R. HOOPER.

Steam-Generators.

No. 138,025. Patented April 22, 1873.

FIG. I.

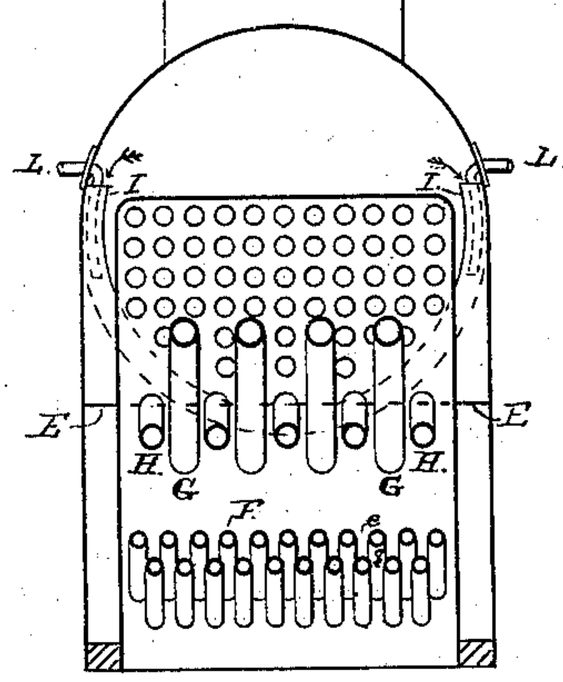


FIG. III.

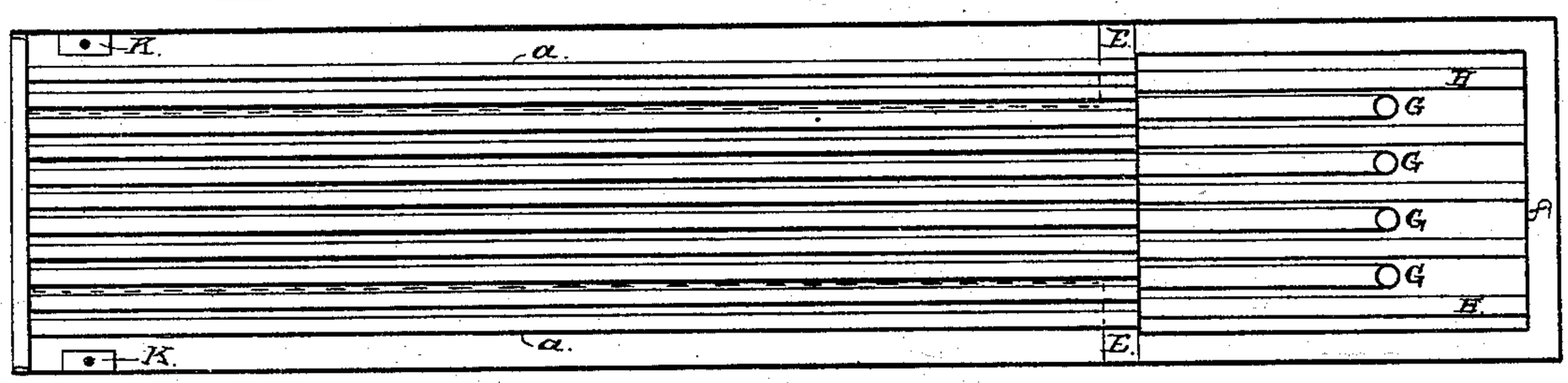
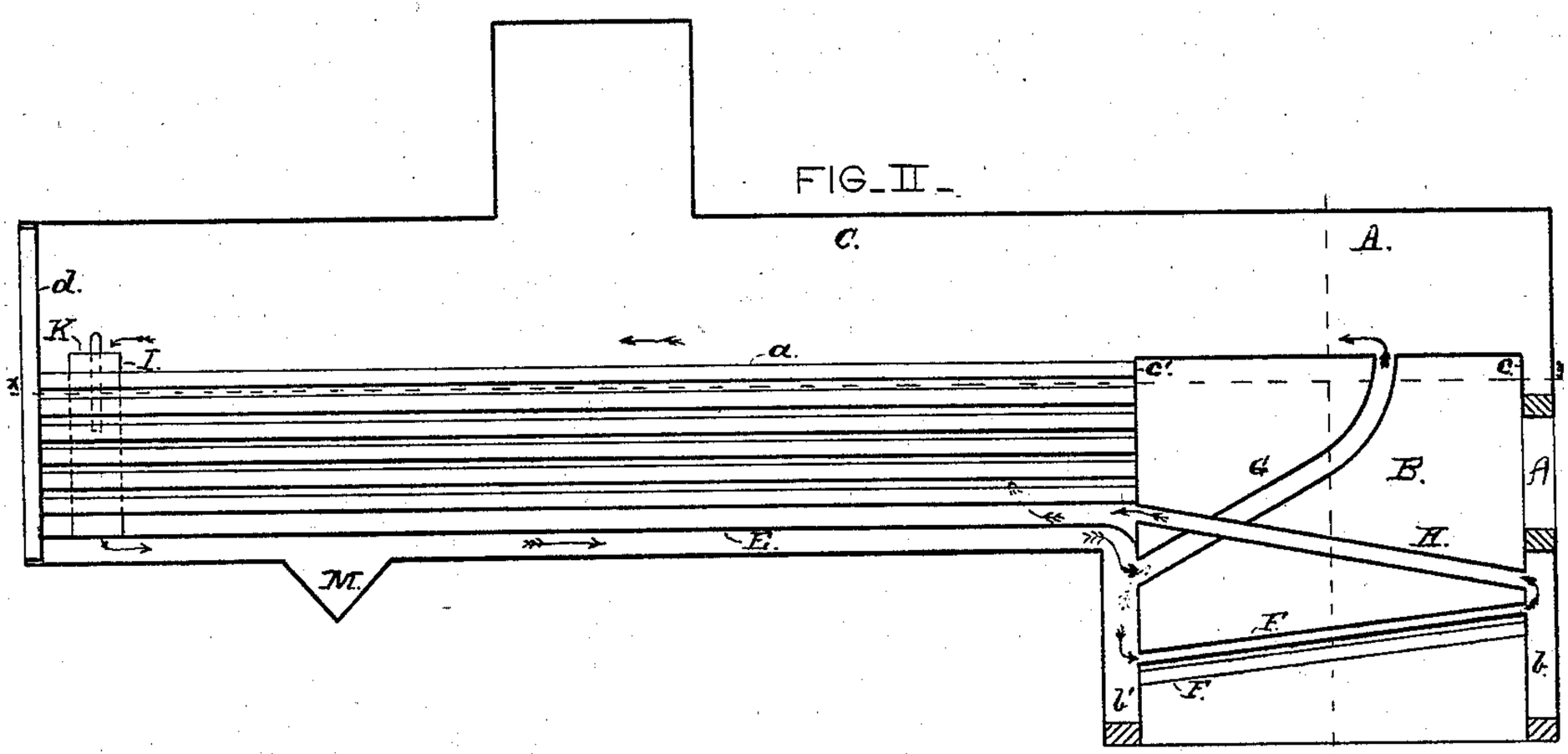


FIG. II.



WITNESSES:

R. F. Whittlesey.

Daniel Breed.

INVENTOR:

Robert Hooper

by G. H. & W. J. Howard
attys

UNITED STATES PATENT OFFICE.

ROBERT HOOPER, OF BALTIMORE, MARYLAND.

IMPROVEMENT IN STEAM-GENERATORS.

Specification forming part of Letters Patent No. **138,025**, dated April 22, 1873; application filed January 31, 1873.

To all whom it may concern:

Be it known that I, ROBERT HOOPER, of the city of Baltimore and State of Maryland, have invented certain Improvements in Steam-Boilers, of which the following is a specification; and I do hereby declare that the same is a full, clear, and exact description of my said invention, reference being had to the accompanying drawing and to the letters of reference marked thereon.

My invention relates to a steam-boiler, the construction of which is such as to assist the natural circulation of the water contained therein, and to provide for a general upward and onward movement of the whole body of water coming in contact with the heated surfaces, whereby the steam formed is conveyed with the water more readily to the surface, the better conduction of the heat from the plates exposed to fire secured, the steaming qualities of the boiler improved, incrustation and priming prevented, and the said boiler absolutely protected from that prolific source of explosions—the repulsive and spheroidal state of the water contained therein. My invention consists, first, in a diaphragm combined with the front tube-sheet of the boiler, the said diaphragm being placed longitudinally of the shell at a point considerably below the center thereof, and provided with certain channels connecting the said diaphragm to the sides of the shell and leading to a point at or near its center; secondly, in the combination of certain pipes with the said tube-head above and below the point of union with the diaphragm leading to and connecting, respectively, with the inside, front, and crown sheets of the furnace; and, thirdly, my invention consists in the combination of the feed-pipes from the engine with the aforesaid channels connecting the diaphragm and shell, in order that the water discharged by the pumps in the direction of the circulating current shall be caused to assist the said current by its injected force.

In the accompanying drawing forming a part of this specification, Figure I is a sectional front view of a boiler embodying my invention. Fig. II is a longitudinal section of the same. Fig. III is a sectional plan, showing the parts below the dotted line *x y*.

Similar letters of reference indicate similar parts in all the views.

A is the front shell of the boiler, in which is situated the furnace B. C is the round shell, which incloses the fire tubes or flues *a*. The front leg of the boiler is represented by *b* and the back one by *b'*. The front and back heads of the furnace are represented, respectively, by *c* and *c'* and the back tube-head by *d*. E is a diaphragm extending from the back tube-head *d* to the back head *c'* of the furnace, and secured in a position below the fire-tubes *a* and parallel with the round shell of the boiler. F F are water-tubes, by which the water in the front and back legs is connected, and are placed at an inclination, being lower at the ends next to the back leg *b'*. G G are circulating-pipes, extending from the back head *c'* of the furnace to the crown or top of the same, thereby connecting the water below the diaphragm E with that above the furnace B. To facilitate the securing of the pipes G to the boiler-plates, to which they connect, the said pipes are curved, as shown in Fig. II of the drawing, which curvature allows the ends to meet the boiler-plates at or nearly at a right angle; it also prevents the parts of the boiler before mentioned as being connected by the tubes from sustaining injury caused by the expansion and contraction of the said pipes, when the same are exposed to sudden change in temperature, by the opening and closing of the fire-doors in the furnace. H H are also circulating-pipes, and connect the front leg *b* with the interior of the round shell C above the diaphragm E. I I are plates fastened to the interior surface of the round shell near the tube-head *d*, for the purpose of forming the channels K, by which communication is established between the spaces above and below the diaphragm. The channels K need not necessarily be formed in the manner described, but may be constructed as ordinary pipes, and placed in any suitable position in the boiler; or in some cases the channels may be dispensed with, and one or more openings left in the diaphragm instead. L L are the feed-pipes leading from the pumps of the engine, extending a suitable distance into the channels K. In boilers in which the channels are not used

the feed-pipes may be lengthened so as to pass through the opening left in the diaphragm, and have the ends turned in the direction in which the circulating water flows. M is a drum, designed to collect sediment, placed upon the under side of the round shell, and is provided with a suitable valve and pipe, through which the sediment when collected may be blown off.

The manner in which the above-described channels and pipes effect the movement of the water, to cause the thorough circulation, and to secure the advantages resulting therefrom, as before enumerated, is as follows: The most intense heat being applied to the tubes F and circulating-pipes G and H, the water contained therein is expanded and ascends, the supply to the said pipes and tubes passing from I, near the surface of the water in the round shell, through the channels K to the space below the diaphragm, and thence to the legs of the boiler, which are in direct communication with the said tubes and pipes G and H. To prevent any temporary interruption of the current passing horizontally to the back leg *b'*, caused by its sudden change of direction, the portion of the diaphragm crossing the said leg is curved, thereby imparting a descending movement to the said current before reaching the back head *c'* of the furnace. Thus the series of pipes and circulating-tubes are continually ejecting heated water in an upward as well as a lateral direction, and receiving a supply of cooler water from the legs and the round shell below the diaphragm E. The direction of the current in the boiler, as described in the foregoing, is clearly indicated by the arrows, and the water-line represented by the dotted line extending from the front of the boiler to the back tube-head in Fig. II.

The tubes F, although forming an important feature in my invention, as means by which the circulation is increased, are also used instead of the ordinary grate-bars, and in this capacity furnish a considerable amount of heating-surface. The pipes G and H, in this respect, present the same advantages, besides offering a convenient resting-place for a deflector, composed of fire-brick or some other non-combustible material, to counteract the bad effects experienced from a too rapid current through the fire-tubes *a*. One or more of the tubes F may be left out, and an ordinary cast-iron grate-bar inserted instead, the said bar being so arranged as to be easily removed for the purpose of cleaning the furnace. The surface of the fire exposed to the action of the air below the tubes F can be extended without virtually increasing the width of the air-passages, by enlarging the openings *e* and raising the lower tubes so as to maintain the desired width of air-passage at *g*.

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

1. The diaphragm E, with the channels K, in combination with the front tube-head *c'*, substantially as and for the purpose herein set forth.

2. The combination of the crown-sheet of the furnace, circulating-pipes G, front tube-head *c'*, and diaphragm E, substantially as herein set forth, for the purpose specified.

3. The combination of the tubes F and circulating-pipes H with the inside front sheet *c* of the furnace, front tube-head *c'*, and diaphragm E, relatively arranged, substantially as and for the purpose herein set forth.

4. The combination of the diaphragm E and channels K with the engine feed-pipes L, as and for the purpose specified.

ROBERT HOOPER.

Witnesses:
WM. T. HOWARD,
JNO. MCKIM.