No. 772,340. PATENTED OCT. 18, 1904.

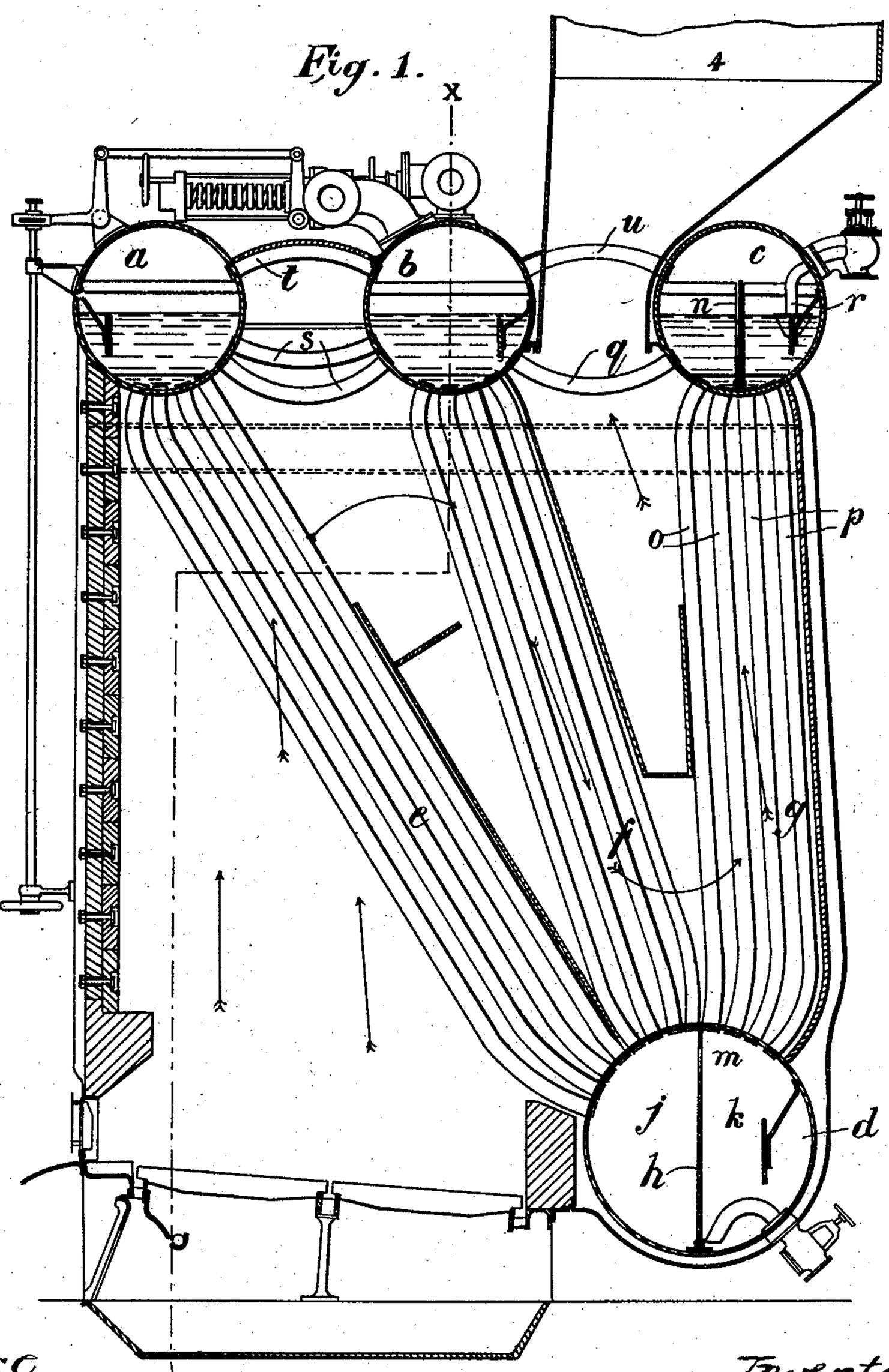
J. COWAN.

WATER TUBE BOILER.

APPLICATION FILED JULY 22, 1902.

NO MODEL. 2 SHEETS—SHEET 1.

Fig. 1.



Attest.

C. D. Macleod

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Inventor.

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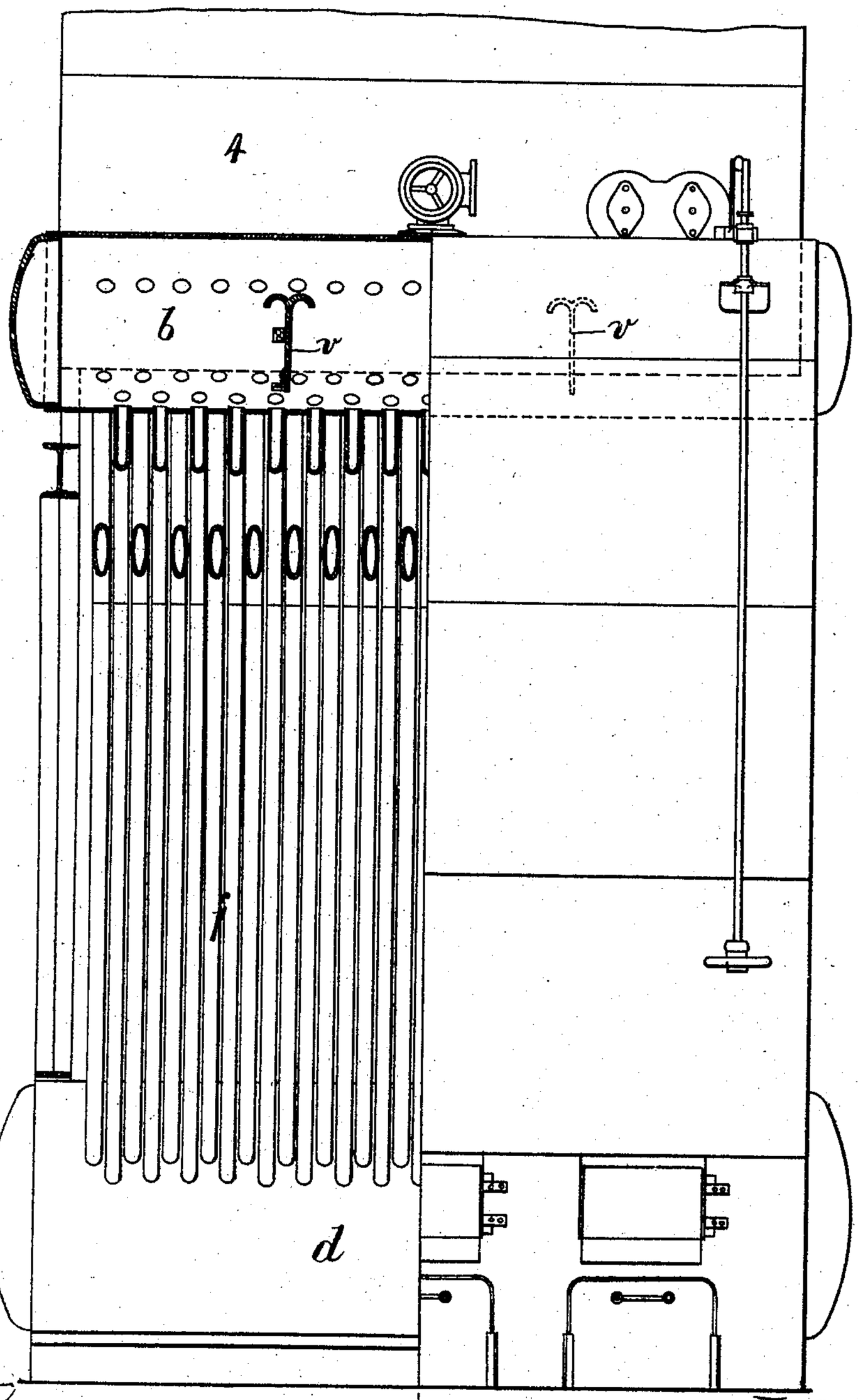
NO MODEL. 2 SHEETS—SHEET 2.



Attest.
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Fig. 2.

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No. 772,340. Patented October 18, 1904.

UNITED STATES PATENT OFFICE.

JOHN COWAN, OF EDINBURGH, SCOTLAND.

WATER-TUBE BOILER.

SPECIFICATION forming part of Letters Patent No. 772,340, dated October 18, 1904.

Original application filed October 3, 1901, Serial No. 77,456. Divided and this application filed July 22, 1902. Serial No. 116,543. (No model.)

To all whom it may concern:

Be it known that I, JOHN COWAN, managing director of the Stirling Boiler Company, Limited, a subject of the King of Great Britain and Ireland, residing at 2 St. Andrew's Square, Edinburgh, Scotland, have invented certain new and useful Improvements in Water-Tube Boilers, (for which I have made application for Letters Patent in Great Britain, No. 9,924, dated May 13, 1901; in Germany, dated September 30, 1901; in Russia, No. 15,281, dated October 3, [September 20,] 1901, and for which I have obtained a patent in France, No. 314,561, dated September 28, 1901,) of which the following is a specification.

This invention is a division of the apparatus disclosed in application for Letters Patent of the United States, Serial No. 77,456, filed October 3, 1901.

My invention relates to water-tube boilers, especially to the "Stirling" boiler of the construction known as the **W** type. In this type of boiler the three steam and water drums of the boiler are connected by banks of tubes with the two lower water-drums, a considerable space between these two drums being necessary.

In many cases, particularly where boilers are placed in vessels where space is valuable and a reduction in weight desirable, any saving that can be effected in the space occupied by and in the weight of the boiler without causing a loss of efficiency is of great importance.

It is the object of my invention to reduce the weight of the boiler as well as the space which the boiler occupies while maintaining its efficiency and water circulation and to so provide for the circulation of the water that no matter how much the firing of the boiler be forced there will be no danger of burning out the water-tubes or of priming.

My invention consists in providing the boiler with one lower water-drum divided by a longitudinal partition into two water-spaces communicating with each other at the upper part of the partition, the feed-drum being divided longitudinally, whereby the entering feed-water is prevented from freely mingling with the hotter circulating water until it reaches the lower water-drum, which is connected by banks of tubes with each steam and water space above, and in so proportioning the tube-circulation areas as to prevent burning out of the tubes and priming.

Referring now to the accompanying drawings, Figure 1 is a sectional side elevation of a Stirling boiler with my invention applied. Fig. 2 is an end view of the same, the left-hand half being a section on the line *x x* of Fig. 1 with the half-grate removed.

In carrying my invention into effect according to one modification I form the boiler with three upper steam and water drums *a*, *b*, and *c*, and I connect each of them to a lower water-drum *d* by banks of tubes *e*, *f*, and *g*. The back steam and water drum *c*, into which the feed-water is delivered, is connected by a nearly-vertical bank of tubes *g* to the lower water-drum *d*. The central drum *b* is connected by an inclined bank of tubes *f*, while the front drum *a* is connected by a more sloping bank of tubes *e*. The drums *a* and *b* are also connected together by banks of tubes *s* and *t*, the former entering the drums below the normal water-level and the latter above it. The steam-spaces of the drums *b* and *c* are likewise connected by a bank of tubes *u*.

Inside the lower water-drum *d* I place a longitudinal partition *h*, dividing the drum into two water-spaces *j* and *k*, and I place this partition so that the banks of tubes *e* and *f* are led into the space *j*, and the bank of tubes *g* is led into the space *k*. In some cases it is preferable to arrange the partition to divide the central bank of tubes, so that half of its tubes and the front bank of tubes communicate with the space *j* and the remainder of the tubes communicate with the space *k*. Passages *m* are provided in the upper part of the partition to permit intercommunication between these two water-spaces *j* and *k*. By employing one lower water-drum and dividing it into two spaces in this manner I am able to dispense with one of the two lower water-drums formerly used, thus reducing

the total weight and cost of the boiler and greatly reducing the floor-space occupied. I have found, however, that in boilers provided with my divided lower water-drum when the boiler is forced there is a tendency for the water to pile in the two steam and water drums *a* and *b* nearest to the furnace and to lower the level in the feed-drum *c*. This I found was due to the fact that the half of the central bank of tubes *f* nearest the furnace under these conditions acts as an uptake for the water, leaving only the other half of the central bank of tubes to act as a downtake. Circulation was thus to a certain extent retarded. I have found by experiment, however, that this difficulty may be effectually overcome, and the water circulation and efficiency of the boiler greatly improved by the following simple device.

Within the steam and water drum *c*, which acts as a feed-drum, I place a longitudinal partition *n*, preferably fixed to the bottom of the drum, so as to divide the bank of tubes *g* into two banks *o* and *p*. I also form direct communication between the side of the feed-water drum *c* nearest the furnace and the central steam and water drum *b* by one or more rows of tubes *q*, arranged below the level of the water in these drums and of such capacity that the water-level in the front half of the feed-drum *c* will remain practically the same as in the front drums *a* and *b* at all times. The feed-water pipe *r* delivers into the feed-drum on the side of the partition remote from the furnace. I make the upper edge of the partition *n* rise a suitable height above the normal water-level, so that when under forcing piling of the water tends to take place in the front and middle drums *a* and *b* the water in the front part of the drum *c* will be correspondingly raised and will flow over into the back half of this drum, which forms the feed-drum proper.

I have made careful experiments on a boiler thus constructed and have found that it may be very heavily forced without the least detriment to its water circulation, for as soon as there is any tendency for the level of the water to rise in either or both of the steam and water drums nearest the furnace a rapid flow of water occurs from these drums to the feed-water drum, since all of them are in direct communication with each other. Further equilization of the water-level takes place by overflow from the front half of the back drum *c* into the back half. The single lower water-drum *d* is thus made to satisfactorily perform the functions of the two drums formerly used.

A further important advantage obtained by a boiler constructed according to my invention is that practically all the feed-water is kept separate from the circulating water of the boiler until it has passed down the bank of tubes *p* most remote from the furnace into the coolest and most quiescent part *k* of the lower water-drum *d*. By treating the feed-water in this manner before allowing it to mix freely with the circulating water most of the incrustation-forming compounds and mud which it contains are deposited before the water reaches the hottest bank of tubes *e* nearest the furnace.

The mud-drum should be provided with the necessary blow-off valve and mandoor, as desired.

In applying my boiler to marine purposes I may provide the steam and water drums with cross-baffle plates *v*, Fig. 2, to assist in preventing serious commotion of the water due to the unsteady motion of the vessel.

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

A water-tube boiler for marine and other purposes, having in combination, a plurality of steam and water drums, a single lower water-drum a bank of tubes leading from each of the steam and water drums to the lower water-drum; a partition in lower drum, said partition having openings near its upper end and being arranged to provide a quiescent space for settling of mud and also suitaby deflect the circulating water through the tubes in the rear bank; a partition in the steam and water drum most remote from the fire dividing the same into compartments communicating with each other over the top of the partition; tubes connecting the front compartment of said partitioned steam and water drum and the adjacent steam and water drum, said connecting-tubes being arranged below the water-level, and means for feeding feed-water into the rear compartment of the partitioned steam and water drum, substantially as described.

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

JOHN COWAN.

Witnesses:
ANDREW SMITH,
P. A. MAC BRAQUE.