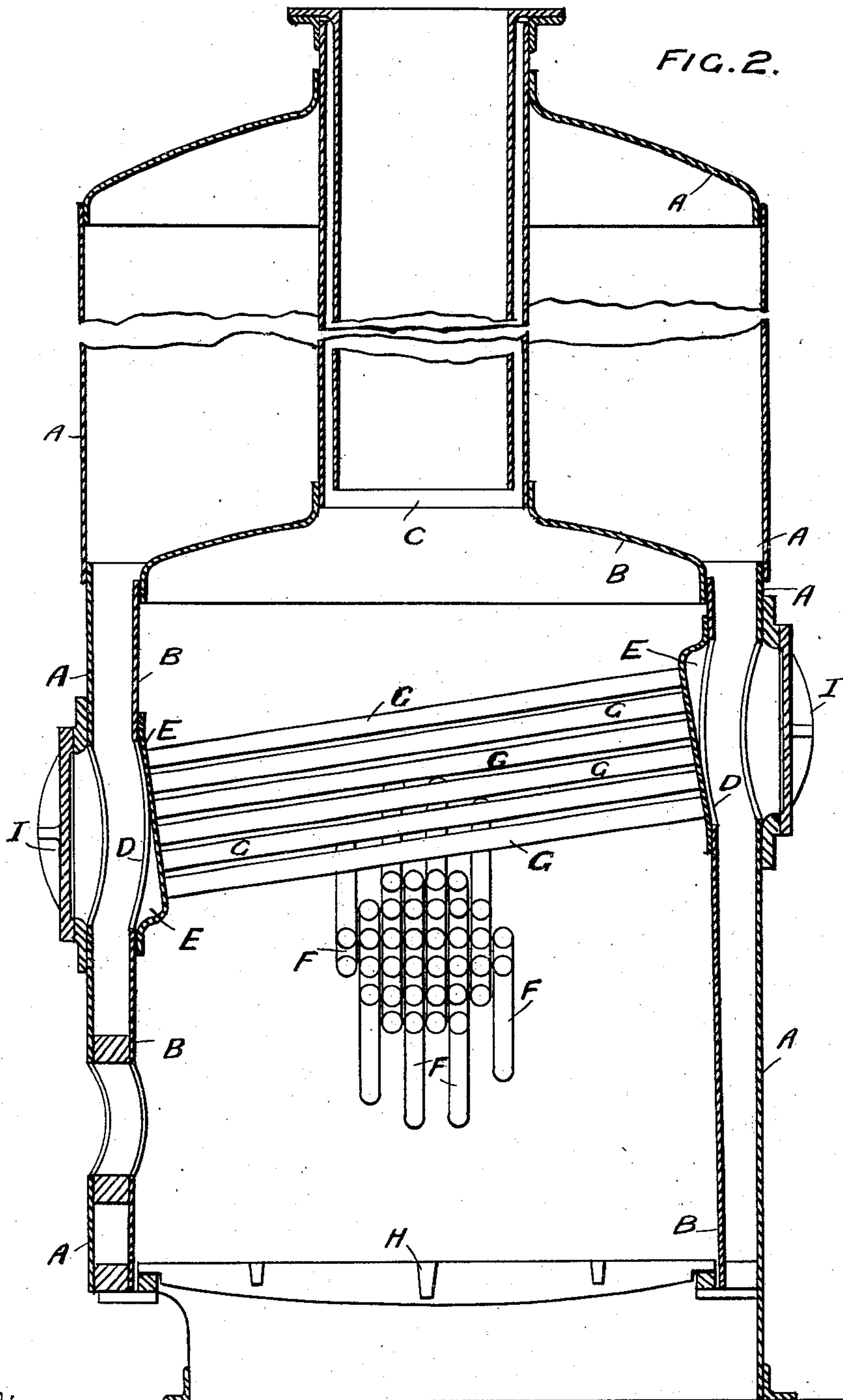
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(No Model.)

2 Sheets—Sheet 2.



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UNITED STATES PATENT OFFICE.

WILLIAM PENMAN, OF GLASGOW, SCOTLAND.

VERTICAL STEAM-BOILER.

SPECIFICATION forming part of Letters Patent No. 708,729, dated September 9, 1902.

Application filed August 19, 1901. Serial No. 72,544. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM PENMAN, a citizen of the United Kingdom of Great Britain and Ireland, residing at Springfield House, Springfield road, Glasgow, Scotland, have invented certain new and useful Improvements in Vertical Steam-Boilers, (for which application for patent has been made in Great Britain, No. 1,815, dated January 26, 1901,) of which the following is a specification.

This invention has for its object to provide a vertical steam-boiler of improved construction wherein great heating-surface and rapid and complete circulation are obtained by means of inclined cross-tubes connecting opposite sides of the annular water-space surrounding the furnace.

The invention is illustrated by the accompanying drawings, in which—

Figures 1 and 2 are vertical sections at right angles to each other of a vertical boiler constructed in accordance with my invention.

The improved boiler comprises an outer shell A and an inner shell B, united in the usual way at the base and at the domed top around a central chimney-outlet C. The inner cylindrical shell B is pressed or dished at various points or has cut in it a number of upper and lower openings D, around each of which is attached, by riveting, an inwardly dished or pressed plate E, having by preference an inclined flat surface, the dished plates E at top and bottom being oppositely inclined and arranged in pairs diametrically opposite each other. Into orifices in the opposite dished plates E water-tubes F are expanded, the tubes F being preferably straight and entering the orifices at right angles to the dished plates, though they may be curved or bent, and these tubes F extend from the lower dished plates E on either side to the upper dished plates E on the opposite side of the boiler. The tubes F, connecting the upper and lower dished plates E, thus cross each other after the fashion of the letter X; but additional rows of tubes G may extend horizontally, or nearly so, across the boiler above the inclined rows F. The fire-grate H is fitted, as usual, in the lower part of the boiler, and the hot fire-gases arising therefrom impinge on the surfaces of the cross-tubes F and G on their way upward to the chimney C. The inclined arrangement of the tubes F and

G provides for rapid circulation of the water from the lower toward the upper sides of the boiler and prevents the formation of a zone of comparatively cold water around the base of the boiler at the level of the fire-grate H.

In the outer shell of the boiler doors I, which may be removable, are fitted opposite the dished plates E in the inner shell B to provide for access to the tubes F and G for expanding them into their orifices and for cutting them out.

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

1. A vertical steam-boiler comprising the usual outer shell, in combination with an inner shell formed with dished portions arranged in pairs opposite each other, one of each pair being in proximity to the fire-grate and the other to the furnace-crown, cross-rows of inclined tubes expanded into these dished portions approximately at right angles to the dished surfaces, and additional rows of tubes extending horizontally across the boiler above said inclined rows of tubes and orifices in the outer shell covered by doors substantially as described.

2. The herein-described vertical steam-boiler comprising in combination with an outer shell an inner cylindrical shell formed with dished portions diametrically opposite each other, cross-clusters of inclined tubes expanded into said dished portions, the outer shell having orifices opposite said dished portions closed by doors, substantially as and for the purpose set forth.

3. The herein-described vertical steam-boiler comprising in combination with an outer shell an inner cylindrical shell formed with orifices diametrically opposite each other, dished plates riveted to the inner shell covering said orifices, cross-clusters of inclined tubes expanded into said dished plates, the outer shell having orifices opposite those on the inner shell and closed by doors, substantially as and for the purpose set forth.

In witness whereof I have hereunto set my hand in presence of two witnesses.

WILLIAM PENMAN.

Witnesses:

WALLACE FAIRWEATHER,
JOHN MORTON.