

J. BAIRD.
STEAM BOILER.

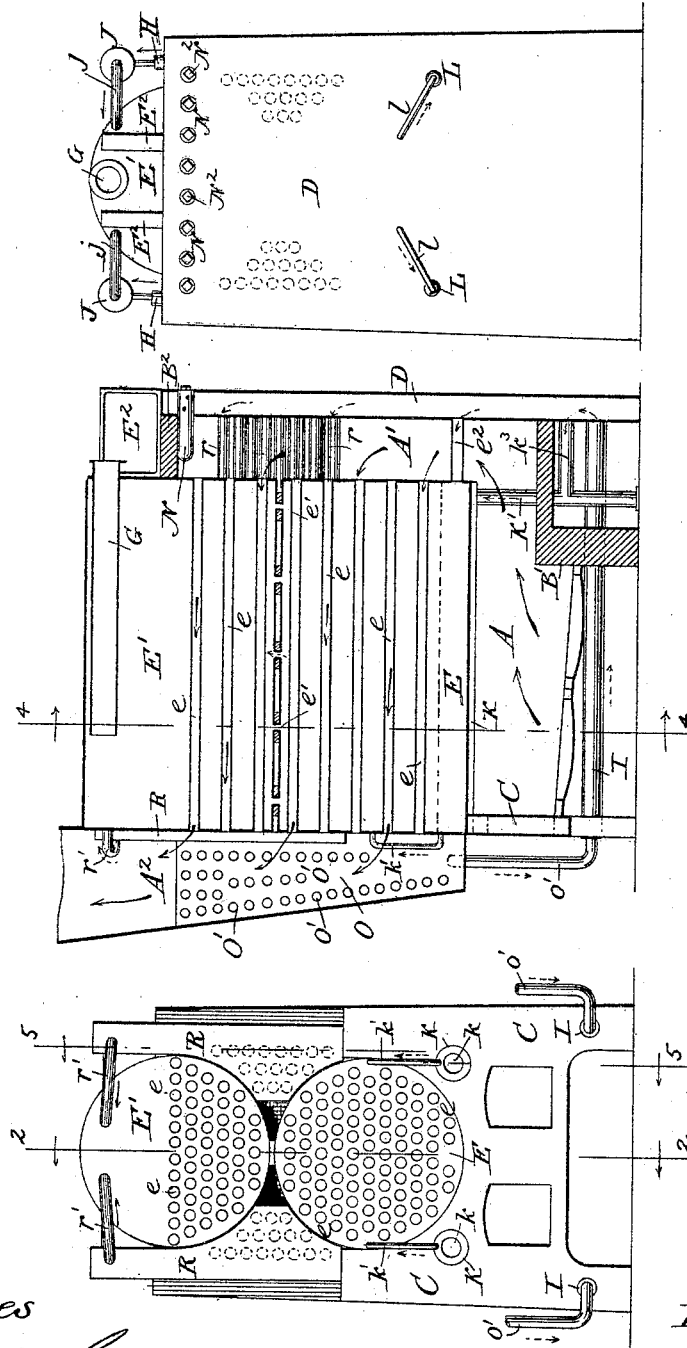
No. 458,819.

Patented Sept. 1, 1891.

Fig. 3.

Fig. 2
ON LINE 2-2

Fig. 1



Witnesses
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Inventor
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Fig. 6

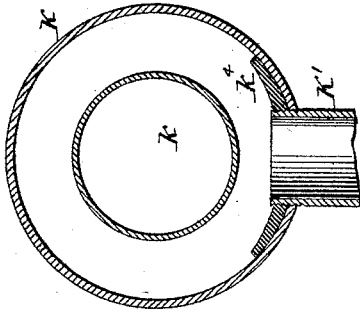


Fig. 7.

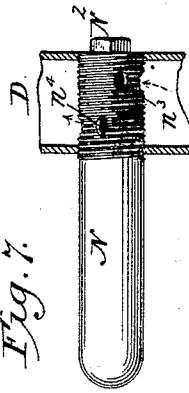


Fig. 8.

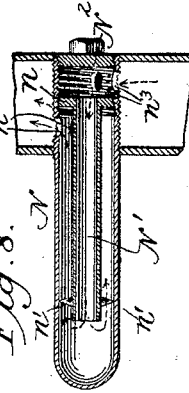


Fig. 5
ON LINE 5-5

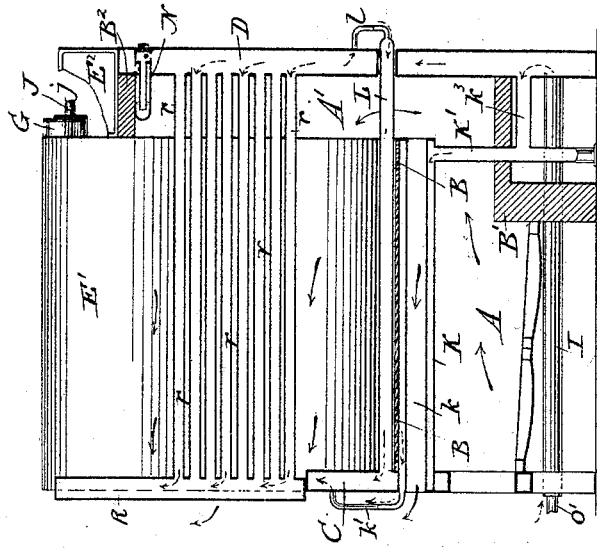
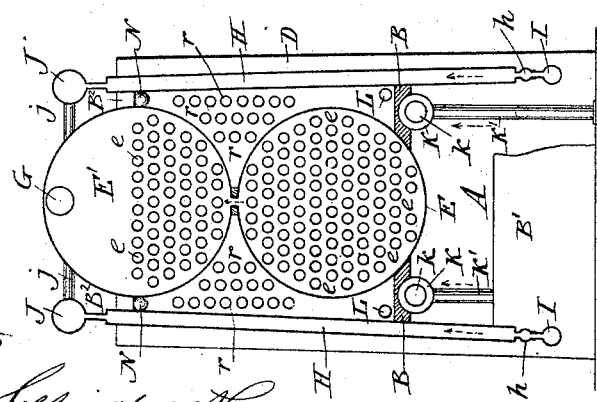


Fig. 4
ON LINE 4-4



Witnesses

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UNITED STATES PATENT OFFICE.

JOHN BAIRD, OF NEW YORK, N. Y.

STEAM-BOILER.

SPECIFICATION forming part of Letters Patent No. 458,819, dated September 1, 1891.

Application filed April 29, 1891. Serial No. 390,888. (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 Steam-Boilers, of which the following is a specification.

My invention more especially relates to marine and stationary steam-boilers of the class having substantially horizontal flues inclosed in suitable shells partially inclosed by both horizontal and upright water-tubes, as exemplified, for instance, in my patent of November 12, 1889, No. 415,135.

The objects of my invention are to secure a compact, safe, simple, and efficient boiler of high steam-generating capacity, which ends I attain by certain novel organizations of instrumentalities hereinafter specified.

The accompanying drawings show my improvements embodied in apparatus consisting, essentially, of two large central shells arranged one above the other, with small side shells all surrounded by upright casing-tubes, somewhat on the plan shown in the above-mentioned patent. So much of the apparatus only is shown, however, as is requisite to illustrate the subject-matter claimed. Unless otherwise indicated the parts are of usual approved construction. The fire-door end of the boiler I term the "front," the opposite end the "rear." That side on the right hand of a person facing the fire-doors I term the "right" and the opposite side the "left." Short unfeathered darts indicate the direction of view of the corresponding sections, solid feathered arrows the course of the hot gases, and dotted ones that of the water.

Figure 1 is a front elevation with the casing removed; Fig. 2, a vertical central longitudinal section therethrough looking to the left; Fig. 3, a back view; Fig. 4, a vertical central transverse section on the line 4 4 of Fig. 3, looking backward; Fig. 5, a vertical longitudinal section through one of the side shells on the line 5 5 of Fig. 1, looking inward or to the left. Fig. 6 is a vertical transverse section through one of the side shells and its supporting water-inlet pipes on an enlarged scale. Fig. 7 is a plan view through one of the water-circulating tubes supporting the

fire-brick roof of the back connection; and Fig. 8, a horizontal longitudinal section therethrough illustrating the details of its construction and connection with the back head.

The products of combustion pass from the fire-box A through and around the various fire-tubes, flues, and water-tubes by way of the back connection A' and front hood or uptake A², and thence up the chimney. The front head C and back head D are made of parallel plates, with a water-space between them, and are provided with the usual fire-doors and man-holes. A cylindrical shell E with flat ends rests on the correspondingly-shaped front head and extends back directly over the fire-box to the front end of the back connection, which is formed by a space left between the shell and back head. The rear end of this shell is connected with the back head near its bottom by a series of water-pipes e², five or six in number, crossing the back connection. This shell is entirely filled with fire-tubes e. A similar shell E' lies directly over and parallel with this lower shell, to which it is securely fastened at intervals by short vertical pipes e' in a manner similar to that shown in Letters Patent No. 437,745, granted to me October 7, 1890, so that the lower shell is partly supported from the upper shell. The upper shell E' is filled about two-thirds or one-half full with fire-tubes e, the normal water-line being just above the uppermost row of these tubes, thus leaving the upper portion of the boiler to constitute a steam-space provided with the usual steam-exit pipe G. The rear end of the upper shell is supported by semi-girders E², fastened to it and resting on the top of the back head, which latter extends about or slightly above the normal water-line of the boiler. The front head C, it will be observed, terminates below the top of the lower shell. The front ends of these shells are partly encompassed and supported by flat water-boxes R, consisting of vertical front and back plates, with a water-space between, conforming in shape to and interposed between the shells, their upper ends extending as high as the top of the upper shell. These boxes rest upon but are separate from the front head, and their upper ends are connected directly with the steam-space of the upper shell by tubes r' to permit

any steam generated in them to pass into the boiler. The back plates of these heads are connected by a series of horizontal or slightly-inclined water-tubes r with the back head, so
 5 that water can circulate freely through them. These water-boxes are free to slide back and forth on the front head to accommodate the expansion and contraction of their water-tubes r , which tubes, it will be observed, extend
 10 across the upper part of the back connection, which extends up as high as the water-line of the boiler.

The side walls of the furnace are composed of a series of parallel, upright, or slightly-inclined water-tubes H lying close together
 15 and filling the space between the front and back heads. These casing-tubes are connected at bottom with their respective longitudinal water-supply pipes I , which are connected
 20 with the water-space of the back head on each side near the bottom, and extend through the front head by suitable packed or sliding joints to the feed-water heater herein-after described. The casing-tubes H are
 25 likewise connected at top with longitudinal steam-pipes J , connected by pipes j with the steam-space of the upper shell. The casing-tubes H are preferably connected with the
 30 pipes I J by expansion-joints or jam-nuts h , in a manner shown in my patent, No. 415,135, above mentioned, which allows the connections to expand and contract freely as required.

Small side shells K extend lengthwise of
 35 the fire-box beneath and on each side of the lower shell E with which they correspond in length, and each one of them is fitted with a central flue k to make broader and more equal draft from the furnace and back connection
 40 to the uptake. The front ends of these shells extend through the front head with which they are connected by small curved pipes k' to compensate their contraction and expansion. The side shells are each connected with
 45 the back head by a vertical pipe K' , which supports its rear end and is connected by a horizontal pipe k^3 with the back head, thus serving both as a support and as a conduit or water-way. The lower ends of these vertical
 50 pipes K' rest upon the floor or bed-plate, while their upper ends are screwed into the bottoms of the side shells and into correspondingly-shaped re-enforcing plates or washers resting therein, as shown in Fig. 6, to strengthen the
 55 connection.

Longitudinal water-tubes L between the lower shell and casing-tubes connect the front and back heads, passing across the back connection and through sleeves or packed joints
 60 in the back head, with which they are connected by small curved pipes l , which compensate their expansion, substantially as shown in my patents, No. 411,882, of October 1, 1889, and No. 437,745, of October 7, 1890.

65 A series of water-circulating tubes N is shown as projecting from the back head into the upper part of the back connection. These

pipes consist of a large external tube closed at its inner end, having its open end screw-threaded and screwed into corresponding
 70 openings in both walls of the back head. A smaller tube N' , provided with a flanged head n at one end and with supporting-spurs n' at the other, fits into each outer tube, its head
 75 being screw-threaded and screwed into said outer tube so as to lie midway between the walls of the back head. A screw-plug N^2 closes the open end of the outer tube after the inner tube is inserted. Lateral openings n^3
 80 in the outer tube allow the feed-water to flow through the inner tube to its inner end, and then outward between the inner and outer tube through openings n^4 on the opposite
 85 side of the head n from the inlet-opening n^3 . The water thus circulates through these openings from the back head and tubes and returns to the back head again. In addition to their function of circulating-tubes, these tubes also perform the additional one
 90 of supporting the roof of the back connection, which consists of fire-brick B^2 interposed between these pipes and the girders E^2 , which fire-brick serves to retain the heat therein. The feed-water flows through a series of horizontal pipes O' , traversing the up-
 95 take in front of the fire-tubes and connecting water-legs O , connected by pipes o' with the water-supply tubes I , above described.

This apparatus being a part of the subject-matter of my application, Serial No. 386,335, filed March 25, 1891, is only claimed herein
 100 in combination with other parts of the organization.

The boiler is to be covered or jacketed wherever necessary with usual material for
 105 resisting the conduction of heat.

The roof of the fire-box is shown as composed of fire-brick B , interposed between the casing-tubes and the lower shell near its bottom and lying just over the side shells.
 110

B' represents a portion of the brick-work at the back of the furnace.

The most approved appliances—such as safety-valves, water-valves, cocks, &c.—are to be provided for filling, emptying, or regulating the flow of air, steam, or water through
 115 the boiler. The products of combustion pass into the back connection and return to the uptake through the flues or fire-tubes of the upper, lower, and side shells, a portion of the
 120 heat impinging upon the casing-tubes and the longitudinal water-tubes crossing the back connection and lying between the shells, escaping into the uptake between the water-boxes R and the upper and lower shells and
 125 between the boxes and casing-tubes. (See Fig. 1.) The feed-water flows through the tubes I to the bottom of the casing-tubes and back head, passing from the latter to the lower shell and side shells and through the
 130 pipes r to the boxes R .

The steam circulation will readily be understood from the foregoing description.

The whole apparatus, it will be observed, is

rectangular in outline and its space fully occupied. The two main shells being of comparatively large diameter compared with their length, and being surrounded with both horizontal and vertical tubes, constitute with the side shells a very compact apparatus of high steam-generating capacity.

My patent, No. 437,745, above mentioned, shows a four-shell boiler, the side shells being some distance from the center one and not extending across the back connection. By substituting for these short shells and their fire-tubes the water-boxes interposed between the central shells and connected by water-tubes extending across the back connection with the back head and lying in the flue-space traversed by the products of combustion I am enabled to heat the water contained in these tubes thoroughly by the products of combustion circulating around them, and at the same time am able very materially to diminish the width of the boiler, and thus obtain room for the upright side tubes H, thus securing an equivalent steam-generating capacity in much less lateral space.

Application, Serial No. 390,439, filed by me April 25, 1891, describes and claims certain features herein shown; but I, of course, do not claim herein any subject-matter claimed in that application.

I claim as new and as of my own invention—

1. The combination, substantially as hereinafore set forth, of a back head, a front head, a lower shell resting thereon, an upper shell connected with the lower shell, separate water-boxes interposed between the shells conforming in shape thereto and resting directly on the front head, and water-tubes traversing both the flue-space around the shells and the back connection and connecting the water-boxes and back head.

2. The combination, substantially as hereinafore set forth, of a back head, a front head, a lower shell resting thereon, an upper shell connected with the lower shell, pipes connecting these shells, separate water-boxes resting on the front head between the shells and conforming in outline thereto, water-tubes traversing both the flue-space around the shells and the back connection and connecting these water-boxes with the back head, water-tubes connecting the lower shell and back head, and steam-tubes connecting the tops of the water-boxes and of the upper shell.

3. The combination, substantially as hereinafore set forth, of a fire-box, its back connection, a flue-space, an uptake, a back head, a front head, a lower shell resting thereon, an upper shell connected therewith, fire-tubes therein, separate water-boxes between the shells conforming in shape thereto and resting on the front head, and water-tubes crossing the flue-space and back connection and connecting the water-boxes and back head.

4. The combination, substantially as hereinafore set forth, of a front head, a back

head, a lower shell resting on the front head, an upper shell supported by the back head, pipes connecting the upper and lower shell, water-supply pipes passing through the front head to the back head, upright casing-pipes connected with these slide-pipes and filling the space between the front and back heads, steam-pipes connecting the casing-pipes with the upper shell, water-boxes interposed between the shells and casing-pipes, water-tubes connecting the boxes and back head, and steam-pipes connecting the boxes and upper shell.

5. The combination, substantially as hereinafore set forth, of a back head, a front head, a lower shell resting thereon, an upper shell supported on the back head, pipes connecting the upper and lower shell, side shells below the main shell passing through the front head and connected with the lower shell and back head, water-boxes interposed between the central shells and conforming in outline therewith, and water-tubes traversing the flue-space and back connection and connecting the boxes and back head.

6. The combination, substantially as hereinafore set forth, of a front head, a back head, a lower shell resting on the front head, an upper shell connected therewith, water-supply pipes, upright casing-tubes connected therewith between the front and back heads, steam-pipes connecting these tubes with the upper shell, side shells connected with the back head and boiler, water-boxes between the shells and casing-tubes, and water-tubes connecting the boxes and back head.

7. The combination, substantially as hereinafore set forth, of a front head, a back head, a lower shell, an upper shell connected therewith, water-supply tubes, upright casing-tubes connected therewith, steam-pipes connecting the casing-tubes and upper shell, side shells traversing the fire-box, water-boxes between the shells and casing-tubes, and supplementary water-tubes between the lower shell and casing-tubes and connecting the front and back heads.

8. The combination, substantially as hereinafore set forth, of a fire-box, a back connection, an uptake, a front head, a back head, a lower shell, an upper shell, their fire-tubes, water-supply pipes, casing-tubes connected therewith, steam-pipes connecting the casing-tubes and upper shell, side shells passing through the front head, their flues, water-boxes resting on the front head, and water-tubes connecting these boxes and the back head.

9. The combination, substantially as hereinafore set forth, of a fire-box, a back connection, a front hood or uptake, a front head, a back head, a lower shell, an upper shell, the fire-tubes of these shells, feed-water pipes crossing the uptake, water-supply pipes connecting them with the back head, casing-tubes connected with these pipes, steam-pipes connecting the casing-tubes and upper shell,

water-boxes between the boiler-shells and casing-pipes, and water-tubes connecting these boxes and the back head.

10. The combination, substantially as hereinbefore set forth, of the back head, the outer circulating-tubes screwed into both its walls, an inner tube with its flanged head screwed into the outer tube, a screw-plug closing the outer tube, and lateral openings in the outer tube on each side of the flanged head of the inner tube, whereby water is caused to flow from the back head through the inner tube between it and the outer tube and then back to the water-space in the back head again.

11. The combination, substantially as hereinbefore set forth, of a back head, a boiler-shell, a back connection between them, semi-girders connecting the shell and back head, feed-water-circulating tubes projecting from the back head, and fire-brick interposed between the semi-girders and circulating-tubes.

In testimony whereof I have hereunto subscribed my name.

JOHN BAIRD.

Witnesses:

A. J. BAIRD,

ADDISON W. BAIRD.