

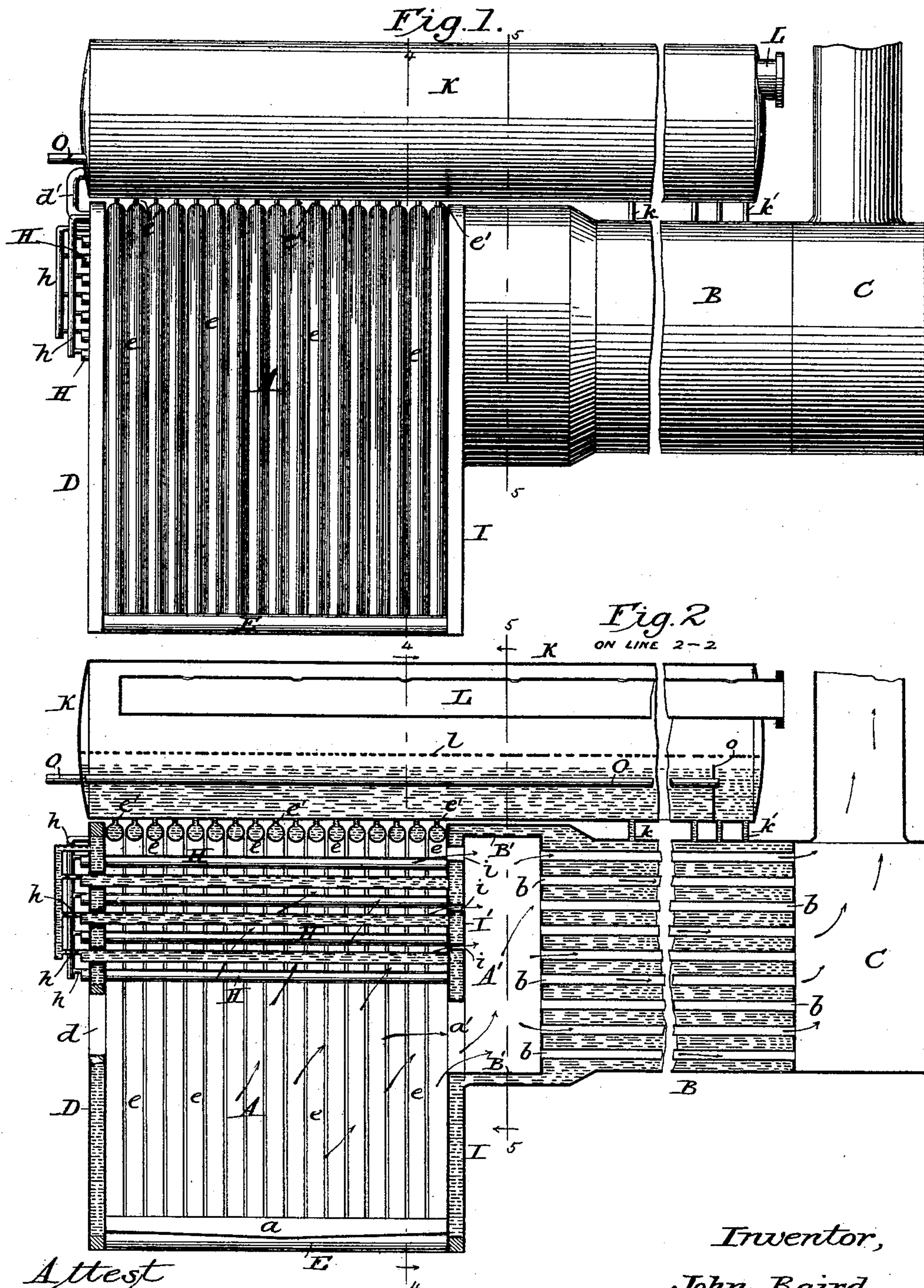
(No Model.)

3 Sheets—Sheet 1.

J. BAIRD.
STEAM BOILER.

No. 435,386.

Patented Sept. 2, 1890.



Attest
Sidney P. Hollingsworth
Balter D. Long.

Inventor,
John Baird
by his attorneys
Baldwin Davidson & Wright.

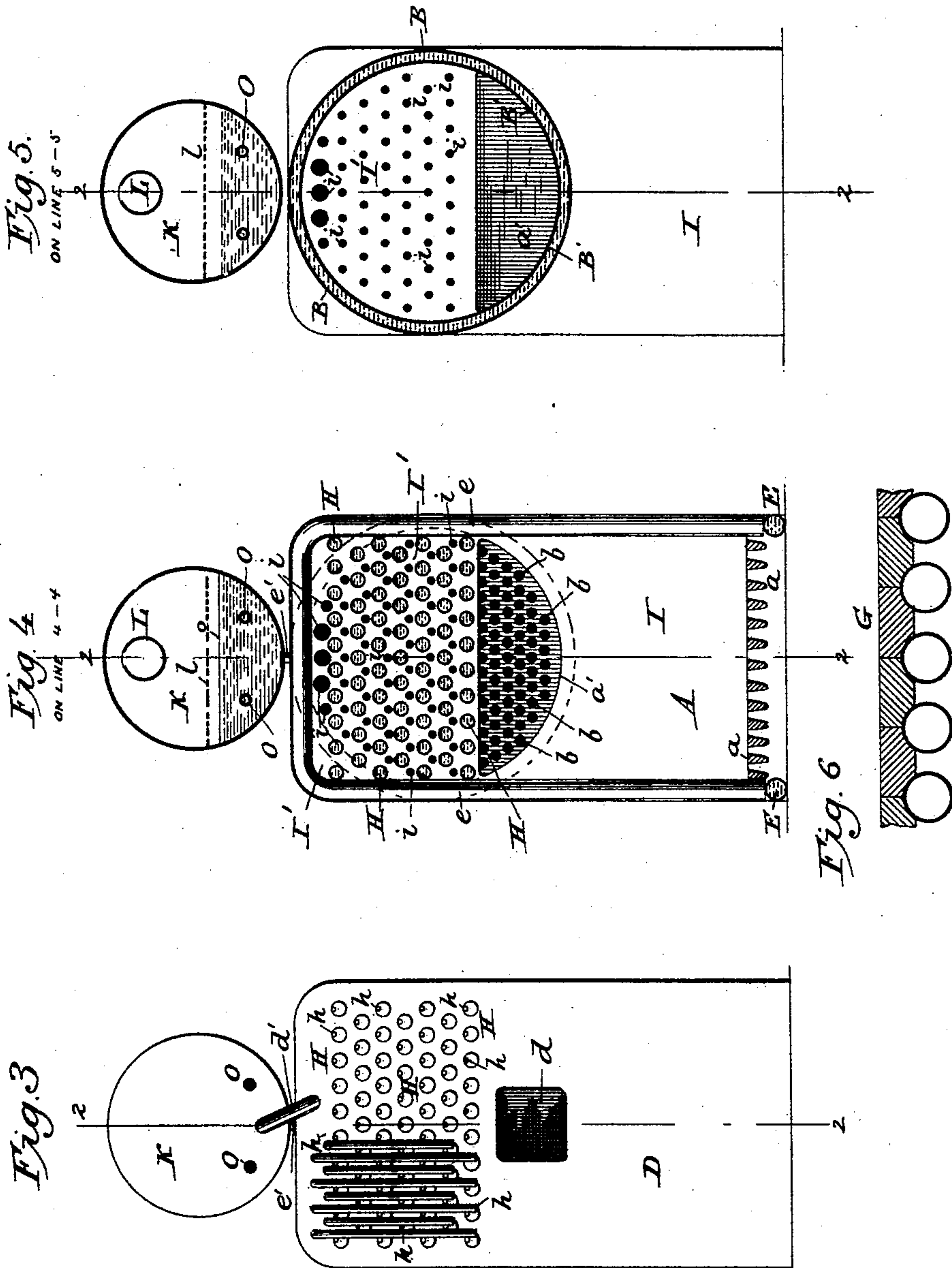
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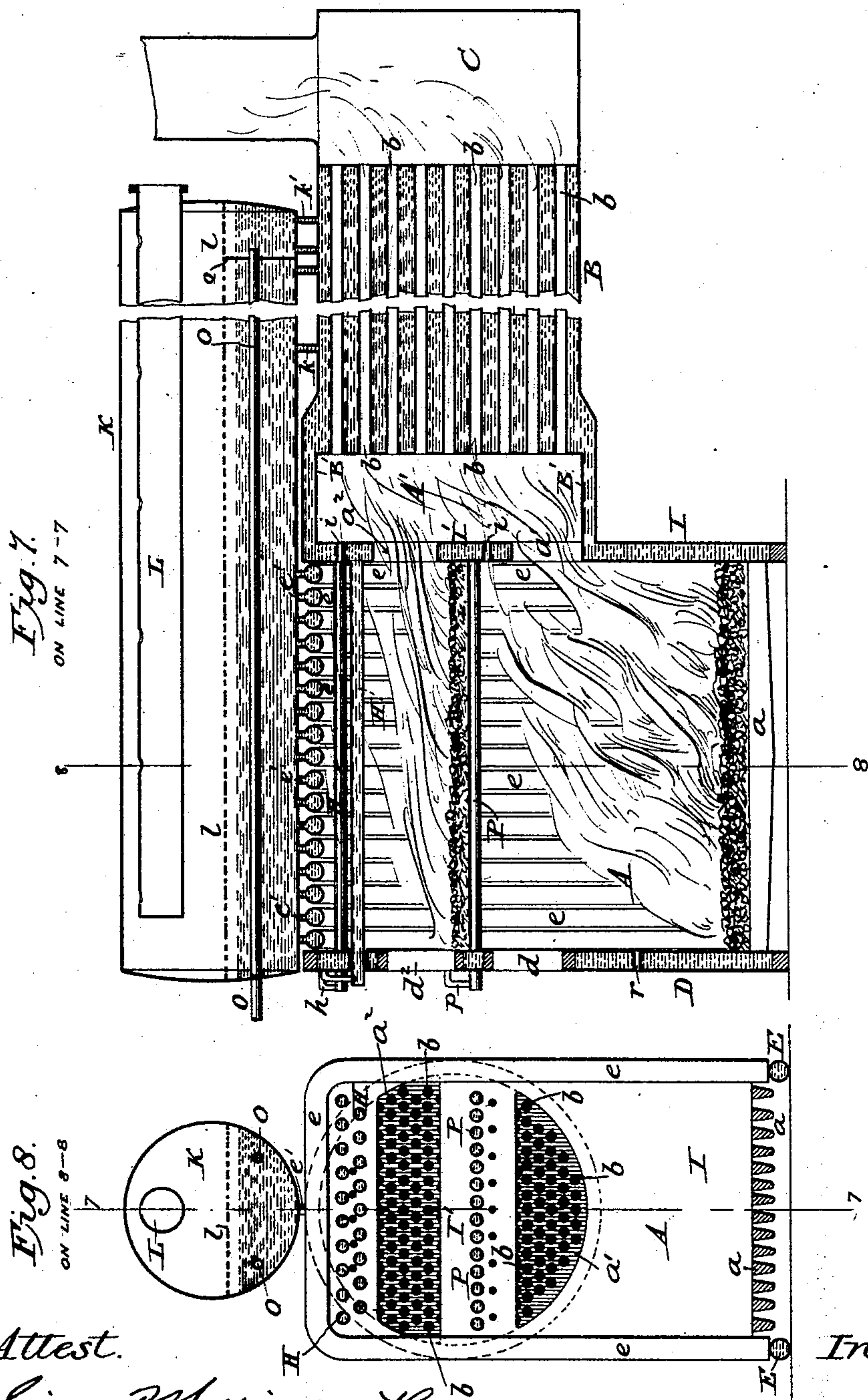
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UNITED STATES PATENT OFFICE.

JOHN BAIRD, OF NEW YORK, N. Y.

STEAM-BOILER.

SPECIFICATION forming part of Letters Patent No. 435,386, dated September 2, 1890.

Application filed April 30, 1890. Serial No. 350,004. (No model.)

To all whom it may concern:

Be it known that I, JOHN BAIRD, mechanical engineer, a citizen of the United States, residing in the city, county, and State of New York, have invented certain new and useful Improvements in Steam-Boilers, of which the following is a specification.

This invention, while particularly relating to locomotive-boilers, may beneficially be applied to stationary or marine boilers.

In United States Letters Patent No. 402,127, granted to me April 30, 1889, and No. 415,105, granted to me November 12, 1889, as well as in a pending application, Serial No. 349,257, filed April 24, 1890, I have shown, described, and claimed various parts of a boiler similar in construction to the one herein shown in many respects, and upon which my present invention constitutes an improvement.

The necessarily limited heating-surface directly exposed to the action of the fire is a great drawback to the efficiency of locomotive-boilers. The surface exposed to the direct action of the fire will generate about three times as much steam as the same amount of surface in fire-tubes. Consequently any increase in such surface must be an advantage. Another and a still greater drawback to the efficient and economical operation of this class of boilers is the limited area of grate-bar surface.

My patents and application above mentioned attain these advantages to a high degree by the use of a wide fire-box, inclosing and surrounded with water-tubes, and by the use of an upper and lower shell with which these tubes are connected.

In the present instance I am enabled to obviate the objections above mentioned and to attain the advantages desired, while adapting my boiler to the American standard locomotive of the present day, which requires a fire-box comparatively narrow, as it lies between the driving-wheels.

To carry out the objects of my invention I provide a front connection in front of the usual tube-sheet, this connection being separated from the fire-box by a water-space, which I call a "bridge-wall." This wall has passages through it for the products of combustion, and its water-space is connected with

the front water-space of the fire-box by horizontal tubes, as hereinafter described.

To increase the area of grate-surface, I utilize some of these tubes as a grate to receive another layer of fuel, these water-tubes thus constituting the grate-bars of the upper furnace and the roof of the lower surface. I also heat the feed-water by conducting it through the upper shell below the water-line from the front to the rear and there discharging it into the lower shell.

The subject-matter claimed consists of certain constructions, combinations, and organizations of instrumentalities hereinafter specified, the details of construction of which, unless otherwise specified, are well known.

The fire-box end of the boiler I call the "front," the opposite end the "back" or "rear."

The accompanying drawings represent so much only of my improved boiler as is requisite for the illustration of the subject-matter claimed.

Figure 1 represents a side elevation; Fig. 2, a vertical central longitudinal section on the line 2 2 of Figs. 3, 4, and 5; Fig. 3, a front end elevation; Fig. 4, a vertical transverse section on the line 4 4 of Figs. 1 and 2, looking forward; and Fig. 5, a similar section on the line 5 5 of the same figures, looking backward. The above-mentioned figures show one grate only and that the usual one. Fig. 6 represents a horizontal section through some of the water-tubes, which form the sides of the fire-box, and their fire-brick protection. Fig. 7 represents a vertical central longitudinal section on the line 7 7 of Fig. 8, showing a two-story furnace, or double tier of grate-bars; and Fig. 8, a vertical transverse section on the line 8 8 of Fig. 7.

The drawings show a fire-box A, provided with grate-bars *a*, a lower shell B, having fire-tubes *b*, connecting the front connection and smoke-box C. The front head D of the fire-box is provided with fire-doors *d*. It is connected near its bottom with a similar back head I by longitudinal tubes E, which are connected by a series of parallel arched transverse water-tubes *e* lying close together between the two heads. The front end of the lower shell is connected with the back head

by a double wall-ring, constituting an annular shell B', which projects far enough to provide a front connection A'.

A bridge wall or partition I', consisting of parallel plates, is shown as arranged in the upper part of the front connection in the same vertical plane as the back head, with which, in fact, it is connected, the opening a' between the furnace and front connection being in reality made in the back head. The front and rear plates of the bridge-wall are connected by hollow stay-bolt tubes i' , through which the products of combustion pass to the upper part of the front connection.

A series of longitudinal water-tubes H connect the bridge-head I' with the front head D, passing through sleeve stay-bolts in the latter, to compensate the expansion and contraction of the tubes. The small pipes h connect the tubes H with the water-space of the front head.

An upper shell K overlies the fire-box and lower shell. It is connected with the front head by pipe or pipes d' with the transverse arched water-tubes e by small pipes or tubes e' , and with the lower shell by vertical tubes k k' . The water preferably normally stands in the upper shell about one-third of its depth, so as to cover all the above-mentioned connecting-pipes and compel the steam escaping therefrom to pass up through the water in the upper shell. Deflectors, such as shown in my patent, No. 425,970, of April 22, 1890, may be placed in these connecting-pipes to prevent a too violent up-rush of steam and water.

A horizontal plate or diaphragm l in the upper shell above the water-line aids in preventing priming. A perforated steam-pipe L conducts the steam from the upper shell to the engine.

A feed-water pipe or pipes O, extending longitudinally through the lower part of the upper shell and projecting through a vertical transverse partition o at its rear end delivers the feed-water at that point and causes it to descend through pipes k' into the lower shell at the back end thereof, where it flows around the fire-tubes at the point where the products of combustion escape into the smoke-box, and where their temperature is lowest, the water passing forward through the back head, bridge-wall, and connecting-tubes to the front head and upper shell.

The fire-box and tubes are to be jacketed or protected with asbestos, fire-brick, &c., as specified in my patents and application above referred to.

The products of combustion, it will be observed, pass up among the longitudinal water-tubes H in the upper part of the fire-box, and thence through the stay-bolt tubes i in the bridge-wall, into the upper part of the front connection A', thus thoroughly heating these parts and the water around them.

The organization shown in Figs. 7 and 8 is substantially similar to that above described, with the following exception: An upper charg-

ing door or doors d^2 is provided in the front head, and a corresponding opening a^2 is made in the upper part of the bridge-wall, and an additional set of grate-bars P is provided so as to divide the furnace horizontally into two stories. These grate-bars are shown as formed of water-tubes connected with the bridge-wall and front head in the manner above described. The upper fire-box A² is shown as being shallower than the other, so as to apply the heat more directly to the upper longitudinal water-tubes. The grate-tubes P, it will be seen, not only sustain the fuel above them, but are exposed to the heat of the lower grate.

The drawings show a single row of grate-bars only, but they may be arranged in two parallel rows, one above the other.

The intermediate grate-bars extend entirely across the fire-box, so that it constitutes two separate furnaces, both discharging their products of combustion into the front connection, my object being to secure the greatest practicable water-tube surface exposed to the direct action of the fire.

Hollow stay-bolts r in the front head, both above and below the upper grate-bars, serve to admit air to the respective fire-boxes to promote combustion.

I have shown two parallel feed-water pipes in the upper shell; but the two might be connected or a coil substituted therefor, and thus obtain a larger heating-surface in a well-known way.

It will thus be seen from the foregoing description that by my improvements I secure a large area of tube-surface exposed to the direct action of the heat, and am enabled, largely, to increase the grate surface and to heat the feed-water advantageously.

I am aware that two tiers of grate-bars have heretofore been employed in a boiler differing in construction and operation from mine, and do not, therefore, broadly claim such an organization. Neither do I broadly claim the use of water-tubes as grate-bars; but, so far as I am aware, I am the first to employ such water-tubes connecting a front head and bridge-wall in combination with separate water-tubes in the upper part of the fire-box, the products of combustion passing around the tubes and through the bridge-wall.

Having thus described my improved steam-boiler, what I claim therein as new, and as of my own invention, is—

1. The combination, substantially as hereinbefore set forth, of a furnace, a grate, a shell, a front connection, a bridge-wall in the upper part thereof, and longitudinal water-tubes, constituting no part of the grate, connected with the bridge-wall and extending through the upper part of the furnace, around which tubes and through which bridge-wall the products of combustion pass.

2. The combination, substantially as hereinbefore set forth, of a furnace or fire-box, a grate therein, a boiler-shell, a front connection, a bridge-wall separating the furnace and

front connection, a front head, longitudinal water-tubes, constituting no part of the grate, connecting the front head and bridge-wall, and hollow stay-bolts passing through the bridge-wall, through which stay-bolts the products of combustion pass to the front connection after circulating around the water-tubes.

3. The combination, substantially as here-
inbefore set forth, of a furnace or fire-box, a lower shell, a front connection, a bridge-wall separating the furnace and front connection, a front head, water-tubes connecting the bridge-wall and front head, an upper shell, and pipes connecting the lower shell and front head therewith.

4. The combination, substantially as here-
inbefore set forth, of a furnace or fire-box, a lower shell, a front connection, a bridge-wall, longitudinal water-tubes connected therewith and passing through the upper part of the fire-box, an upper shell, its feed-water-supply pipe, the vertical diaphragm or partition near the back end of the upper shell through which the feed-water pipe passes, and tubes connecting this portion of the upper and lower shells to deliver the feed-water at the back of the lower shell.

5. The combination, substantially as here-
inbefore set forth, of a furnace or fire-box, a lower grate, an upper tubular grate, a front connection, a bridge-wall separating the furnace and front connection, and separate lon-

gitudinal water-tubes connected with the bridge-wall and traversing the furnace above the upper grate, and around which tubes the products of combustion pass.

6. The combination, substantially as here-
inbefore set forth, of a furnace or fire-box, its lower grate, a front connection, a bridge-wall separating them, water-tubes connected with the bridge-wall and constituting the roof of the lower fire-box, and a grate to support an upper tier of fuel, and water-tubes above the upper grate, around which tubes the products of combustion pass.

7. The combination, substantially as here-
inbefore set forth, of a furnace or fire-box, a boiler-shell, a front connection between them, a back head, a front head, a bridge-wall separating the fire-box and front connection, a lower grate, an upper grate consisting of water-tubes connecting the back head and bridge-wall, and longitudinal water-tubes, constituting no part of the grate, likewise connecting the front head and bridge-wall in the upper part of the upper fire-box, around which tubes and through which bridge-wall the products of combustion pass.

In testimony whereof I have hereunto subscribed my name.

JOHN BAIRD.

Witnesses:

ADDISON W. BAIRD,
HUBERT KOOPER.