(No Model.)

2 Sheets—Sheet 1.

A. STIRLING.

STEAM BOILER.

No. 580,653. Patented Apr. 13, 1897.

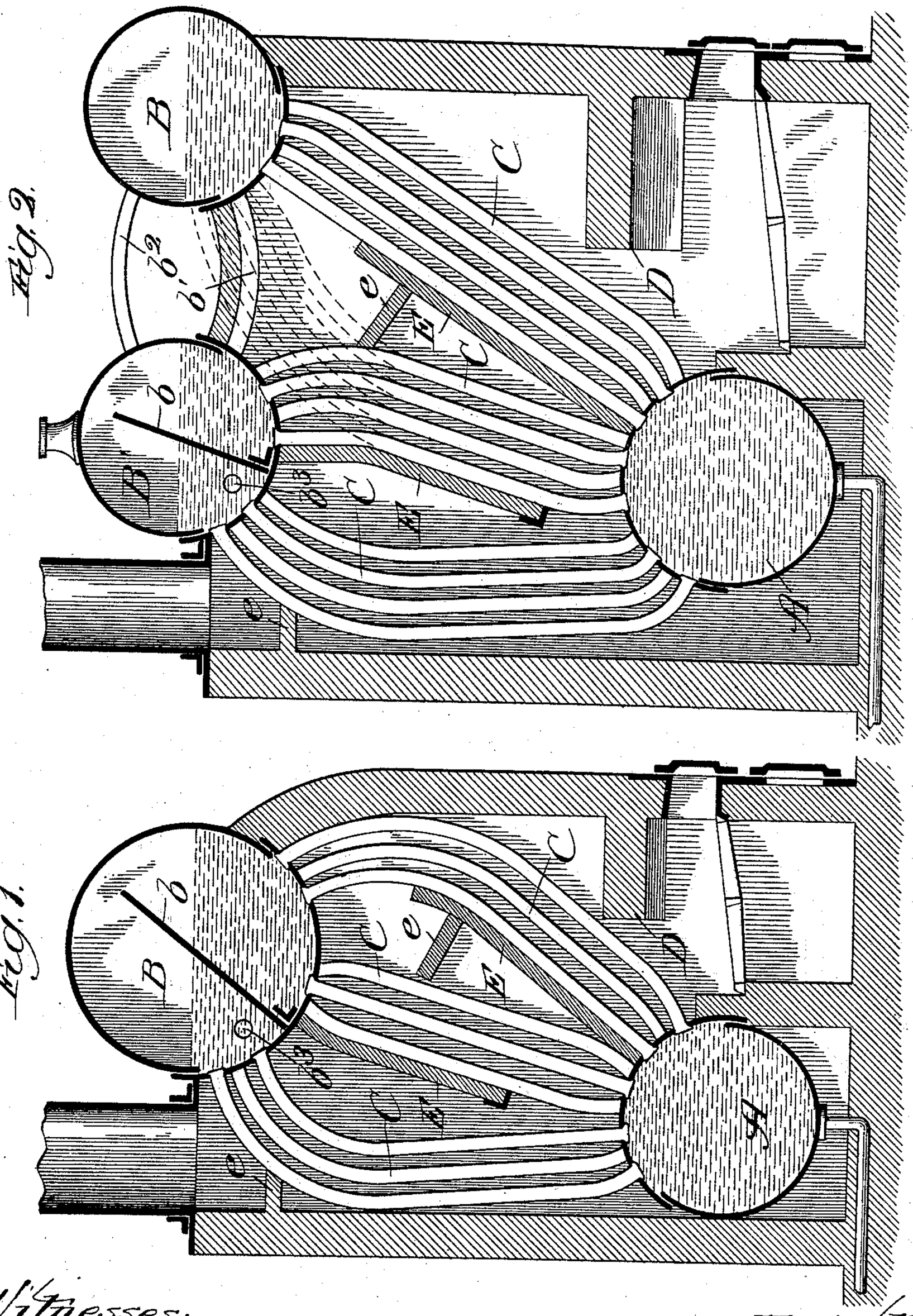

Fig. 2.

Fig. 1.

Witnesses:
Chas. E. Gaylord,
Luther J. Adler.

Inventor:
Allan Stirling
By Banning & Banning & Sheridan,
Attys.

(No Model.)

2 Sheets—Sheet 2.

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STEAM BOILER.

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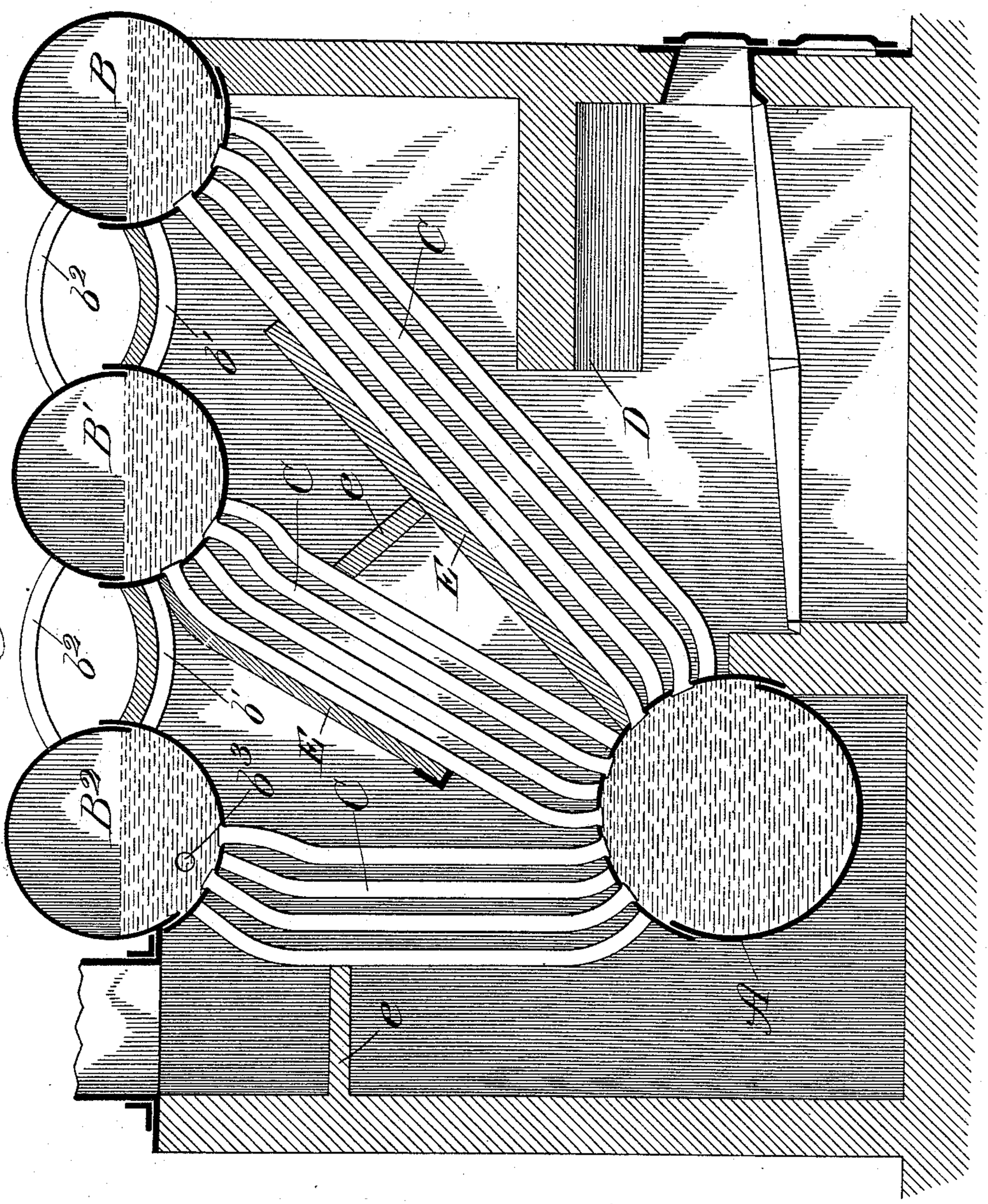

FIG. 3.

Witnesses:
Chas. E. Gaylord.
Luther Alter.

Inventor:
Allan Stirling,
By Banning & Banning & Sheridan,
Attys.

UNITED STATES PATENT OFFICE.

ALLAN STIRLING, OF LONDON, ENGLAND, ASSIGNOR TO THE STIRLING COMPANY, OF CHICAGO, ILLINOIS.

STEAM-BOILER.

SPECIFICATION forming part of Letters Patent No. 580,653, dated April 13, 1897.

Application filed August 26, 1895. Serial No. 560,511. (No model.)

To all whom it may concern:

Be it known that I, ALLAN STIRLING, of London, England, have invented a new and useful Improvement in Steam-Boilers, of which the following is a specification.

The object of my invention, which is an improvement upon the boiler described in Letters Patent of the United States No. 407,260, dated July 16, 1889, and No. 479,678, dated July 26, 1892, is to improve the Stirling type of boiler in certain particulars; and the invention consists in the features and combinations hereinafter described and claimed.

In the accompanying drawings, Figure 1 is a vertical sectional elevation of my improved boiler when constructed with one steam and water drum, one lower mud-drum, and three banks of tubes connecting the mud-drum with the steam and water drum; Fig. 2, the same when the boiler is constructed with two communicating steam and water drums, one lower mud-drum, and three banks of tubes, one connecting the mud-drum with the front upper drum and the other two connecting the mud-drum with the rear upper drum; and Fig. 3, the same when the boiler is constructed with three communicating steam and water drums, one lower mud-drum, and three banks of tubes connecting the mud-drum with the steam and water drums, respectively.

A is the lower mud-drum; B B′ B^2, upper steam and water drums; *b*, a diaphragm or partition in the steam and water drums; *b′*, pipes connecting the water-spaces of the steam and water drums, and b^2 pipes connecting the steam-spaces thereof; C, banks of tubes connecting the lower mud-drum with the upper steam and water drum or drums; D, a fire-brick arch arranged over the grate or fireplace; E, fire-brick tiling adjacent to the banks of tubes, and *e* fire-brick shelves or projections.

In the form of boiler shown in Fig. 1 the lower mud-drum is connected to the upper steam and water drum by three banks of tubes. The furnace is arranged in the usual position in this type of boiler, and a fire-brick arch extends inwardly above the grate to secure complete combustion of the gases and at the same time project them in to and among the front bank of tubes at or near the lower ends thereof. A fire-brick partition extends up inside the front bank of tubes from the mud-drum to a point near the upper drum and requires the flame and heated gases to pass up and along this bank of tubes, completely enveloping the same. After escaping over the top of this fire-brick partition the heated gases enter the second bank of tubes at or near the upper drum and pass thence down along and among the same to a point near the lower mud-drum, whence they escape into the rear bank of tubes. In their final passage the gases ascend along and among the rear bank of tubes to the uptake or chimney. The projecting shelves aid in directing the gases into the banks of tubes and holding them therein. In this way the fire-brick arch, partitions, and shelves operate to hold the heated gases in contact with the tubes of the several banks in and among the same from the time they leave the furnace until they finally escape into the chimney. The result is that the front bank is heated by gases of the highest temperature and the middle and rear banks by gases of gradually-decreasing temperature.

The feed-water which enters the steam and water drum at the opening b^3 behind the diaphragm or partition passes down the rear bank of tubes into the lower mud-drum and thence forward into the other parts of the boiler. Owing to the fact that the front bank of tubes is subjected to the highest heat the natural course of the water after it enters the mud-drum will be forward and up through the front bank of tubes into the upper steam and water drum, thence down through the middle bank of tubes into the mud-drum, again forward and up through the front bank of tubes, and so on in circuit. The rear bank of tubes being heated as above described the feed-water is gradually raised in temperature and its sediment liberated and deposited in the lower mud-drum before the water enters into the general circulation in the forward parts of the boiler.

In the form of boiler shown in Fig. 2 the fire-brick arch, partitions, and shelves are arranged substantially as in the form shown in Fig. 1; but there are two upper steam and water drums instead of one, and the banks of

tubes are changed accordingly, so that the upper ends of the front bank connect with the front steam and water drum and the upper ends of the middle and rear banks with the rear steam and water drum. The upper drums also have their steam and water spaces, respectively, placed in communication. The pipes forming the communication between their water-spaces permit the water to circulate or pass freely from the front upper drum to the middle upper drum, and this water, carrying steam with it, affords relief to the front upper drum and enables steam generated in the hottest part of the boiler to be liberated in both the steam and water drums. The feed-water entering the rear upper drum behind the diaphragm or partition first passes down through the rear bank of tubes, being thus heated and having its scale matter liberated and deposited, as above described.

In some cases it may be found advisable to have the upper ends of both the front and middle banks of tubes connect with the front upper drum, or part of the tubes in the middle bank connect with the front upper drum and part with the rear upper drum, or the front bank may be divided so as to have part of its tubes in front of the fire-brick partition and part in the rear thereof. In these modifications, however, some of the tubes should always be behind the front partition, so as to permit of a down circulation from the front upper drum to the lower mud-drum. When the tubes of the middle bank are all connected to the front or rear upper drum, then this down circulation must of course take place through this drum; but when the boiler is formed with these modifications the water may pass down without going through the middle or rear upper drum, or part of it may pass down in this way and part through the rear or middle upper drum.

In the form of boiler shown in Fig. 3 there are three upper steam and water drums, and the banks of tubes are connected therewith, respectively. The fire-brick arch, partition, and shelves are substantially the same in this form of boiler as in the other forms, and the upper drums have their steam and water spaces, respectively, placed in communication. In this form of boiler the feed-water enters the rear upper drum, passes thence down into the mud-drum, its scale and sedimentary matter being deposited, after which it passes forward into the general circulation, as above described. The pipes connecting the water-spaces of the upper drums enable the water to circulate or pass freely from one drum to the other, as required by the operation of the boiler.

Various other modifications than those above suggested may be made without departing from the spirit of my invention. For instance, the mud-drum may be formed of two or more communicating drums or otherwise divided into compartments, and the diaphragm or partition in one of the upper drums may in some cases be changed in form or position or omitted entirely. In some cases also, especially when only one elevated steam and water drum and one lower mud-drum are used, the position and number of the tubes may be changed so as to make them form, practically, a single bank with a fire-brick partition or partitions between the tubes or two banks divided by a fire-brick partition or partitions.

I am aware of the Preston patent of July 31, 1894, but my invention differs from the construction shown therein in several respects, particularly in that it does not have any large vertical pipe between the upper and lower drums and in that its water-tubes do not enter the upper drum at a point above the water-level therein.

I claim—

A water-tube boiler comprising a lower mud-drum, two elevated steam and water drums, three rows or banks of tubes connecting the lower mud-drum with the elevated steam and water drums, two of the rows or banks of tubes connecting with one of the elevated steam and water drums and one of the rows or banks of tubes connecting with the other steam and water drum, and fire-brick partitions adjacent to the banks of tubes for directing and holding the furnace-gases therein, substantially as described.

ALLAN STIRLING.

Witnesses:

FREDERICK PIATT,

ROBT. J. MACBRIDE, Jr.