

No. 607,067.

Patented July 12, 1898.

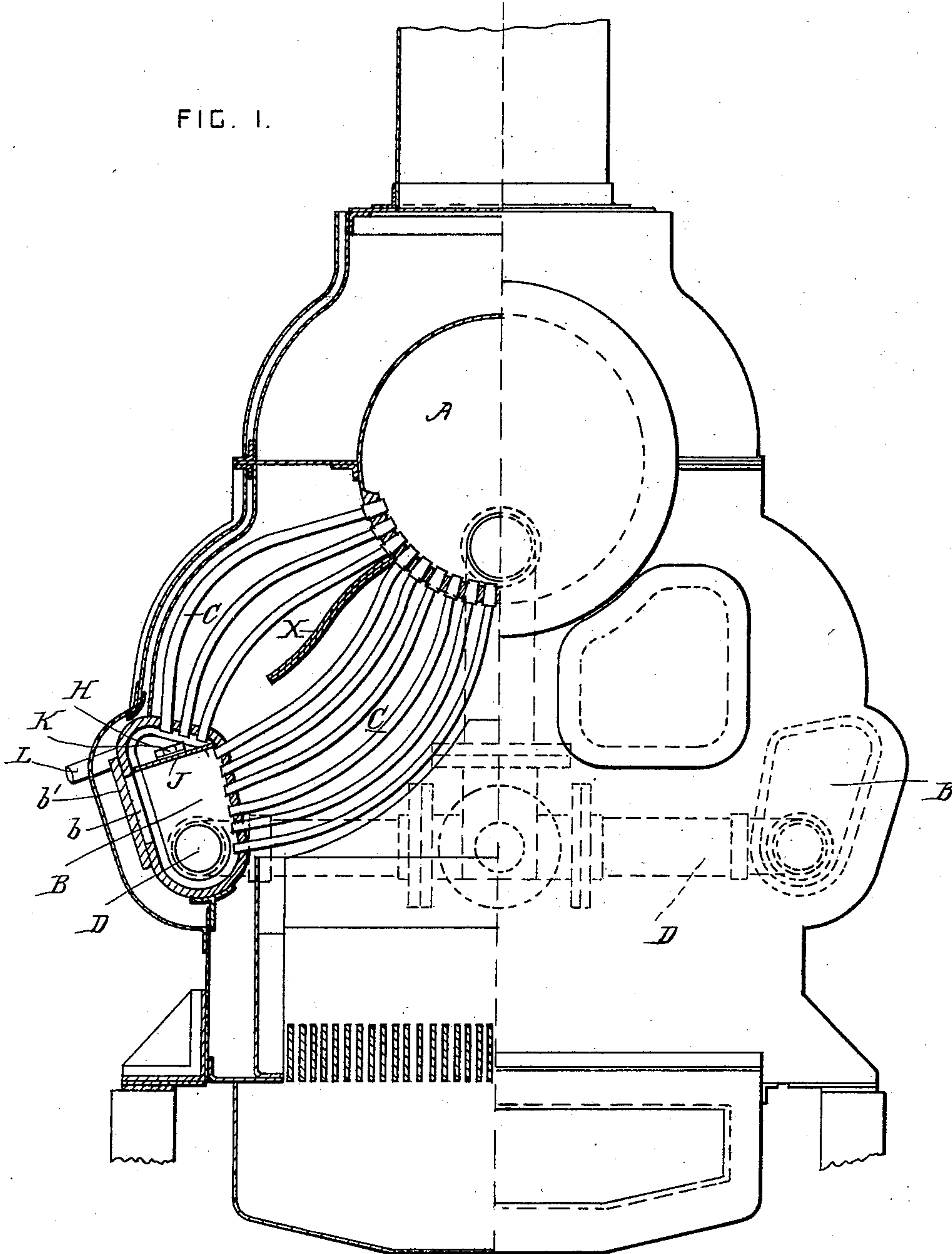
A. G. MUMFORD.  
STEAM GENERATOR.

(Application filed Dec. 28, 1897.)

(No Model.)

4 Sheets—Sheet 1.

FIG. 1.



WITNESSES  
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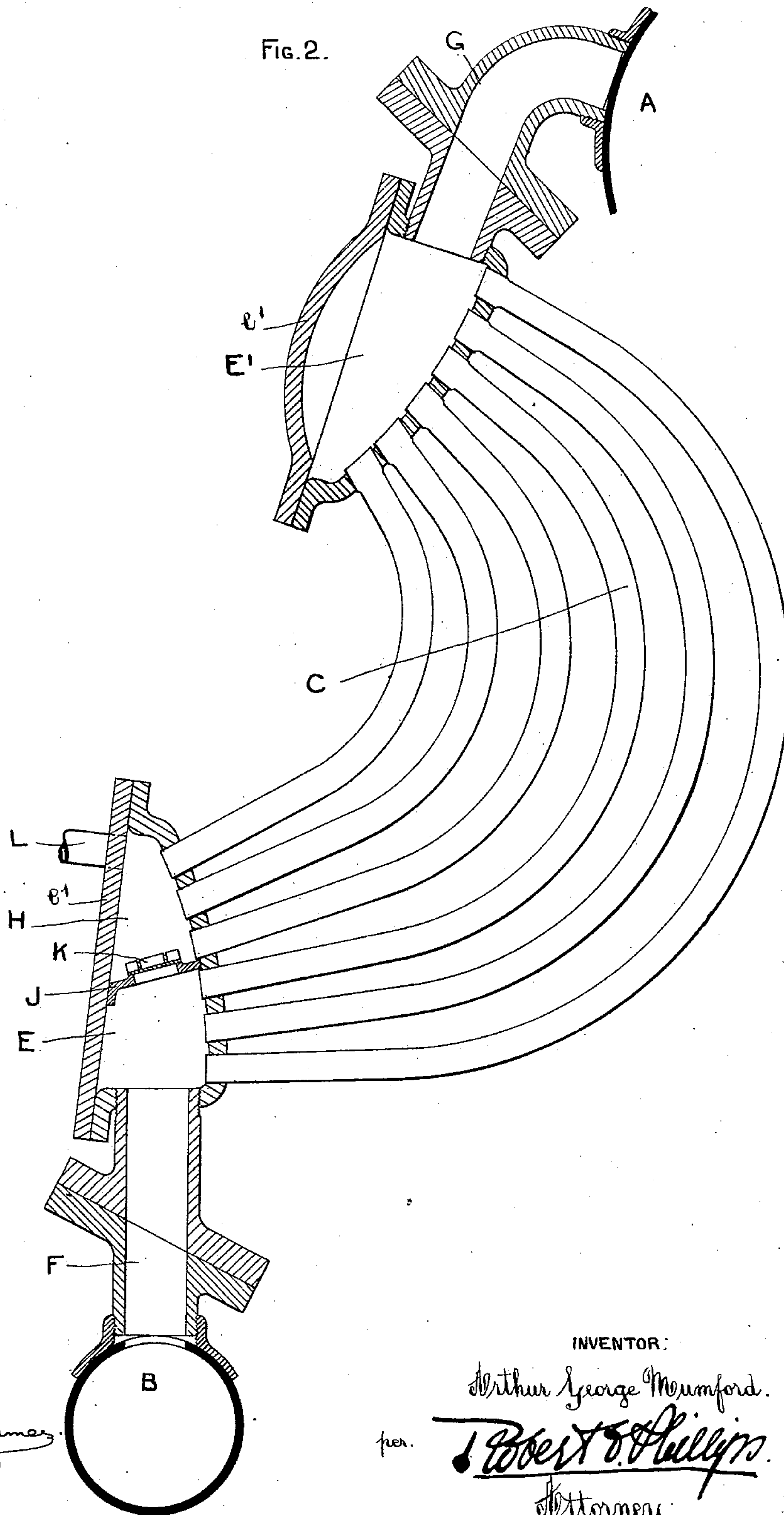
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FIG. 2.



WITNESSES.

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FIG. 3.

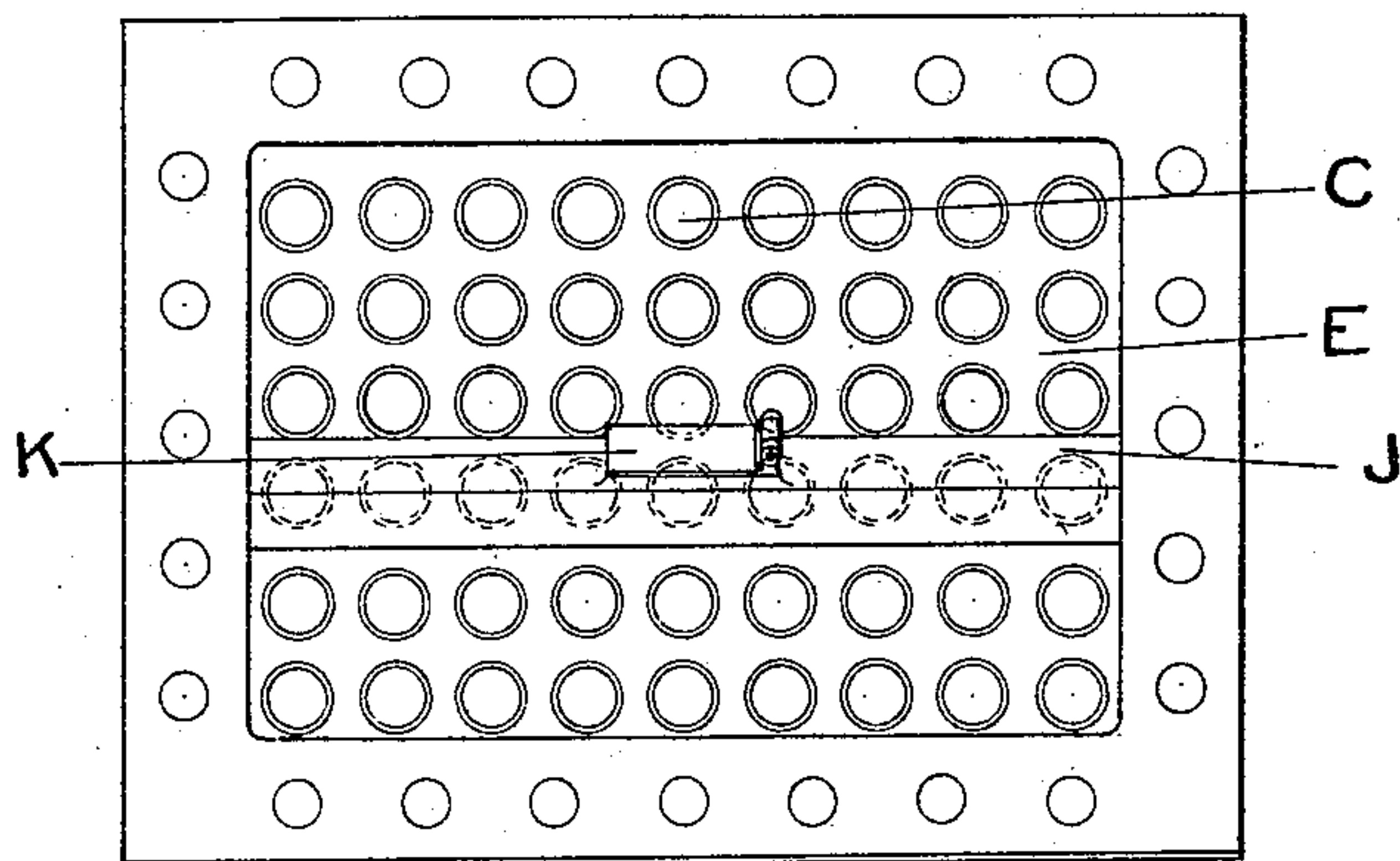
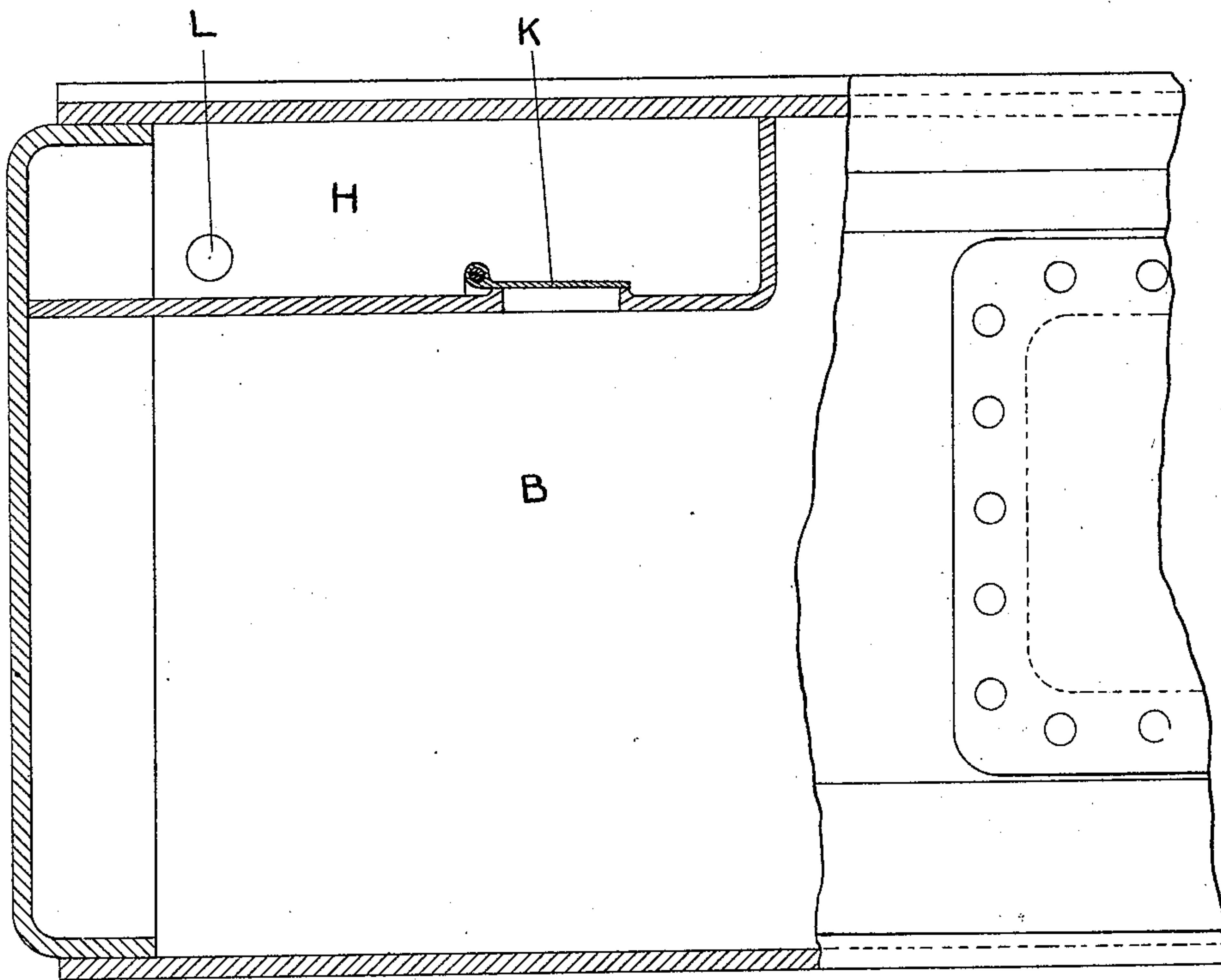


FIG. 4.



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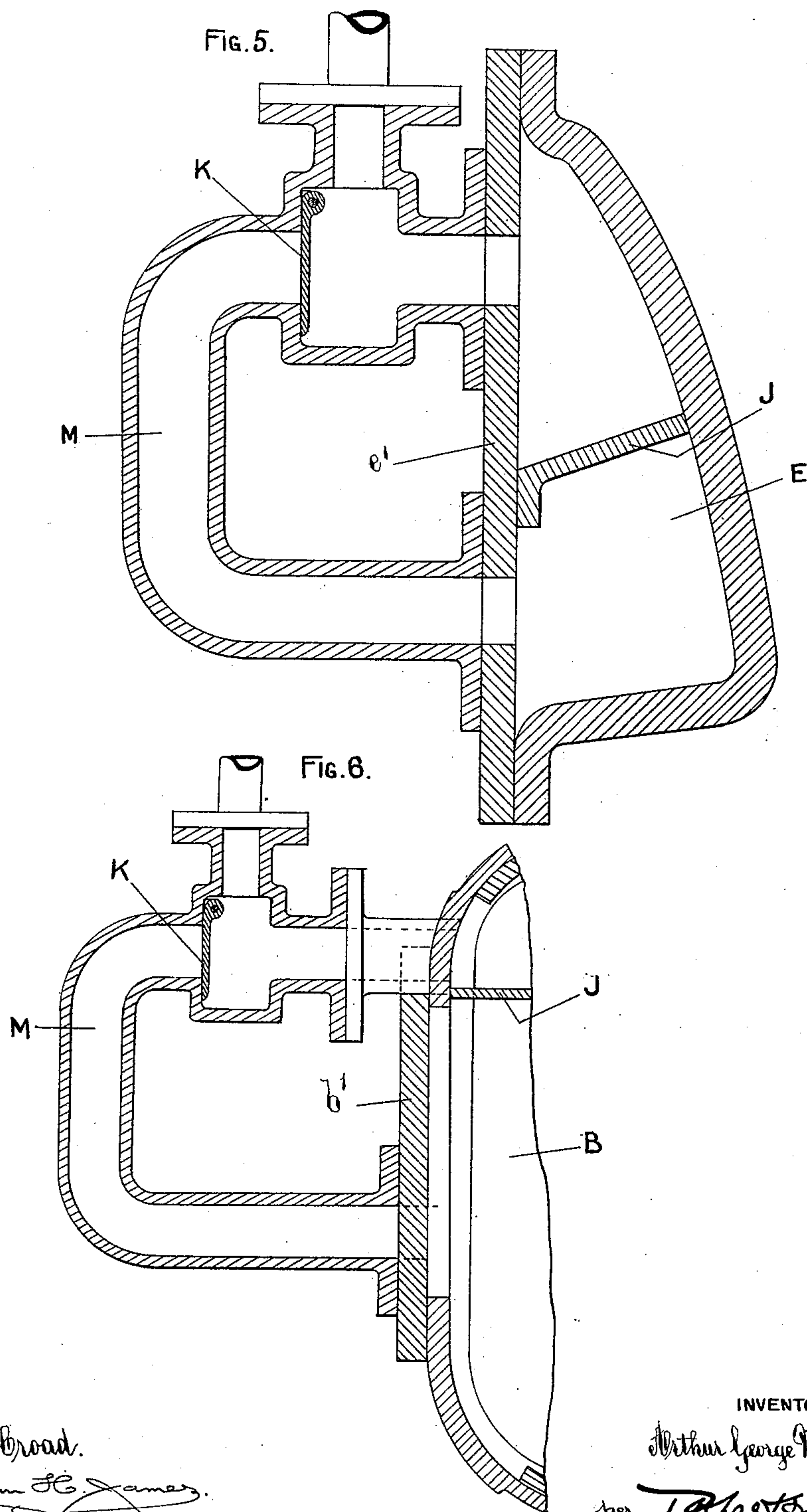
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4 Sheets—Sheet 4.



WITNESSES.

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# UNITED STATES PATENT OFFICE.

ARTHUR GEORGE MUMFORD, OF COLCHESTER, ENGLAND.

## STEAM-GENERATOR.

SPECIFICATION forming part of Letters Patent No. 607,067, dated July 12, 1898.

Application filed December 28, 1897. Serial No. 664,059. (No model.) Patented in England August 17, 1897, No. 19,008.

*To all whom it may concern:*

Be it known that I, ARTHUR GEORGE MUMFORD, a subject of the Queen of Great Britain, residing at Colchester, in the county of Essex, England, have invented certain new and useful Improvements in and Relating to Steam-Generators, (for which I have obtained a patent in Great Britain, No. 19,008, bearing date the 17th day of August, 1897,) of which the following is a full and complete specification.

This invention relates to water-tube boilers having a steam-collector, and two water-chambers which are each connected to the steam-collector by a series of small tubes and by one or more circulating-pipes, and it is especially applicable to that type of boiler covered by a prior patent of the United States of America granted to me on the 5th day of March, 1895, and numbered 535,068.

The present invention comprises an improvement in the water-chambers or tube-boxes, whereby the insertion and withdrawal of the tubes are facilitated, and a device for heating the feed-water in a simple and economic manner.

In the accompanying drawings, which illustrate this invention, Figure 1 is a view in front elevation, partly in section, showing the application of my invention to a water-tube boiler in which the water-tubes are connected directly to the water-chambers. Fig. 2 is a broken view showing the application of my invention to a water-tube boiler in which the water-tubes are connected to tube-boxes connected to the water-chambers by separate pipes, thus allowing the tubes to be grouped to form separate elements. Fig. 3 is a view in side elevation of one of the lower tube-boxes with the cover removed, and Figs. 4, 5, and 6 are views showing alternative constructions.

Throughout the views similar parts are marked with like letters of reference.

Referring to the drawings, A designates the steam-collector; B B, the water-chambers; C, the water-tubes; D, the circulating-pipes; E and E', the tube-boxes; F, the pipes connecting the tube-boxes with the water-chambers, and G the pipes connecting the tube-boxes with the steam-collector.

The water-chambers B when they are adapt-

ed to receive the water-tubes C directly are made three-sided or triangular in cross-section. The one side has a series of openings *b* for giving access to the interior of the chamber, the said openings being closed by suitable plates *b'* and the other two sides being provided with a series of small holes to receive the water-tubes C, the shape of the said two sides of the chamber being such that the tubes C enter the chamber at right angles to the said sides, whereby the attachment of the tubes is facilitated. Each series of tubes are so grouped as to provide space between them for a baffle-plate X, which extends throughout the whole length of the boiler at each side thereof.

When the tubes C are connected to tube-boxes E and E' instead of to the water-chambers and steam-collector, respectively, they are connected to one side only of the said boxes, the other two sides being occupied by the openings giving access to them and by the pipes connecting them with the water-chambers and steam-collector, respectively, as shown by Fig. 2.

In one of the water-chambers or tube-boxes, as the case may be, is formed a second chamber H by means of a diaphragm J or its equivalent. In communication with this second chamber H are a limited number of the tubes C. This diaphragm J is provided with any suitable valve K, preferably of the clack or flap type, as shown, adapted to open upward, so as to allow the water in the chamber or box to circulate upward through the valve into the chamber H, which it will do when the pressure on both sides of the diaphragm is the same. The feed-water enters through a pipe L into the chamber H, and as a consequence the pressure in the said chamber is greater than in the water-chamber or tube-box, as the case may be. Consequently the valve K remains closed, the result of which is that the feed-water is forced to pass through the tubes C, connected with the chamber H, whereby it becomes heated before it circulates through the other tubes. When the feed-water is not being passed into the boiler, the valve K opens and allows the water to circulate in the usual manner.

The chamber H is conveniently formed in



the water-chamber B, as shown by Fig. 6; but in the tube-box E it may conveniently extend the whole length of the said box.

Instead of mounting the valve K in the diaphragm J it may be contained in an elbow-pipe M, mounted on one of the closing-plates b' and connected with the feed-water pipe L, as shown by Figs. 5 and 6.

This device for heating the feed-water may be arranged either on one side of the boiler or on both sides thereof.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. In a steam-generator, the combination, with two superposed water-chambers connected by a valve which opens upward automatically; of a steam-chamber, two sets of water-tubes connecting the respective water-chambers with the steam-chamber, and a baffle-plate arranged between the two sets of tubes adjacent to the steam-chamber, a passage for the products of combustion being formed between the said baffle-plate and the water-chambers, substantially as set forth.

2. In a steam-generator, the combination, with two superposed water-chambers connected by a valve which opens upward automatically; of a steam-chamber, water-tubes connecting the respective water-chambers with the steam-chamber, and a feed-water pipe connected to the upper of the said water-chambers, whereby the direction of the water circulating in the said tubes is reversed when water is forced through the said pipe into the said water-chamber, substantially as set forth.

3. For steam-generators consisting essentially of a steam-separator, two water-chambers, two series of tubes connecting the steam-separator with the water-chambers on each side of the furnace, and of one or more circulating-pipes connecting the steam-collector with the water-chambers; a device for heating the feed-water consisting of a second chamber in one of the water-chambers into which the feed-water is delivered, and of a valve between the said chambers, as set forth.

4. For steam-generators, consisting essentially of a steam-separator, two water-chambers, one or more circulating-pipes, and groups of tubes in combination with tube-boxes forming separate and detachable elements each of which is connected with the steam-collector and one of the water-chambers respectively by single pipes; a device for heating the feed-water consisting of a second chamber in one of the tube-boxes connected with one of the water-chambers, into which the feed-water is delivered, and of a valve be-

tween the said second chamber and the other part of the tube-box, as set forth.

5. In a steam-generator, the combination with a steam-collector, of two water-chambers of a three-sided or triangular shape in cross-section each of which is connected with the steam-collector by a series of small tubes, some of which are connected to one of the sides of the water-chamber and some to another of the sides thereof, the third side having the usual openings giving access to its interior and provided with suitable closing-plates; and of a device for heating the feed-water consisting of a second chamber in one of the water-chambers into which the feed-water is delivered and of a valve between the said chambers, as set forth.

6. In a steam-generator, the combination with a steam-collector, of two water-chambers of a three-sided or triangular shape in cross-section each of which is connected with the steam-collector by a series of small tubes, some of which are connected to one of the sides of the water-chamber and some to another of the sides thereof, the third side having the usual openings giving access to its interior and provided with suitable closing-plates; of a baffle-plate dividing each series of tubes into two groups; and of a device for heating the feed-water consisting of a second chamber in one of the water-chambers into which the feed-water is delivered and of a valve between the said chambers, as set forth.

7. In a steam-generator, the combination with a steam-collector and two water-chambers, of groups of tubes connected to tube-boxes adapted to be connected to the steam-collector and water-chambers respectively by single pipes the said tube-boxes being of a three-sided or triangular shape in cross-section, the tubes of each group being connected to one of the sides of the said boxes, the pipes connecting the boxes with the steam-collector and water-chambers being connected to another of the sides of the said boxes, and the third side having an opening giving access to its interior and closed by a suitable plate; and of a device for heating the feed-water consisting of a second chamber in one of the tube-boxes connected with one of the water-chambers, into which the feed-water is delivered; and of a valve between the said chamber and the other part of the tube-box, as set forth.

ARTHUR GEORGE MUMFORD.

Witnesses:

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SIDNEY C. GOODY.