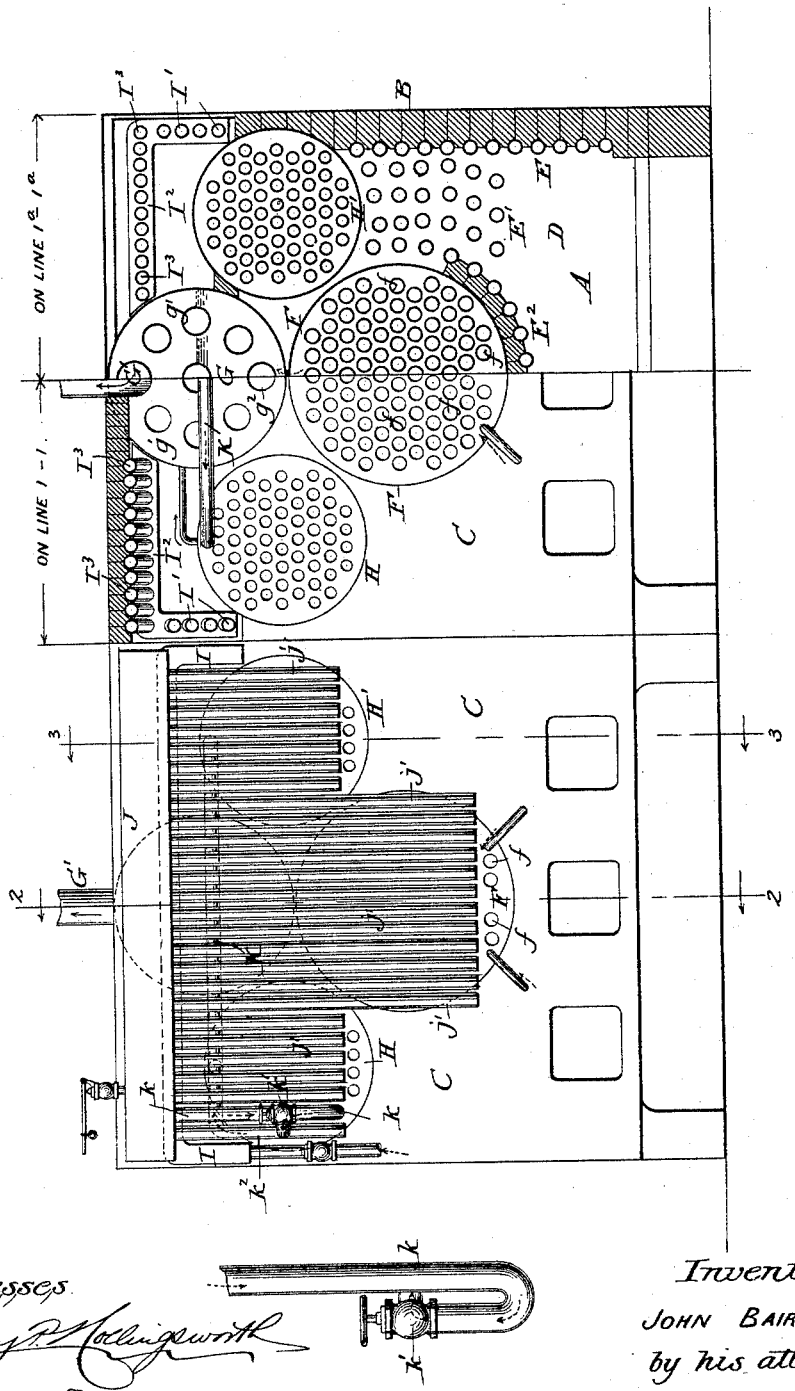
(No Model.) 2 Sheets—Sheet 1.

J. BAIRD.

FEED WATER HEATER.

No. 456,712. Patented July 28, 1891.

Fig. 1.



Witnesses.
Sidney P. Hollingsworth
Baltus De Long.

Inventor
JOHN BAIRD
by his attorneys
Baldwin Davidson & Wright

(No Model.) 2 Sheets—Sheet 2.

J. BAIRD.

FEED WATER HEATER.

No. 456,712. Patented July 28, 1891.

Fig. 2.

ON LINE 2-2

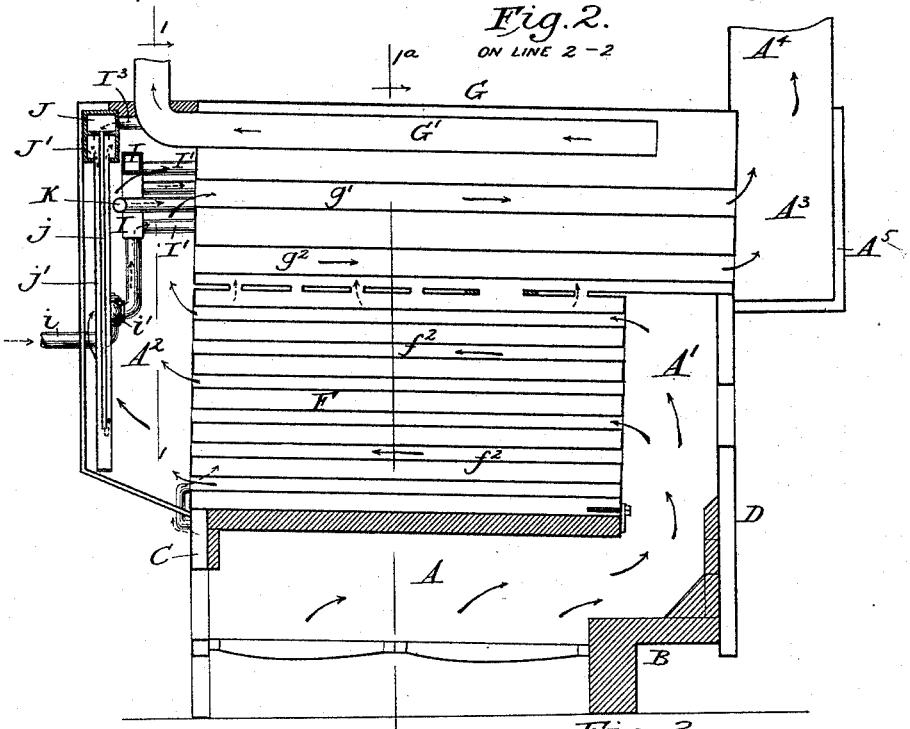
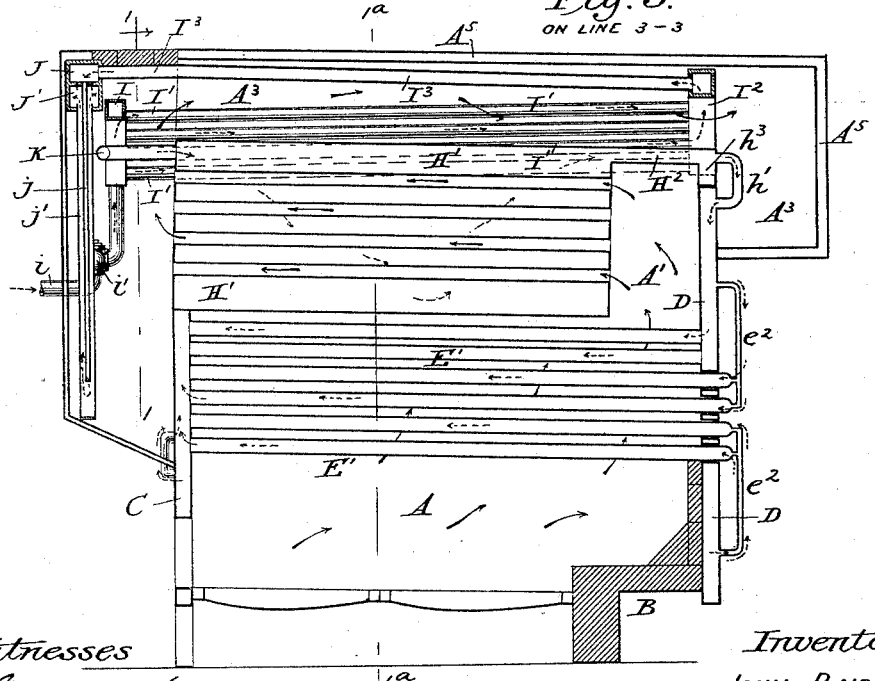


Fig. 3.

ON LINE 3-3



Witnesses

Sidney P. Hollingsworth

Baltus L. Long.

Inventor

JOHN BAIRD

by his attorneys

Baldwin Dandeno & Wright

UNITED STATES PATENT OFFICE.

JOHN BAIRD, OF NEW YORK, N. Y.

FEED-WATER HEATER.

SPECIFICATION forming part of Letters Patent No. 456,712, dated July 28, 1891.

Application filed March 5, 1891. Serial No. 383,854. (No model.)

To all whom it may concern:

Be it known that I, JOHN BAIRD, mechanical engineer, a citizen of the United States, residing at No. 324 Lexington avenue, in the city, county, and State of New York, have invented certain new and useful Improvements in Feed-Water Heaters for Steam-Boilers, of which the following is a specification.

My invention more especially relates to that class of marine and stationary steam-boilers having horizontal or slightly-inclined flues. Its principal object is to utilize the heat of the products of combustion in heating the feed-water of the boiler, in addition to their ordinary function of heating the water in the boiler itself, which end I attain by certain novel combinations and organizations of instrumentalities hereinafter specified.

My improvements, while readily adaptable to almost any horizontal-tube boiler, are particularly applicable to the type shown in my patent of October 7, 1890, No. 437,745, which shows a "four-shell" boiler.

Another application, filed by me February 27, 1891, as Serial No. 383,096, shows and describes a four-shell boiler similar to that illustrated in my patent, No. 437,745, with certain improvements in the feed-water-heating apparatus embodied therein. Consequently I do not claim herein anything shown in either of these applications or patents. As the construction and operation of the apparatus are fully described in said applications and patents, it will be sufficient to refer to them here, describing in detail the novel features of my present invention only.

The accompanying drawings show so much only of the apparatus as is necessary to illustrate the subject-matter herein claimed.

Figure 1 shows a front elevation, partly in section, on the line 1 1 and partly on the line 1^a 1^a of the other figures. Fig. 2 is a vertical longitudinal section through the central shells on the line 2 2 of Fig. 1, and Fig. 3 a similar section through the side shell and boiler-tubes on the line 3 3 of Fig. 1.

Unless otherwise indicated, the parts are of usual construction.

That end of the boiler at which the firing is done I call the "front;" the opposite end, the "back" or "rear." That side of the boiler on the left of a person facing the front I call the "left;" the opposite side, the "right." Short unfeathered darts indicate the direction in which the sections are shown. Solid feathered arrows show the course of the products of combustion. Corresponding unfeathered ones that of the steam, and dotted ones that of the water. The products of combustion in this instance are shown as passing from the fire-box A around and through the various water and fire tubes, by way of the back connection A′, front hood or uptake A^2, smoke-box A^3, and chimney or smoke-stack A^4.

C and D respectively represent the front and back heads; E E′ E^2, water-tubes, the rear ends of which pass through sleeves in the back head, and e^2, pipes connecting their ends with said heads.

B represents the usual brick-work; F, the lower shell; f^2, its fire-tubes; G, the upper shell; g' g^2, fire-tubes therein, and G′ the steam-exit pipe.

H H′ represent supplementary shells; H^2, hoods connecting the shells with water-boxes h^3; h', pipe connecting water-box and back head.

The boiler-shells are covered by a casing A^5, leaving spaces at each side constituting a smoke-box A^3, through which a portion of the products of combustion pass from the front hood or uptake to the smoke-stack at the back of the boiler. Another portion of the products of combustion passes back from the uptake to the smoke-box through the fire-tubes g g'. The normal water-line of the boiler passes through the center of the upper shell. Consequently the heat passing through the upper tubes and that passing through the smoke-box dry or superheat the steam in the upper part of the boiler.

The feed-water enters the pipe i through a check-valve i' and flows into a box I, with which are connected a series of pipes I′, which extend inside the smoke-box to a channel I^2, extending across the back of the boiler, with which are connected a row of pipes I^3, extending horizontally beneath the casing to an upper channel J, arranged across the front of the boiler above its water-line. From this

channel the water descends through a series of pendent tubes *j*, arranged concentrically within larger tubes *j'*, through which it rises in a similar lower channel J', from which it flows through a pipe *k*, provided with a check-valve *k'* to a pendent tube k^2, connected with an inlet-tube K, extending horizontally across the uptake and connected at each end with one of the supplementary shells near its upper side. The pendent water-circulation tubes are shown as arranged in a row in front of the boiler-shells, where they are in the direct path of the products of combustion escaping through the fire-tubes. They are also shown as arranged close to the front of the uptake, so as to leave ample space for the passage of the products of combustion, and are also arranged a short distance apart, so that the products of combustion may pass through and around them. The central tubes are also shown as extending down nearly to the bottom of the lower shell. The feed-water-inlet tube K, it will be observed, extends across the uptake, between the pendent tubes and the front of the upper shell, directly in the path of the products of combustion passing to the smoke-stack, and where it obtains the full benefit of the heat.

In my pending application hereinbefore referred to the pendent water-tubes are shown as arranged close to the ends of the fire-tubes and between the latter and the feed-water-inlet pipe. My present organization enables me to supplement the heating-surface by the additional horizontal pipes I' I^3 and back channel I^2, the advantage of which is obvious.

The boiler of course is to be supplied with suitable appliances, including safety-valves and proper steam, water, and air passages for filling and working the boiler, the operation of which will readily be understood from the foregoing description.

I claim as new and as of my own invention—

1. The combination, substantially as hereinbefore set forth, of an uptake, a smoke-box, feed-water heater-tubes extending longitudinally through the smoke-box, a back channel connecting them, heater tubes in the upper part of the smoke-box connecting the back channel with an upper front channel, pendent concentric water-circulating tubes in the uptake, a lower channel with which they are connected, and a pipe connection to the boiler.

2. The combination, substantially as hereinbefore set forth, of an uptake, a smoke-box, feed-water heater-tubes extending longitudinally therethrough, a back channel connecting them, other feed-water heater-tubes in the smoke-box connecting the back channel with a front channel in the uptake above the water-line, another channel parallel therewith, concentric pendent feed-water-circulating tubes connecting these front channels, and a transverse feed-water-inlet pipe intermediate of the pendent water-circulating tubes and boiler-shell and constituting the connection between them.

3. The combination, substantially as hereinbefore set forth, of a boiler-shell, its uptake, its smoke-box, fire-tubes opening into the smoke-box, longitudinal feed-water heater-tubes in the smoke-box, a back channel connecting them, other feed-water heater-tubes in the smoke-box connecting the back channel with the front channel in the uptake, another channel parallel therewith, concentric pendent feed-water-circulating tubes connecting these front channels, and a transverse feed-water-inlet pipe intermediate of the pendent water-circulating tubes and boiler-shell and constituting the connection between them.

4. The combination, substantially as hereinbefore set forth, of an uptake, a chimney, an interposed smoke-box, a system of horizontal feed-water heater-pipes traversing the smoke-box, a transverse channel in the uptake, with which they are connected, and water-circulating pipes suspended from said channel in the uptake.

5. The combination, substantially as hereinbefore set forth, of a lower shell, an upper shell, their fire tubes, an uptake connecting them, a smoke-box inclosing the upper shell, feed-water heater-tubes in the smoke-box, a channel in the uptake, with which they are connected, feed-water-circulating pipes pendent therefrom, and a pipe connecting these tubes with the boiler.

6. The combination, substantially as hereinbefore set forth, of a lower shell, an upper shell, supplementary shells on opposite sides thereof, the fire-tubes of all these shells, an uptake connecting them, a smoke-box above the shells, feed-water heater tubes traversing the smoke-box, a channel in the uptake, with which they are connected, water-circulating tubes pendent from the channel in the uptake, and an inlet-pipe connecting them with the boiler.

7. The combination, substantially as hereinbefore set forth, of a lower shell, an upper shell, supplementary shells on opposite sides thereof, the fire-tubes of all these shells, an uptake connecting them, a chimney, a smoke-box connecting the uptake and chimney above the shells, feed-water heater-tubes traversing the smoke-box, a back channel with which they are connected, a front channel in the uptake above the water-line, tubes connecting the front and back channels, water-circulating tubes pendent from the channel in the uptake opposite the fire-tubes, and a transverse pipe in the uptake between the pendent tubes and the fire-tubes, connecting the feed-water tubes with the shells.

In testimony whereof I have hereunto subscribed my name.

JOHN BAIRD.

Witnesses:
A. J. BAIRD,
ADDISON W. BAIRD.