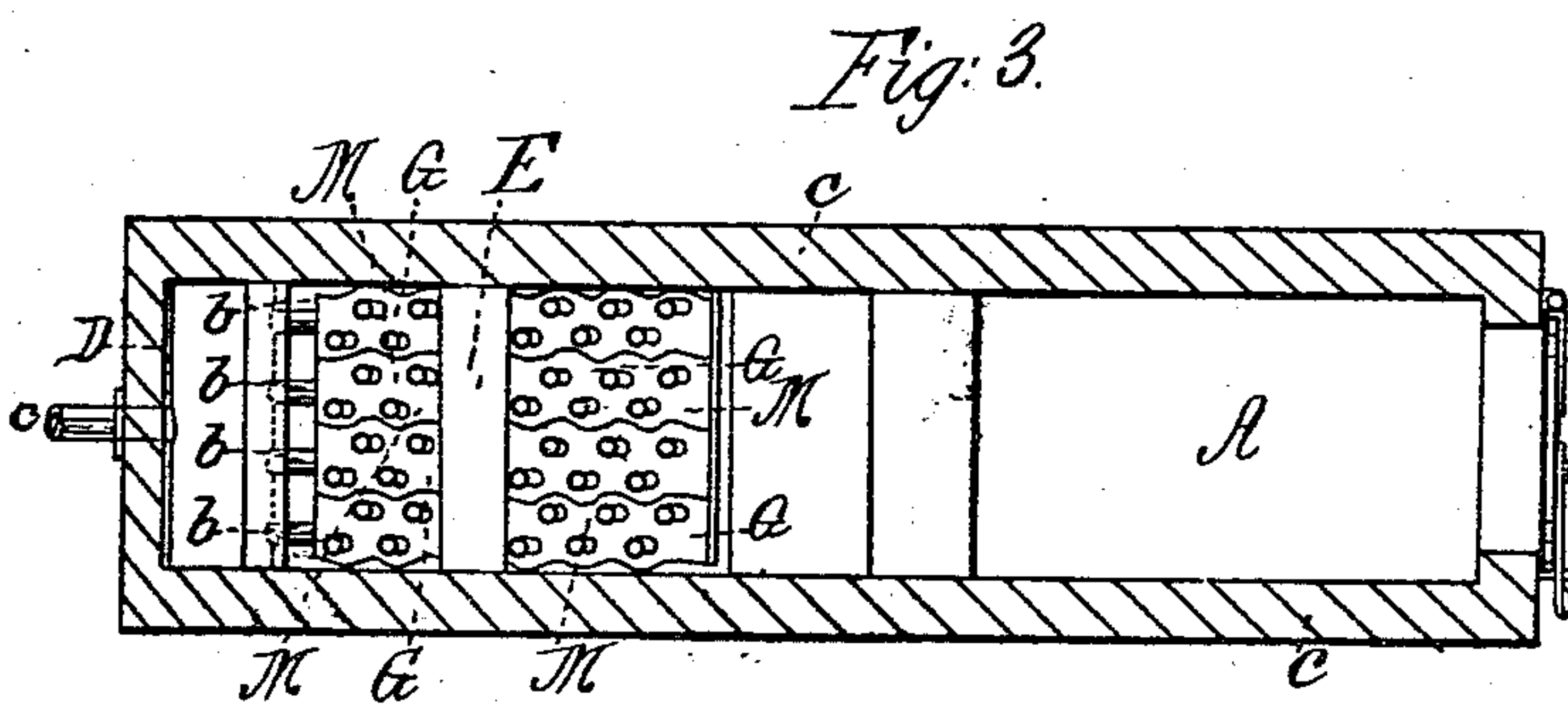
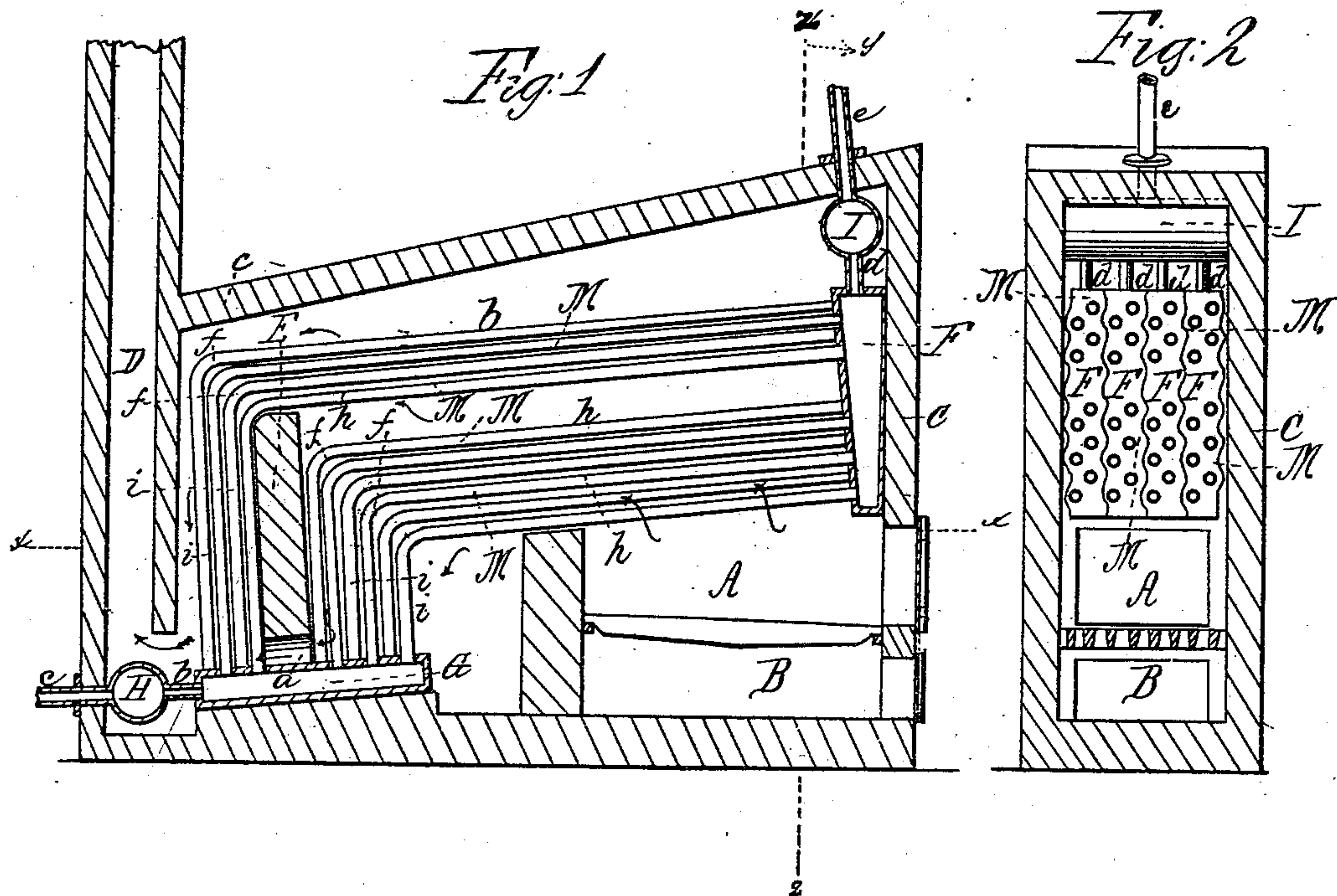


G. W. BLAKE.  
STEAM GENERATOR.

No. 84,607.

Patented Dec. 1, 1868.



Witnesses:  
A. LeClere  
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# United States Patent Office.

GEORGE W. BLAKE, OF NEW YORK, N. Y.

Letters Patent No. 84,607, dated December 1, 1868.

## IMPROVEMENT IN STEAM-GENERATORS.

The Schedule referred to in these Letters Patent and making part of the same.

To all whom it may concern:

Be it known that I, GEORGE W. BLAKE, of the city, county, and State of New York, have invented a new and useful Improvement in Steam-Boilers or Generators, of which the following is a full, clear, and exact description, reference being had to the accompanying drawing, forming part of this specification, and in which—

Figure 1 represents a longitudinal sectional elevation of a steam-generator constructed in accordance with my improvement;

Figure 2, a front sectional elevation of the same, taken, as denoted by the line *z z* in fig. 1, looking in direction of the arrow *y*; and

Figure 3, a sectional plan, taken as indicated by the line *x x* in fig. 1.

Similar letters of reference indicate corresponding parts.

My invention consists in a series of tubes bent, at a point intermediately of their length, to a right angle, or approximating position, in combination with headers or chambers to the ends of the tubes thus angled or bent, and whereby, while intermediate joints may be dispensed with, increased facility is afforded for contraction and expansion of the tubes, without injuriously straining on their sockets or end-attachments to the headers or chambers.

Said invention also consists in a zigzag or triangular arrangement of the several tubes, forming a series of two or more rows, in combination with a waved or corrugated construction to or of the headers or end-chambers, whereby a more perfect exposure of the tubes to the action of the fire or heated gases is obtained.

Referring to the accompanying drawing—

A represents the fire-box or chamber;

B, the ash-pit;

C, the outer walls or setting;

D, the smoke-stack or chimney; and

E, a bridge interposed between the fire-box and smoke-stack, said bridge being provided with a lower opening, *a*, through it, in addition to the regular passage-way above and over it.

F and G are water-boxes or chambers, or, as they may be termed, headers, each box being complete in itself, and a number of them arranged side by side in each set or series F and G.

As here arranged, the lower series of headers G may be connected, by branches *b*, with a water-receiving vessel or chamber, H, to which water may be supplied by or through a feed-pipe, *c*, said headers here being shown as extending or running at a slight angle from a horizontal position below the bridge E, and connecting with the chamber H at foot of the smoke-stack, though this arrangement may be changed.

The upper headers F are of similar construction, but set vertically, or slightly inclining from a vertical position, the same forming what may be termed the

front of the generator, and connected, by branches *d*, with a steam-drum, I, made either entire or in sections, bolted together, with communication between them, and from which may project a steam-supply pipe, *e*.

Connecting these headers F and G are tubes bent at points intermediate of their length, as, for instance, at *f*, so as to give them an angled character, made up of horizontal or slightly-inclining arms *h*, and vertical or nearly-vertical legs *i*. Said tubes are shown as of varied and gradually-increasing length, extending over the fire-box, and beyond it, and so that a portion of them terminate in front of the bridge E, while others pass over and are extended downwards, on the rear side of it; but such divided arrangement of them relatively to the bridge E, where the latter is used, may be changed.

By the angled or bent formation of these tubes, and connection of them at their front and rear or upper and lower ends to the headers or boxes F and G, a freedom for expansion and contraction is given them, both horizontally and vertically, from their ends as points of rest, and which prevents all injurious straining of them at their connections with the headers, while the elbow or bend in them not being established by a joint, there is no exposure to leakage otherwise.

To secure a more perfect action of the fire and heated gases under and around them, and to promote a better circulation and exposure generally, said tubes are arranged in a zigzag manner as regards their connection with the headers, each header, or corresponding pair of headers F and G, carrying two or more rows of tubes, lying, as it were, side by side, with the tubes in one row disposed intermediately of the tubes in the next adjacent row. To accommodate this irregular arrangement of the tubes, the headers F and G are made of a waved or corrugated shape at their sides, which construction also serves to make the several headers in a series support each other.

Apart from the outer brick-work or setting, there is no absolute necessity for any outside shell, which makes the generator strictly of a tubular character, with, according to the arrangement shown, passage for the smoke and heated gases both above and below the bridge E, the passage *a* contributing to establish free circulation of the heated gases to and around the lower portions of the tubes and headers with which said ends are connected.

The upper and longer sets of tubes are designed to be only partly charged with water, whereby they serve as superheaters, as well as generators, the upper portions of the headers F constituting steam-spaces.

Inasmuch as the headers are each separate and complete in the formation of a series, every facility is afforded for removing one pair of headers, F and G, with their attached tubes, by simply detaching them from the vessels or chambers H and I, without dis-



turbing the remaining tubes and headers, should such separate removal be rendered necessary, either from the bursting of a tube or other cause.

If desired, the whole arrangement, as regards the disposition of the tubes, may be inverted, the arms *h* lying undermost, and legs *i* projecting upwards, with the fire-box and other portions of the generator arranged to suit, but such inverted disposition of the tubes is not considered as advantageous as the one shown in the drawing.

What is here claimed, and desired to be secured by Letters Patent, is—

1. The arrangement of the hollow headers G and E with the pipes M, bent as described.

2. The hollow headers G and F, of corrugated construction on their sides, to admit of the alternate triangular arrangement of the pipes, and to form a close joint with the adjacent header, as shown and described.

GEO. W. BLAKE.

Witnesses:

A. LE CLERC,  
A. KINNIER.