

No. 670,065.

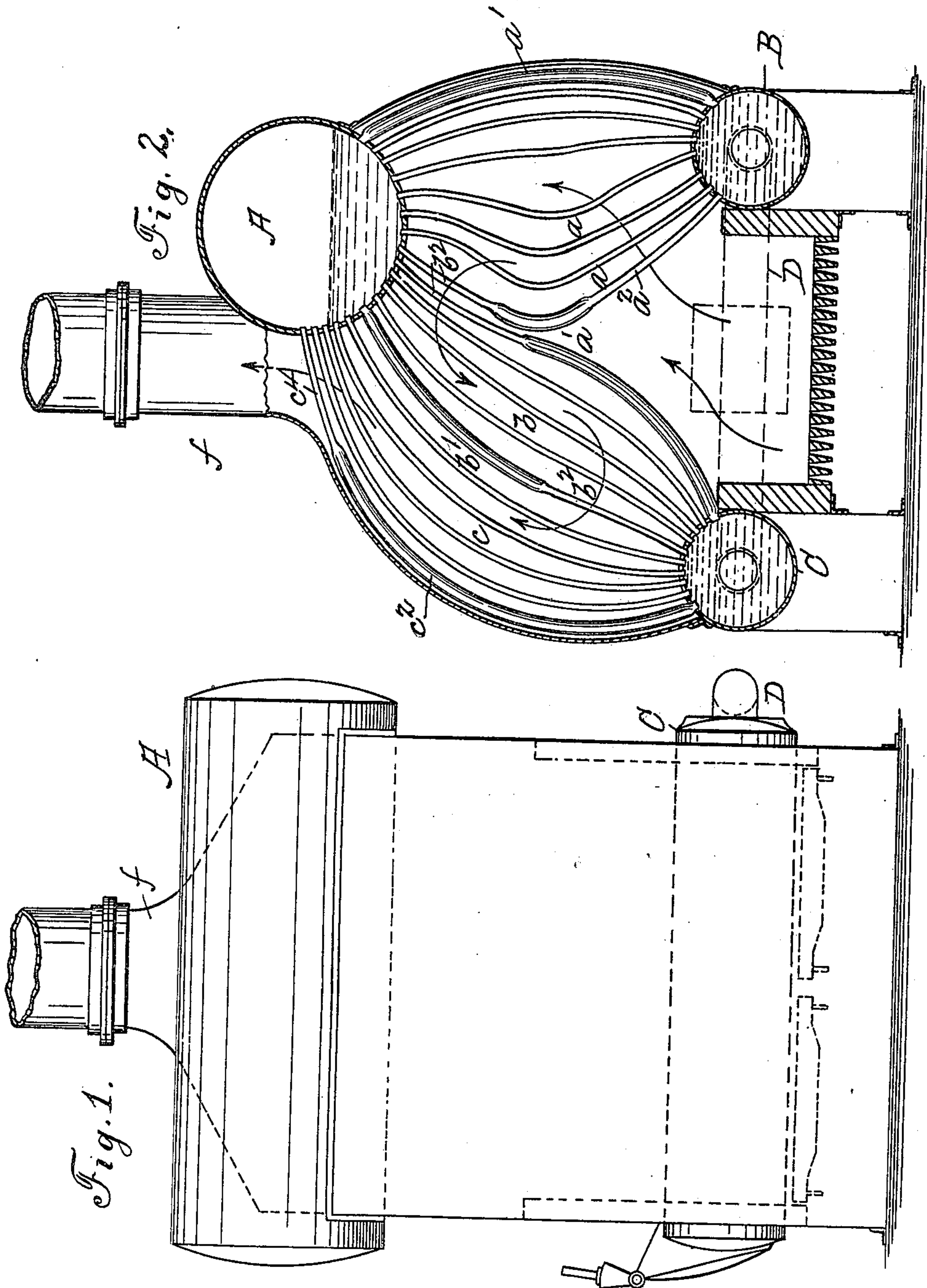
Patented Mar. 19, 1901.

R. SCHULZ.
WATER TUBE BOILER.

(Application filed May 3, 1900.)

(No Model.)

2 Sheets—Sheet 1.



Witness:
Attest
B. H. Sommers

Inventor,
Richard Schulz
by *[Signature]* Attorney

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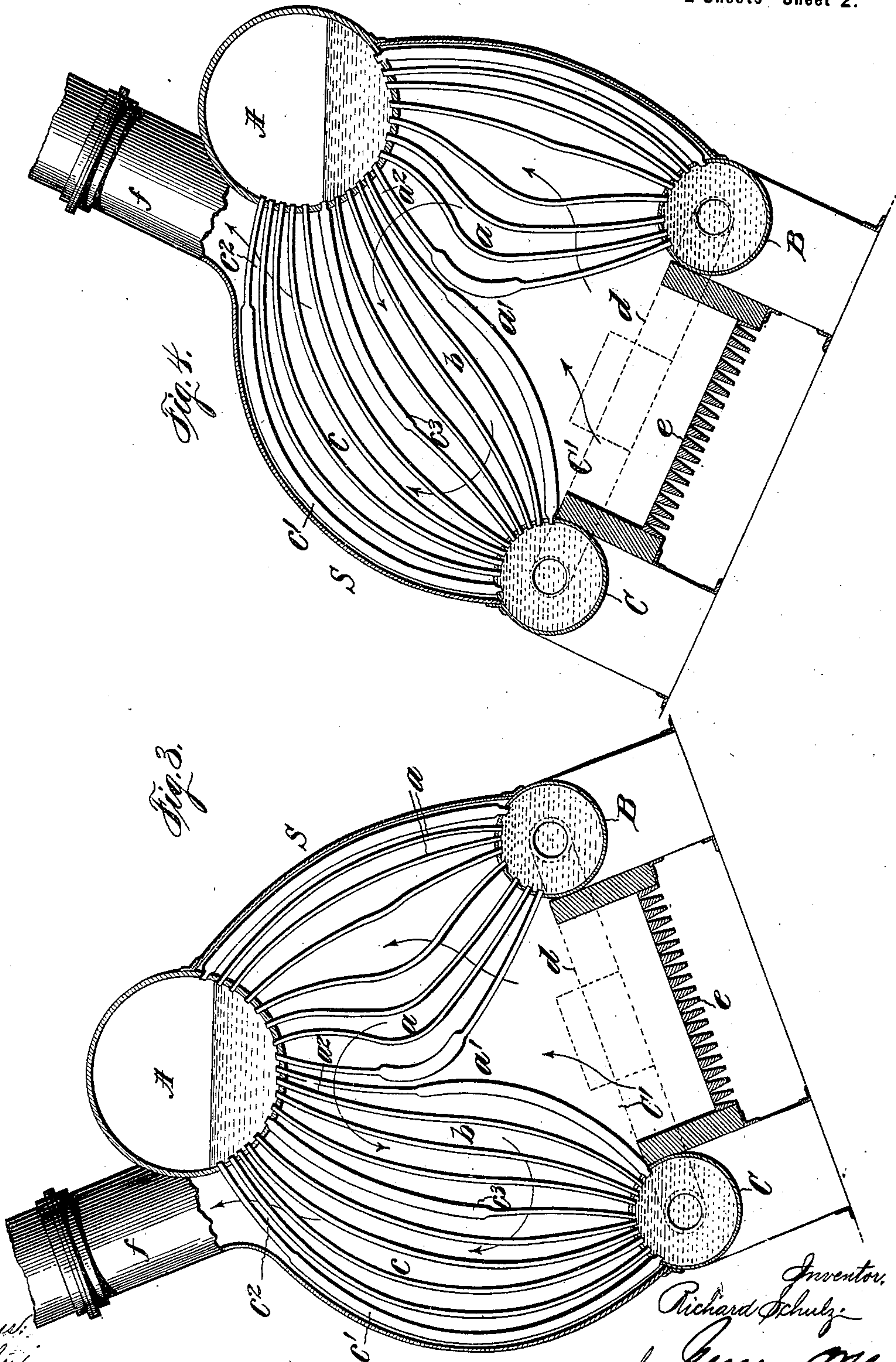
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2 Sheets—Sheet 2.



Witness:
A. H. Ober,
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Inventor,
Richard Schulz,
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UNITED STATES PATENT OFFICE.

RICHARD SCHULZ, OF BERLIN, GERMANY.

WATER-TUBE BOILER.

SPECIFICATION forming part of Letters Patent No. 670,065, dated March 19, 1901.

Application filed May 3, 1900. Serial No. 15,390. (No model.)

To all whom it may concern:

Be it known that I, RICHARD SCHULZ, a subject of the King of Prussia, Emperor of Germany, residing at Berlin, Germany, have invented certain new and useful Improvements in Water-Tube Boilers; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to letters of reference marked thereon, which form a part of this specification.

My invention has relation to steam-boilers, and more particularly to water-tube boilers of that type in which upper and lower drums are connected by series of tubes of comparatively small cross-sectional area.

The essential objects of my invention reside in a simplified construction, in the arrangement of the water-tubes relatively to the drums to insure a constant and rapid circulation of the water from the upper to the lower drums, and vice versa, and in so arranging the water-tubes that this circulation is not interfered with when the boiler is used for marine purposes by the rolling of the ship. These objects I attain by connecting all the water-tubes rising from one of the lower drums on one side of the furnace with the upper drum below the normal water-level therein, while the outer series of tubes rising from the lower drum on the opposite side of the furnace are connected with the upper drum above the normal water-level therein, both lower drums being connected together by horizontal water-legs external to the boiler-shell, so that the circulation between the upper and lower drums is maintained whatever may be the inclination of the boiler from a vertical due to the rolling of a ship. To promote this circulation, I so arrange certain series of tubes as to form flue-walls and cause the products of combustion to first flow along and about the water-tubes connected with the upper drum below the water-level therein and connecting therewith a lower drum on one side of the furnace, the products of combustion being then caused to flow in a downward direction along and about those water-tubes also connected with the upper drum below its water-level and connecting therewith the lower

drum on the opposite side of the furnace, the products of combustion being finally caused to flow in an upward direction along and about those tubes connected with the upper drum above the normal water-level therein and also connecting therewith the lower drum last referred to.

That my invention may be fully understood, I will describe the same in detail, reference being had to the accompanying drawings, in which—

Figure 1 is a side elevation, and Fig. 2 a vertical sectional view, of a steam-boiler embodying my invention; and Figs. 3 and 4 are sectional views illustrating the position of the water-tube connected with the upper drum relatively to the water-level therein when the boiler is inclined to one side or the other from a vertical due to the rolling of the ship carrying such boiler.

Referring to Figs. 1 and 2, S indicates the boiler-shell, *e* the furnace-grate, A the upper drum, and B and C the lower drums, one on each side of the furnace, connected by a horizontal water-leg *d*, external to the boiler-shell. The lower drum B is connected with the upper drum A, below the normal water-level therein, by a series of tubes *a*, the inner rows of which are bent inwardly and the outer rows outwardly. The outer and inner rows of tubes are so constructed and arranged as to form flue-walls, the inner row from the drum B or from a point near said drum toward the upper drum being attenuated to form openings *a'* for the circulation of the products of combustion, said inner row of tubes constituting one of the side walls of the combustion-chamber C'. The lower drum C on the opposite side of the furnace is connected with drum A, below the normal water-level therein, by a series of rows of tubes *b*, also bent inwardly toward the combustion-chamber C'. The inner row of such tubes from the drum C to the point where they meet the inner row of tubes *a* are also so constructed or arranged as to form a wall for the opposite side of the combustion-chamber C', while above the meeting-point of said inner row of tubes *b* and *c* said tubes are attenuated to form openings *a''* for the circulation of the products of combustion. Another series of rows of outwardly-bent tubes *c* also connect drum C with drum A,

the inner ones below and the outer ones above the normal water-level in said drum A. The outer row of tubes *c* is arranged to form an outer flue-wall *c'*, said tubes being attenuated at their upper ends, where they connect with the drum A, to form passages *c²* for the products of combustion, leading into a smoke-box and thence to the chimney *f*, the upper drum A being, as shown, out of line with said chimney.

An intermediate row of tubes *c³*, connecting drums A C, is arranged to form a flue-wall extending from drum A downwardly toward drum C, the lower part of said tubes being attenuated to form passages for the products of combustion.

By means of the described construction and arrangement of tubes the flow of the products of combustion is in an alternate upward and downward direction, as indicated by arrows in Fig. 2.

In the arrangement of water-tubes as described the water-tubes *a* and *b*, converging into the combustion-chamber *C'*, are exposed to the direct action of the products of combustion, hence highly heated, and perform the functions of steam-generators, while the diverging tubes *a* and *c*, more remote from the source of heat-supply, together with the external water-leg *d*, perform the function of circulating-tubes, whereby an energetic circulation is established from the upper drum A through diverging tubes *a*, lower drum B, water-leg *d*, drum C, and diverging tubes *c* back to drum A, and this circulation is materially enhanced by the arrangement of tubes to form flue-walls and passages, whereby the products of combustion are caused to take the course described.

It will readily be seen that if the boiler were inclined from a vertical to the left, for instance, as shown in Fig. 3, by the rolling of a ship the described circulation would not be interfered with, the direction of flow being simply reversed—namely, from drum A through diverging tubes *c*, drum C to drum A, and through some or all of the tubes *a* back to drum A. If, on the contrary, the boiler were inclined in a reverse direction, Fig. 4, the circulation would be substantially the same as if the boiler were in its normal horizontal position.

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

A water-tube boiler comprising a fuel-grate, an upper drum, a lower drum on each side of the grate, an external water-leg connecting said lower drums, a series of water-tubes connected to one of said lower drums and to the upper drum below the normal water-level therein, a second series of tubes connected with the other lower drum, an inner portion of said tubes connected with the upper drum below its normal water-level, and an outer portion connected with said drum above said level, the inner tubes of both series converging to form a combustion-chamber above the fuel-grate, and the outer tubes of either series diverging from said chamber, for the purpose set forth.

In testimony that I claim the foregoing as my invention I have signed my name in presence of two subscribing witnesses.

RICHARD SCHULZ.

Witnesses:

MAX. C. STAEHLER,
HENRY HASPER.