(No Model.)

3 Sheets—Sheet 1.

C. D. MOSHER.

BOILER OR STEAM GENERATOR.

No. 525,856. Patented Sept. 11, 1894.

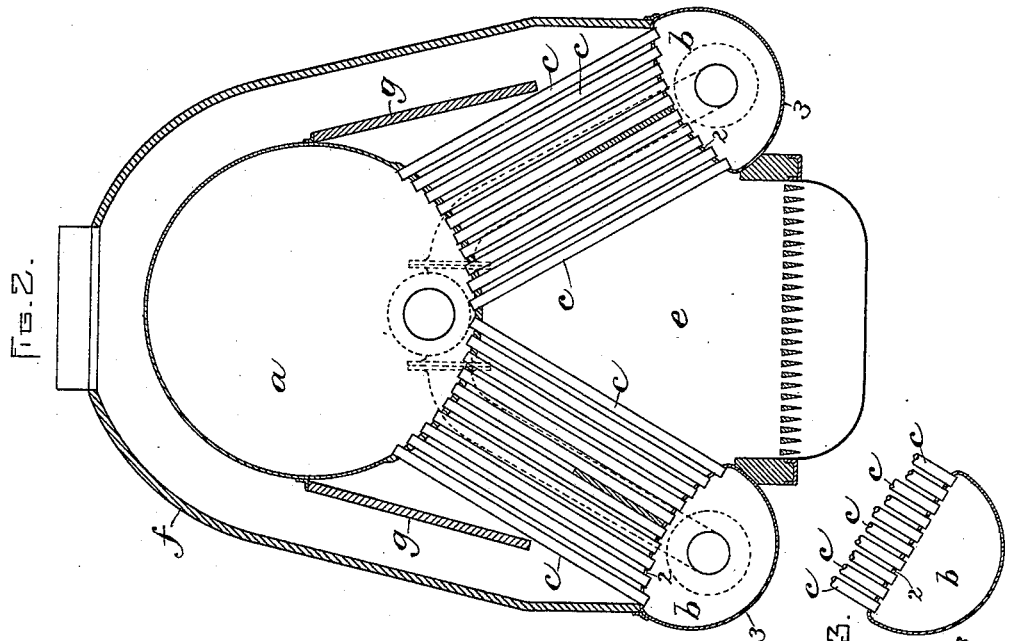

Fig. 2.

Fig. 3.

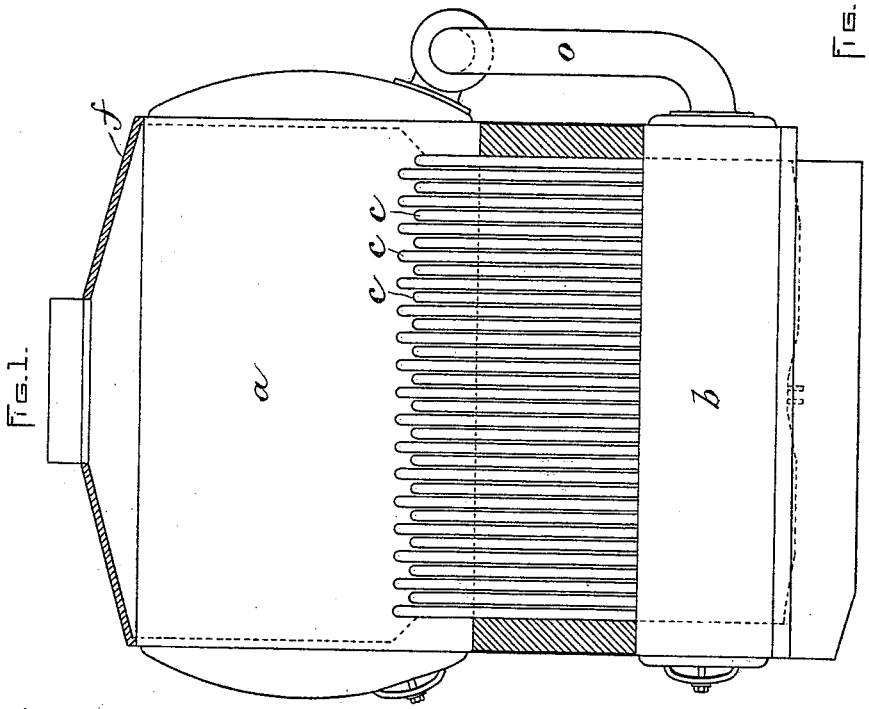

Fig. 1.

Witnesses:
Rollin Abell.
A. D. Harrison

Inventor:
C. D. Mosher
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(No Model.) 3 Sheets—Sheet 2.

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Fig. 4.

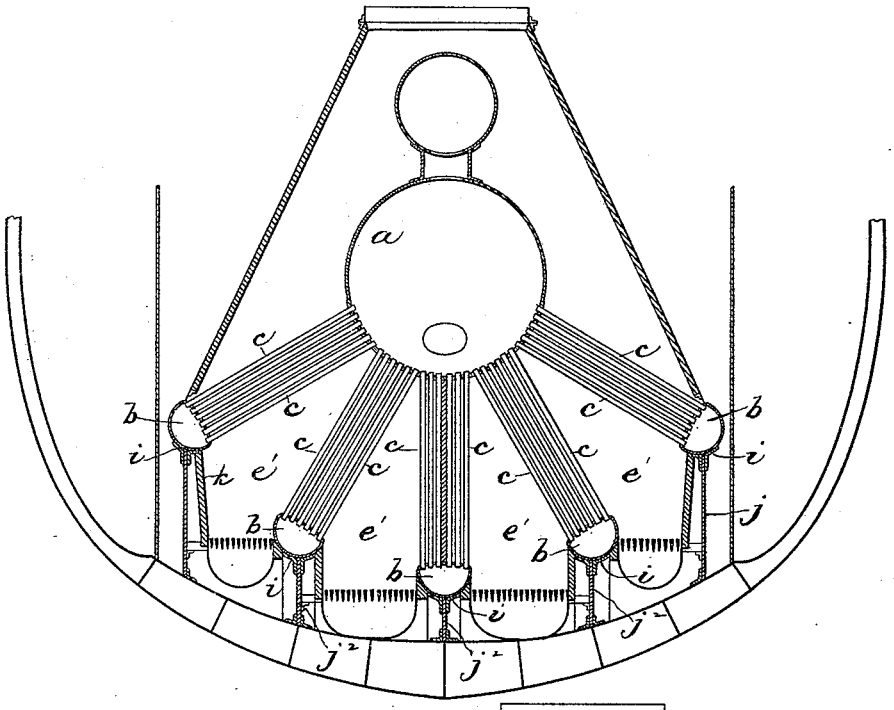


Fig. 6.

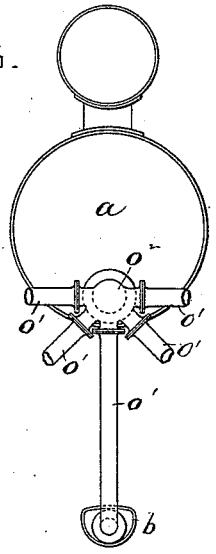
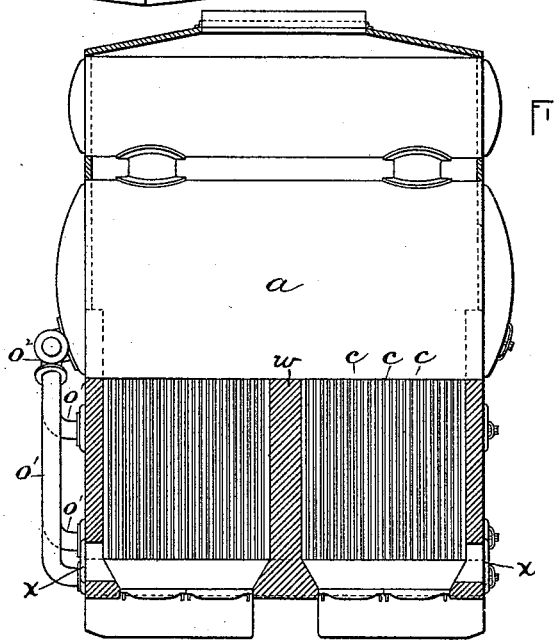


Fig. 5.



WITNESSES:

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A. D. Harrison

INVENTOR:

C. D. Mosher

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(No Model.) 3 Sheets—Sheet 3.

C. D. MOSHER.

BOILER OR STEAM GENERATOR.

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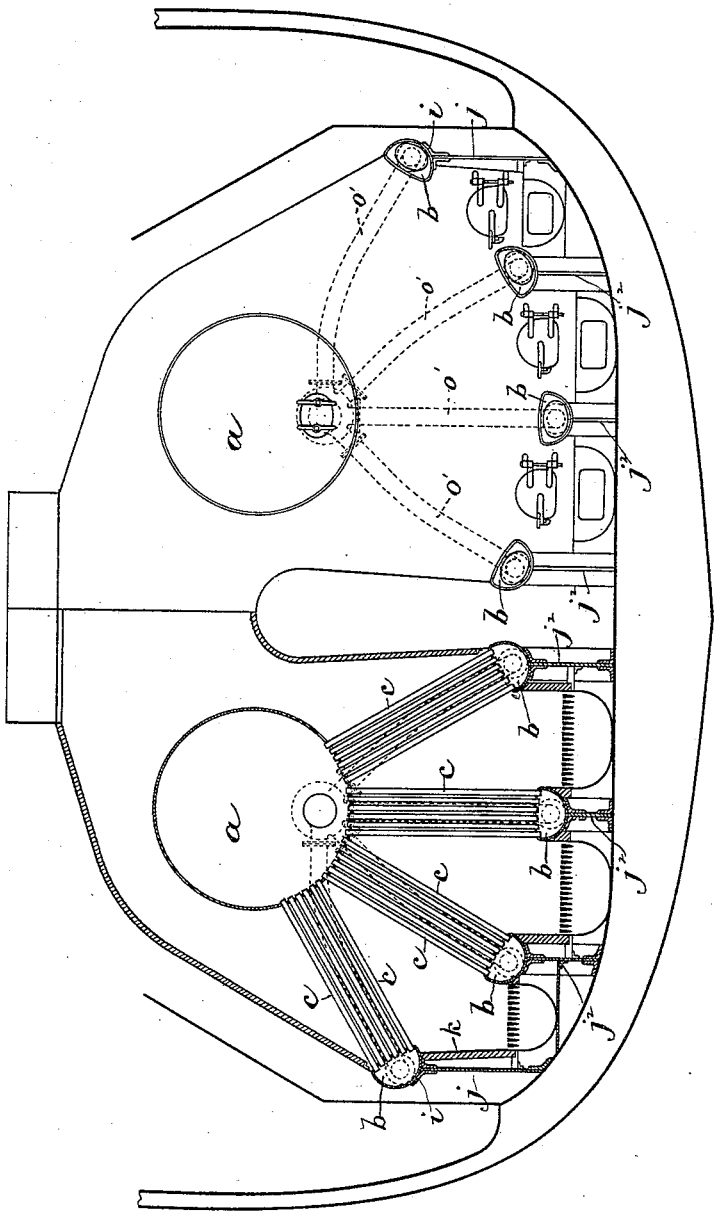

FIG. 7.

WITNESSES:
Rollin Abell.
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INVENTOR:
C. D. Mosher
by Wright Brown Quinby & Atty.

UNITED STATES PATENT OFFICE.

CHARLES D. MOSHER, OF NEW YORK, N. Y.

BOILER OR STEAM-GENERATOR.

SPECIFICATION forming part of Letters Patent No. 525,856, dated September 11, 1894.

Application filed April 26, 1894. Serial No. 508,971. (No model.)

To all whom it may concern:

Be it known that I, CHARLES D. MOSHER, of the city, county, and State of New York, have invented certain new and useful Improvements in Boilers or Steam-Generators, of which the following is a specification.

This invention relates to a boiler or steam generator comprising an elevated steam drum and a plurality of water drums located below the steam drum and each connected thereto by a series of tubes which are exposed to heat from a fire box.

The invention has for its object to provide a boiler or steam generator of this type, which shall be of compact and simple construction and in which the drum-connecting tubes shall be straight, so that they can be readily inspected and cleaned.

The invention also has for its object to provide such a construction as will enable any tube of the series to be readily removed and replaced by another without disturbance of the adjacent tubes.

To these ends the invention consists in the improvements which I will now proceed to describe and claim.

Of the accompanying drawings forming a part of this specification, Figure 1 represents a longitudinal section of a steam boiler or generator provided with my improvements. Fig. 2 represents a section on line 2—2 of Fig. 1. Fig 3 represents a modification. Fig. 4 represents a transverse section showing a boiler embodying my improvements, and a portion of the hull of a vessel. Fig. 5 represents a partial sectional view and partial side elevation of a boiler embodying my invention. Fig. 6 represents an elevation of a portion of the boiler shown in Fig. 5. Fig. 7 represents a transverse section of a portion of the hull of a vessel showing two of my improved boilers, one of said boilers being shown in transverse section.

The same letters and figures of reference indicate the same parts in all the views.

In the drawings—*a* represents the steam drum, and *b b* the water drums of my improved generator. Each water drum is connected with the steam drum by a series of straight tubes *c*, the ends of which are expanded in holes formed for their reception in said drums. Each water drum is flattened or reduced at the side adjacent to the steam drum, said reduced side constituting a tube sheet 2 which is perferably arched, so that it has the same curvature as the corresponding surface of the steam drum. The water drum thus formed may be made of two parts riveted permanently together, or it may be made by flattening or reducing one side of a lap-welded tube, it being desirable in all cases to give the water drum a semi-cylindrical side 3 for the sake of strength, and a tube sheet 2 having a surface of practically the full width of the drum, which is available for the reception of tubes, so that the series of tubes can extend entirely across each water drum, this arrangement enabling the maximum number of tubes to be used with the minimum width or diameter of water drum. Hence the generator as a whole is given a compact form.

I do not limit myself to giving the tube sheet portions of the water drums an arched form, as said portions may be made flat, as shown in Fig. 3.

The steam drum is made of an internal diameter somewhat greater than the length of the longest tubes *c*, so that each tube can be inserted in the holes formed for its reception in the two drums, by a workman within the steam drum, the relation of the length of the tubes to the diameter of the steam drum enabling the workman to pass the tubes outwardly from within the drum, through the holes therein. The distance between each water drum and the steam drum corresponds to the length of the tubes.

It will be seen that the described form of the water drums, in connection with the diameter of the steam drum relatively to the length of the tubes enables each water drum to be connected with the steam drum by the largest number of straight tubes that is possible with a given diameter of water drum. The tubes, being straight, can be readily inspected and cleaned, and any worn or defective tube can be readily removed and replaced by a new one, by a workman within the steam drum.

The described relation between the diame-

ter of the steam drum and the length of the tubes also enables the walls of the steam drum to be made of the minimum thickness and weight, and without packed joints. If the steam drum were of less diameter, it would be necessary to provide for the removal of a part or parts of the drum to enable the insertion and removal of tubes, so that the drum would have to be made either in sections, its upper half being separable from the lower, or would have to be provided with numerous hand-holes in its upper portion at points opposite the tubes. In either case the walls of the steam drum would have to be made much thicker and heavier, to compensate for the weakening occasioned by the sectional or separable construction, and packed joints would be required. Packed joints in a steam boiler are always a source of weakness, and are to be avoided if possible, particularly in large sized boilers, where the working strains are necessarily great. It will be seen that by making the steam drum of the described diameter relatively to the length of the tubes, I avoid any sectional construction requiring packed joints, and am enabled to utilize any desired portion of the periphery of the steam drum as a tube sheet to receive the upper ends of the tubes.

My present improvements relate chiefly to marine boilers. I have shown various forms of this type of boiler adapted for different sizes and classes of steam vessels or other purposes, all embodying the features above described.

In Figs. 1 and 2, I show two water drums located at opposite sides of a single fire-box *e*. A casing *f* communicating at its upper portion with a smoke-stack, incloses the parts of the boiler above the water drums, and receives the products of combustion after they have passed between the tubes. I prefer to provide baffle-plates *g g* extending downwardly from the sides of the steam drum partly to the lower ends of the tubes, for the purpose of directing the gases, &c., downwardly after they have passed between the upper portions of the tubes, so that they will act on the cooler lower portions of the tubes before escaping to the stack. *o o* represent return pipes which connect the steam drum with the water drums, said return pipes being shown in dotted lines in Fig. 2.

In Figs. 4, 5, and 6, I show a construction which includes five water drums, which with the connecting tubes are radially arranged and are separated by four fire-boxes *e'*. The water drums are arranged on a curve conforming approximately to the cross-section of the hull. Said water drums are supported by saddles *i* formed on or attached to the upper edges of vertical foundation plates *j* which are suitably secured, as by angle-bars *j'* to the hull of the vessel. The plates *j* supporting the outer water drums are of considerable height, so that they have sufficient elasticity to permit the drums to yield to the lateral strain exerted on them by the expansion and contraction of the tubes. The fire-brick, or other refractory linings *k* at the outer sides of the outer fire-boxes are adapted to conform to the movements of the outer water drums. The weight of the steam drum is mainly carried by the three intermediate water drums, and their supports j^2, which are shorter and stiffer than the supports *j j*. The expansion and contraction of the tubes connecting the intermediate water drums with the steam drum are compensated for by the movements of the steam drum, the latter being raised by the expansion and lowered by the contraction of said tubes. *o' o' o'* represent radiating return pipes which connect the steam drum with the water drums, said pipes being preferably connected to a header o^2 common to all the return pipes.

In Fig. 7, I show two boilers arranged side by side, each comprising a steam drum and four water drums. The outer water drums of the combined series are supported by flexible foundation plates, permitting yielding movements of said drums, while the steam drums are supported by the tubes connecting them with the more rigidly supported water drums, as in the construction shown in Fig. 4.

Figs. 4 and 5 show a double-ended boiler with four furnaces at each end, intended to take the place of the largest types of Scotch or other marine boilers, the division wall *w* (Fig. 5) subdividing the furnaces into two lengths, with fire-doors *x x* at each end of the boiler. This construction admits of providing a very large amount of grate surface without having the grate so large in any one furnace as to be unmanageable.

I claim—

1. A boiler or steam generator comprising in its construction a plurality of cylindrical water drums, each flattened or reduced at its upper portion to form a tube sheet, a corresponding plurality of series of straight tubes extending upwardly from said tube sheets, and a cylindrical jointless or continuous steam drum attached to the upper ends of said tubes and arranged parallel with the water drums, the diameter of said steam drum being substantially equal to or greater than the length of the longest tubes, so that the tubes may be passed from within the steam drum to their operative positions.

2. A boiler or steam generator comprising in its construction a steam drum, a plurality of rigidly supported water drums connected with the steam drum by a corresponding plurality of straight tubes which support the weight of the steam drum, the latter being adapted to conform to the expansion and contraction of said tubes, and one or more flexibly supported water drums located at a

higher point than said rigidly supported drums and connected with the steam drum by tubes, the expansion and contraction of which cause lateral or other movements of the flexibly supported water drum or drums, as set forth.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, this 17th day of April, A. D. 1894.

CHARLES D. MOSHER.

Witnesses:
C. F. BROWN,
A. D. HARRISON.