

No. 616,715.

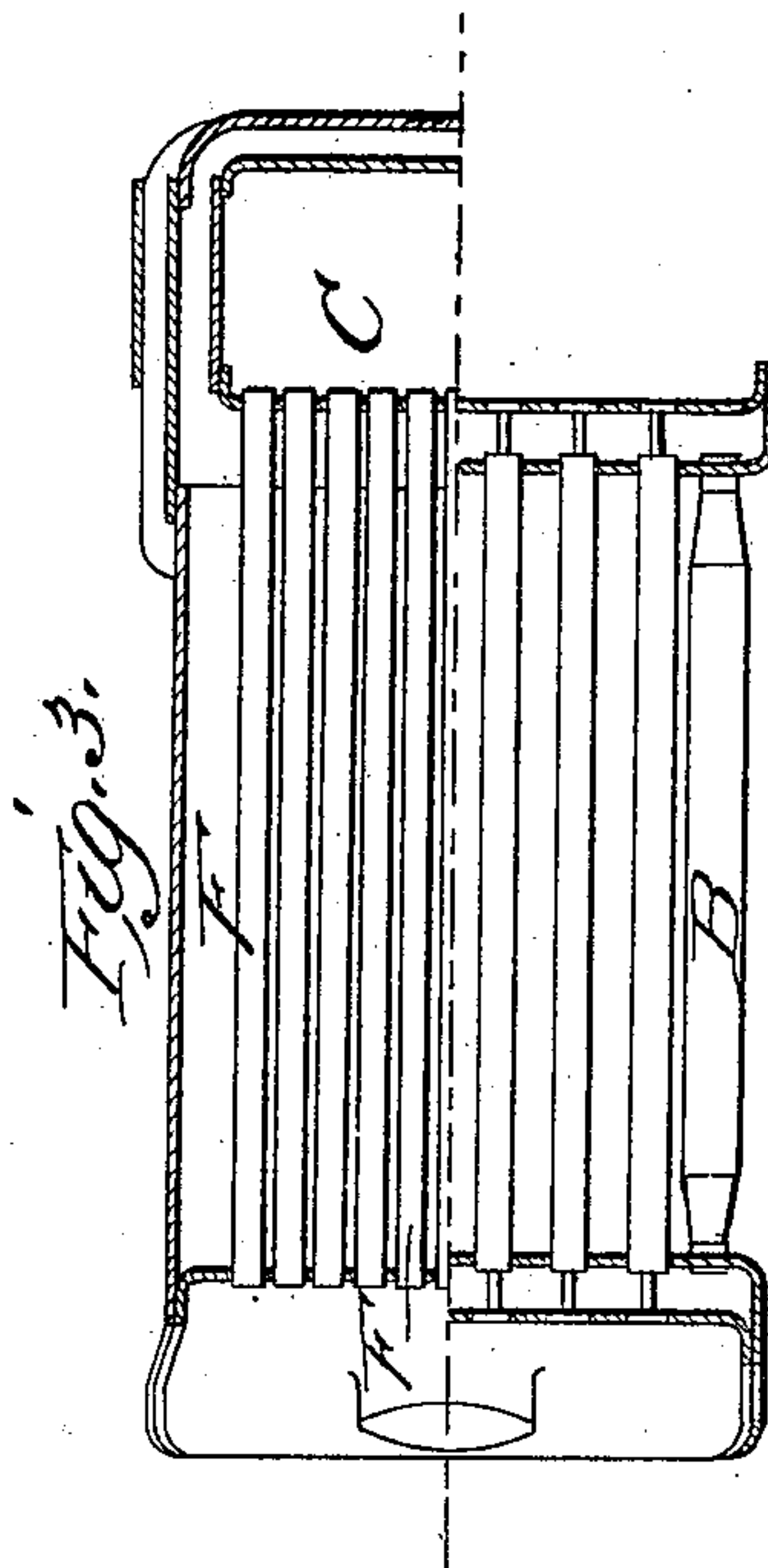
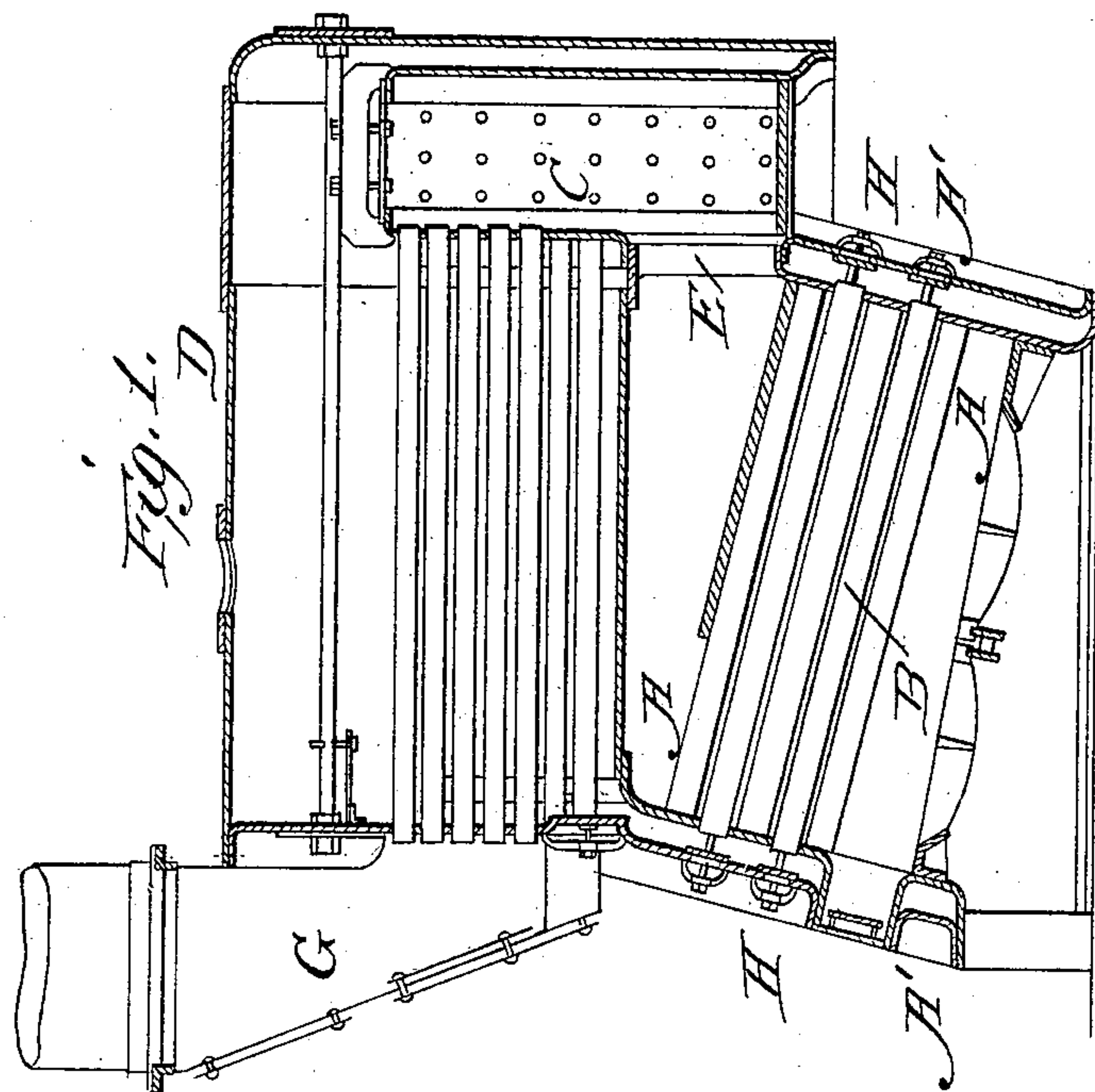
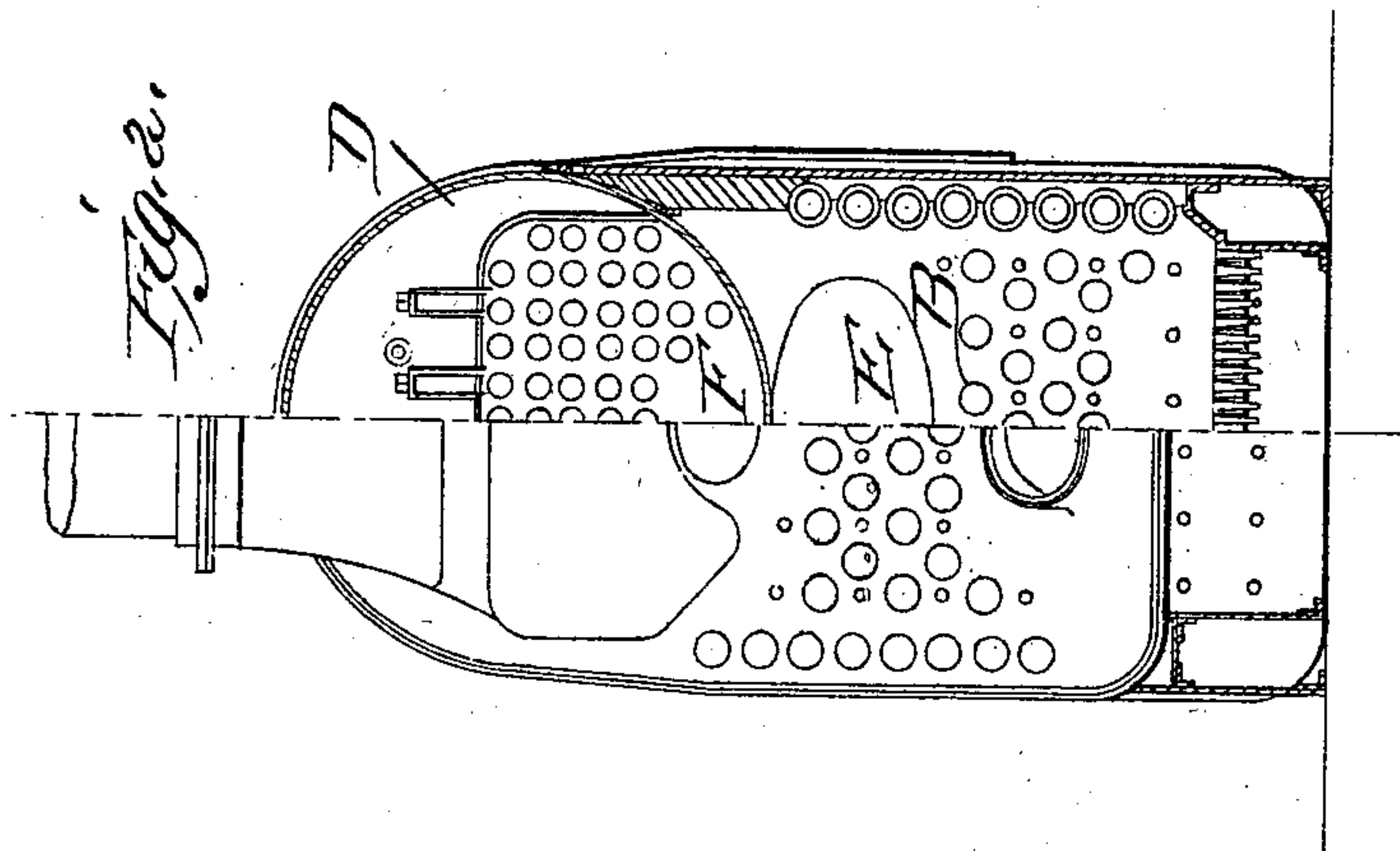
Patented Dec. 27, 1898.

J. LYALL.  
STEAM GENERATOR.

(Application filed Dec. 27, 1897.)

(No Model.)

2 Sheets—Sheet 1.



Attest  
J. L. Mudgett  
Clerk

Inventor  
John Lyall  
by Richards & Co.  
Attys

No. 616,715.

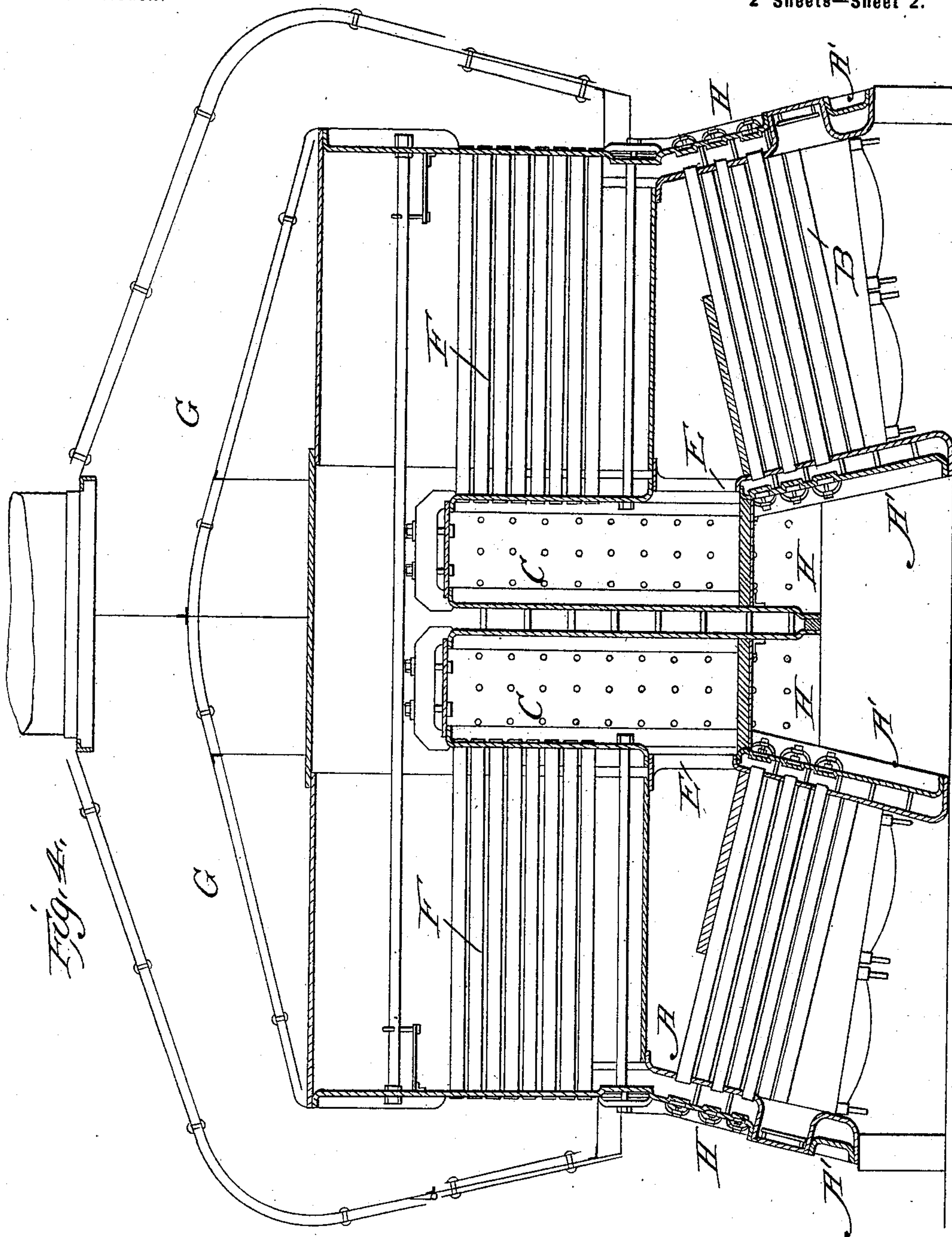
Patented Dec. 27, 1898.

J. LYALL.  
STEAM GENERATOR.

(Application filed Dec. 27, 1897.)

(No Model.)

2 Sheets—Sheet 2.



*Attest*  
*J. L. Mordant*  
*Witness*

*Inventor*  
*John Lyall*  
*by Richards & Co*  
*Attys*



# UNITED STATES PATENT OFFICE.

JOHN LYALL, OF GLASGOW, SCOTLAND.

## STEAM-GENERATOR.

SPECIFICATION forming part of Letters Patent No. 616,715, dated December 27, 1898.

Application filed December 27, 1897. Serial No. 663,620. (No model.)

*To all whom it may concern:*

Be it known that I, JOHN LYALL, engineer, of 5 Osborne place, Govan, Glasgow, Scotland, have invented certain new and useful  
5 Improvements in Steam-Generators, (which have been patented in Great Britain by Letters Patent dated July 8, 1892, No. 12,609,) of which the following is a specification.

This invention relates to steam-generators, and has for its object to provide a water-tube and fire-tube generator of improved construction.

In the accompanying drawings, which illustrate the invention, Figure 1 is a longitudinal vertical section of a modification of the improved steam-generator as adapted for marine purposes. Fig. 2 is partly an end elevation and partly an end section, and Fig. 3 a horizontal section, partly through the water-tubes and partly through the fire-tubes, of the same. Fig. 4 is a longitudinal vertical section of a double-ended marine boiler with a water-space dividing the combustion-chamber.

25 The improved steam-generator is composed of a double shell A A', the interior one, A, of which constitutes the furnace or fire-box and has within it a series of tubes B, extending from front to back and communicating at both  
30 ends with the water-space of the generator.

The upper portion or fire-tube section of the generator is composed of an ordinary boiler-drum D, with open-ended fire-tubes F extending throughout its length, or from the combustion-chamber end to the uptake end. The  
35 boiler-drum is connected to the water-tube section below through water-legs formed by the double shell A A'.

The interior shell A, forming the furnace or fire-box, is inclosed by close-fitting outside rows of water-tubes extending upward from the fire-bars to the cylindrical shell, as indicated at Figs. 1, 2, and 3. A plate-casing is fitted outside this outer row of tubes, and between the tubes and casing is packed non-conducting composition. At the rearward end the interior shell or fire-box A is extended upward to constitute a combustion-chamber C, like the fire-box of a locomotive-boiler, or, as shown in Fig. 4, the combustion-chamber  
45 may be formed outside of the boiler proper and composed of a casing C, lined with fire-brick. The upper chamber of the interior

shell is fitted with fire-tubes F, extending from the fire-box to the end of the boiler, and has a manway at the bottom of the combustion-chamber to afford access to the furnace or fire-box and to afford facility for repairing, cleaning, or renewing the fire-tubes extending through the interior shell. The front and back ends of the exterior shell have a door or doors H opposite the ends of the water-tubes for fitting, unfitting, or cleaning the tubes, the said holes being closed by plugs or caps of suitable construction screwed in or held in position by bridges and screws and rendered steam and water tight, coming metal to metal, or by india-rubber, asbestos, or other packing. The side walls of the furnace or lower part of the marine boiler are composed of water-tubes B, connected to the water-legs, as shown at Figs. 2 and 3, the tubes being tapered at their ends, which are expanded into the inner shell A. From the fire-grate the gaseous products of combustion pass upward between the tubes B and through the flue-port E into the combustion-chamber C, and thence through the fire-tubes F into the smoke-box or uptake G of the generator.

The modification shown at Fig. 4 is a double-ended marine boiler with a water-space dividing the combustion-chamber; but it may be formed without the water-space, the combustion-chamber being in the latter case common to both ends of the boiler.

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

A steam-generator composed of a double shell the interior of which constitutes the furnace or fire-box and is fitted with a series of water-tubes communicating with a water-space at both ends, a boiler-drum with open-ended fire-tubes extending throughout its length, connected by water-legs to the water-tube section or shell below, and a combustion-chamber formed within the space at the rear of the fire-tubes and connected by a flue port or ports with the furnace-chamber, substantially as described.

Signed at Glasgow, Scotland, this 10th day of December, 1897.

JOHN LYALL.

Witnesses:

WALLACE FAIRWEATHER,  
JNO. ARMSTRONG, Junr.