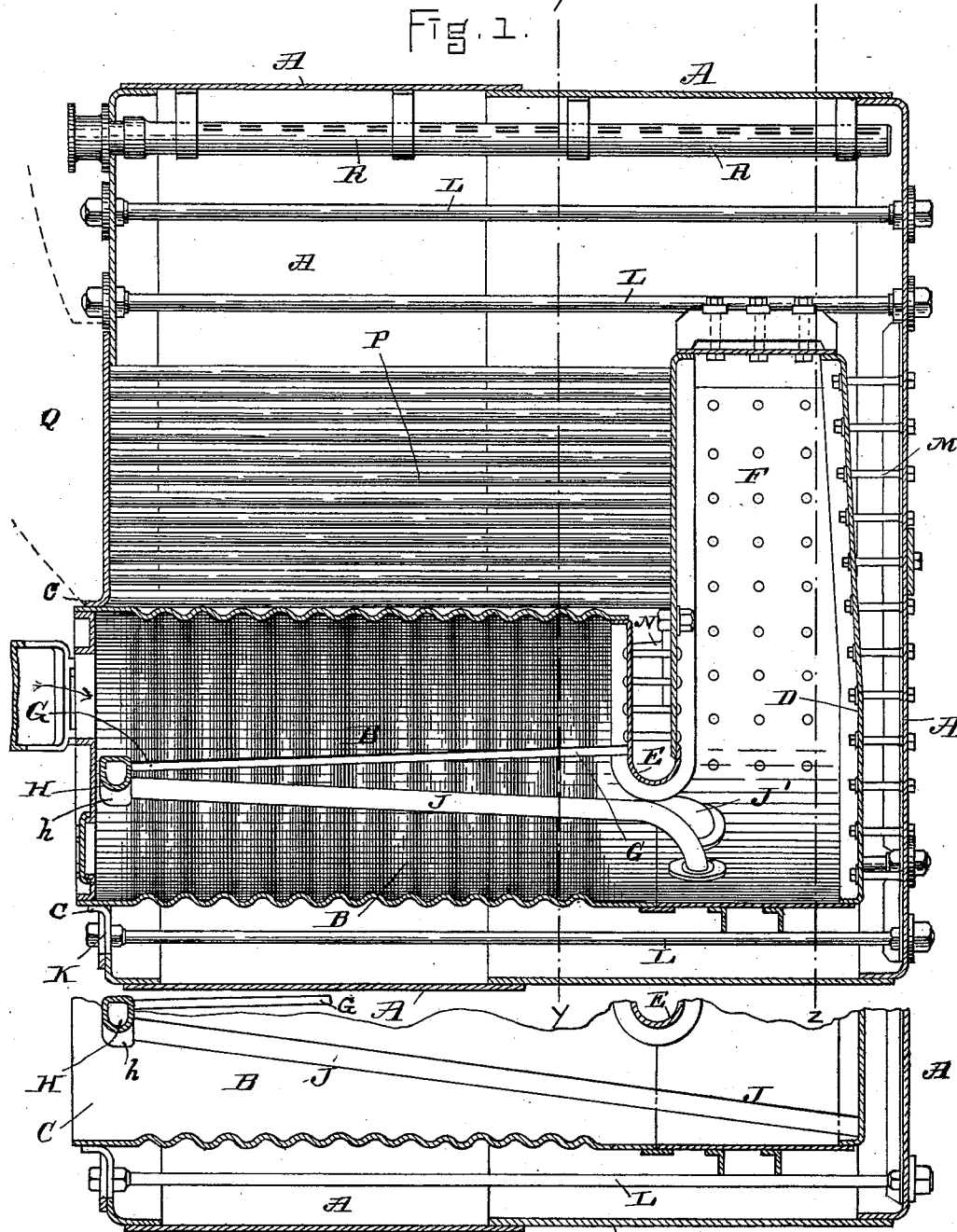


G. A. AYER.  
STEAM BOILER AND FURNACE.

No. 455,698.

Patented July 7, 1891.



WITNESSES.

*Henry Marsh.*  
*James D. Duice.*

FIG. 4.

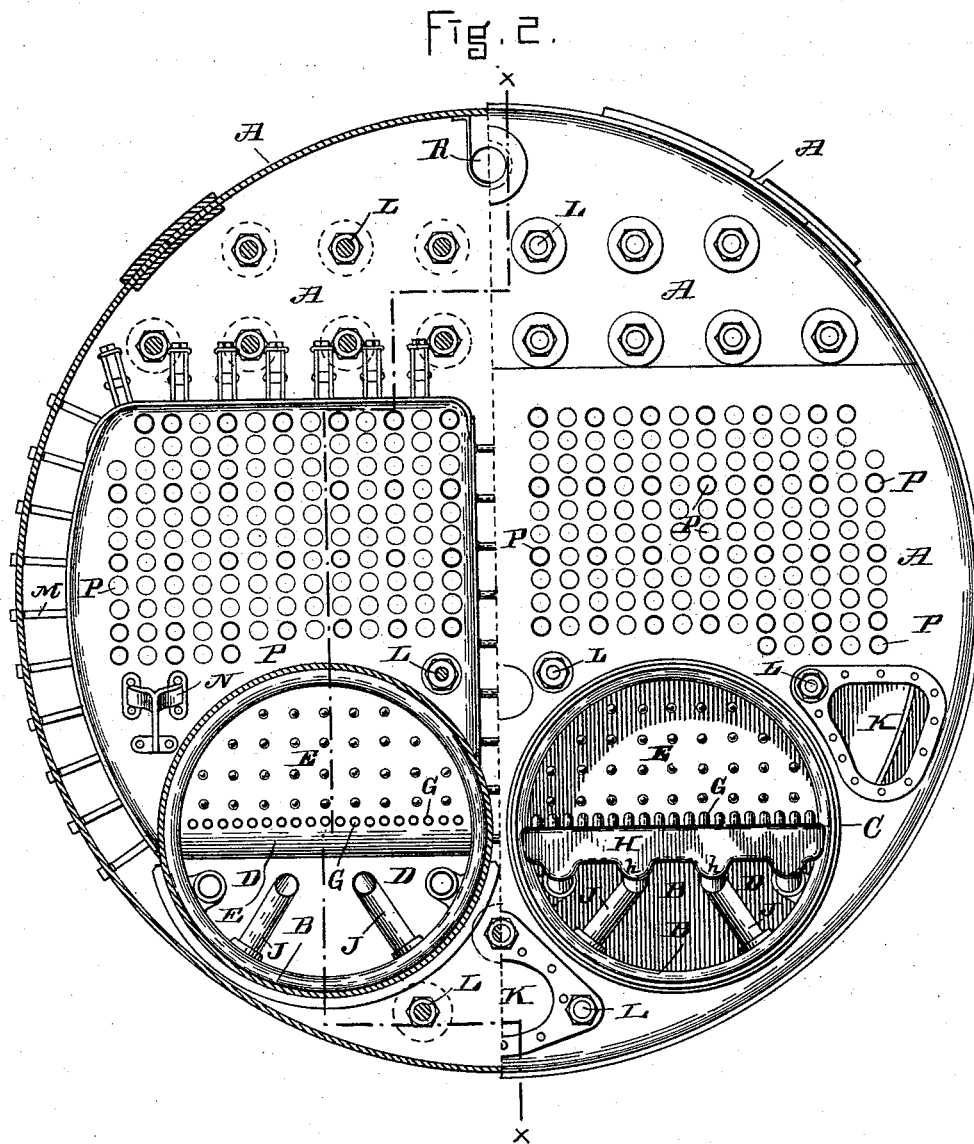
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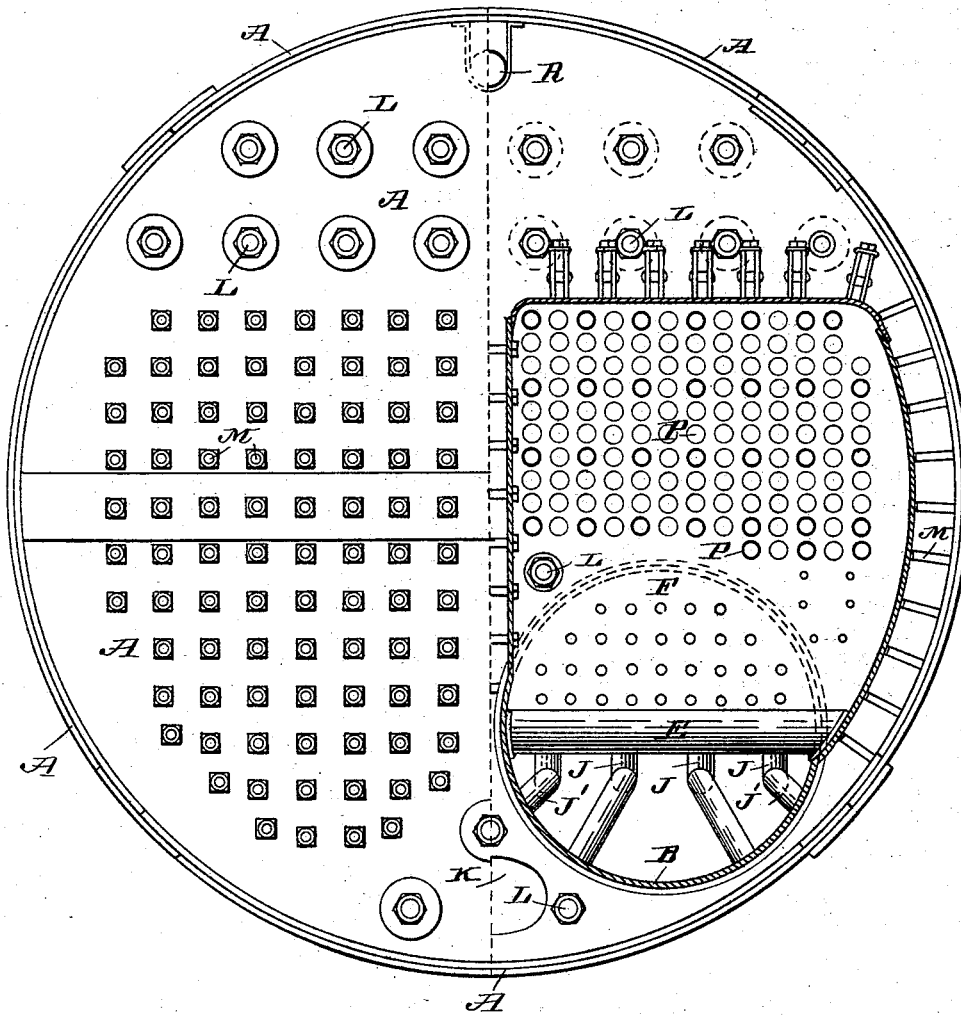
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Fig. 3.



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INVENTOR.

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*Attorney*

# UNITED STATES PATENT OFFICE.

GEORGE A. AYER, OF WORCESTER, MASSACHUSETTS, ASSIGNOR TO THE  
COMPLETE COMBUSTION COMPANY, OF PORTLAND, MAINE.

## STEAM-BOILER AND FURNACE.

SPECIFICATION forming part of Letters Patent No. 455,698, dated July 7, 1891.

Application filed October 3, 1890. Serial No. 366,926. (No model.)

*To all whom it may concern:*

Be it known that I, GEORGE A. AYER, of Worcester, in the county of Worcester and State of Massachusetts, have invented certain new and useful Improvements in Steam-Boilers and Furnaces, of which the following, taken in connection with the accompanying drawings, is a specification.

This invention is in the nature of an improvement upon the apparatus shown in Letters Patent of the United States No. 394,131, granted December 4, 1888, to Post and Sawyer for steam-boiler and furnace. Said apparatus embodied in a downdraft-boiler a suitable water-back, an independent water-box free from attachment to the walls of the boiler, and a series of tubular grate-bars and water-supply pipes therefor directly connecting such water-back and box and providing a circulation from and to the water-back through said pipes, box, and grate-bars.

By my improvement the water-supply is drawn from the bottom of the boiler beneath the fire-box, the supply-pipes extending thence obliquely upward and forward to the water-box, from which the grate-tubes run rearwardly to the water leg or back. By this construction the water leg or back is relieved from much of the weight and strain borne by it in said prior apparatus, the circulation is much improved by drawing water from the bottom of the boiler, and the caloric-current is caused to impinge twice against and to run nearly parallel with the supply-pipes in its course from the fuel-chamber downwardly between the grate-tubes and the supply-pipes and rearwardly passing the lower ends of the supply-pipes. Said current then rises into a chamber in rear of the water-leg and passes to front or rear through ordinary boiler-flues to the uptake, or it may rise through vertical flues, as in the construction shown in said patent.

The several features of my invention are hereinafter described, and are particularly referred to in the appended claims.

In the drawings my invention is shown as embodied in a boiler having within a single cylindrical shell two distinct fire-boxes, each supplemented by its set of horizontal flues

running above it from the vertical extension of such fire-box to the uptake, so as to provide for two independent fires, either of which may be used without the other, or both in concert.

Figure 1 is a longitudinal section on the line *xx* of Fig. 2, and Figs. 2 and 3 are respectively front and rear end elevations, one-half of each figure in vertical section on the lines *yz* of Fig. 1. Fig. 4 is a modification.

A is the external shell, and B B the fire-boxes placed side by side and somewhat apart from each other in the lower part of the shell A. The fire-boxes are preferably corrugated steel cylinders to insure the maximum of strength. The front end of each is shown protruding through a collar C in the end wall of the boiler, while the other end is at its lower half secured to the inner plate of the rear water-containing wall D.

E represents a rigid depending water leg or wall closing the upper half of the fire-pot at a suitable point, leaving behind it an upright chamber F as a vertical extension of the combustion-chamber.

G is the water-grate formed of a series of parallel tubes entering at their inner ends the water-leg E and at their outer ends the transverse water-box H, which box is independent of the walls of the fire-box, so that it can yield with the expansion and contraction of the grate-tubes.

J J are water-supply pipes running from the water-box H through the bottom of the fire-box and bringing water thus from the lower portion of the boiler through the water-box and tubular grate into the water-leg E. The pipes J J extend obliquely from the water-box H, preferably to a point nearly under the water-leg E, where they are furnished with an elbow or formed on a curve J', such elbow or curved part of the pipe running about radially toward and through the lower part of the shell of the fire-box. By making these pipes radiate to right and left, as in Fig. 2, a wide space is given for raking out ashes from beneath the grate and access for workmen to enter the chamber F is afforded. I prefer to form bosses or pockets  $\frac{1}{2}$  on the lower part of the water-box to receive the ends of

the supply-pipes J. Man-holes K are provided between and on either side of the fire-boxes, and strong stay-rods L, stay-bolts M, and curved supports N are furnished.

5 P P represent boiler-flue tubes, in this instance running horizontally above the fire-boxes from the upright chamber F forward to the uptake Q, (indicated by dotted lines at the left of Fig. 1.) The caloric-current, after  
10 acting upon the water-walls on all sides of said chamber, passes through the flues and escapes upwardly. A perforated pipe R may receive steam from the upper part of the boiler and can be coupled to an external pipe to convey it to any desired point.

15 The flue tubes of the boiler are arranged in two distinct series, each appertaining to one of the fire-boxes and each secured at the inner end to the metallic shell or wall of the  
20 vertical extension F rising from the fire-box, a broad water-space being reserved between said shells or chambers themselves and between each and the side walls A of the boiler. Thus each fire-box may be operated without  
25 the other, if desired.

In the modification, Fig. 4, the supply-pipes J run from the water-box H obliquely to the lower part of the boiler and penetrate the rear wall of the chamber F at the bottom of  
30 the fire-box, instead of going through the bottom itself. With this construction, which forms a part of my invention, similar results are obtained, the circulation is approximately the same, the bracing effect of the truss is secured, with freedom of expansion to grate-  
35 tubes and supply-pipes, and the heat applies to such tubes and pipes in substantially the same way.

I claim as my invention—

40 1. The fire-box formed with a depending water leg or wall and the water-grate con-

necting at its inner end directly with the lower part of such leg or wall, in combination with the water-box connected to the opposite end of the grate-tubes, and with the feed-  
45 pipes leading obliquely upward from the lower part of the boiler to said water-box, whereby water is supplied from the bottom of the boiler direct to the grate, substantially as set forth.

2. The fire-box formed with a depending  
50 water leg or wall and the independent water-box free from attachment to the fire-box shell, in combination with the water-grate connecting said water-leg and box, and with the oblique and radially-arranged supply-pipes con-  
55 necting said water-box with the bottom of the boiler, substantially as set forth.

3. The boiler-shell A, fire-box B, inclosed therein, and depending water-leg E, with the vertical chamber F behind it, in combination  
60 with the water-grate G, box H, and supply-pipes J within the fire-box, and the flues P, leading from said chamber, substantially as set forth.

4. The boiler-shell A, fire-boxes B B, with  
65 their respective vertical extensions F F separated by a water-passage and placed side by side within said shell, and the distinct series of flues P P appertaining thereto, in combination with a water-grate suitably supplied  
70 with water, and a depending water leg or back enforcing a downward draft through said grate, substantially as set forth.

In testimony whereof I have signed my name to this specification, in the presence  
75 of two subscribing witnesses, on this 15th day of July, A. D. 1890.

GEORGE A. AYER.

Witnesses:

A. H. SPENCER,  
JAMES P. PRINCE.