E. REYNOLDS.

Steam-Boiler Furnace.

No. 220,424. Patented Oct. 7, 1879.

Fig. 1.

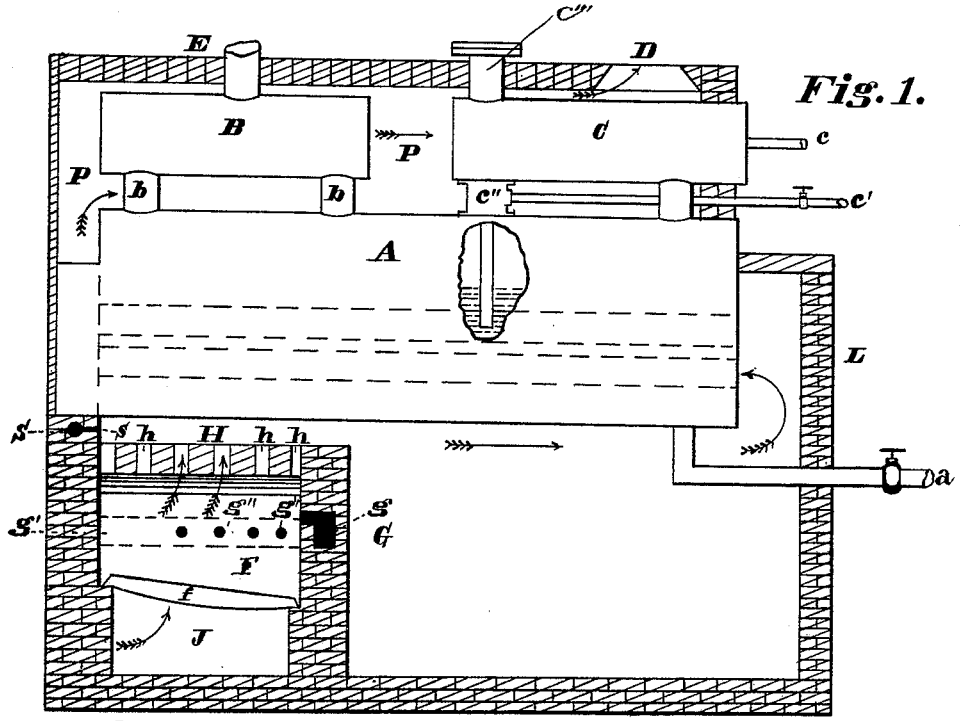


Fig. 2.

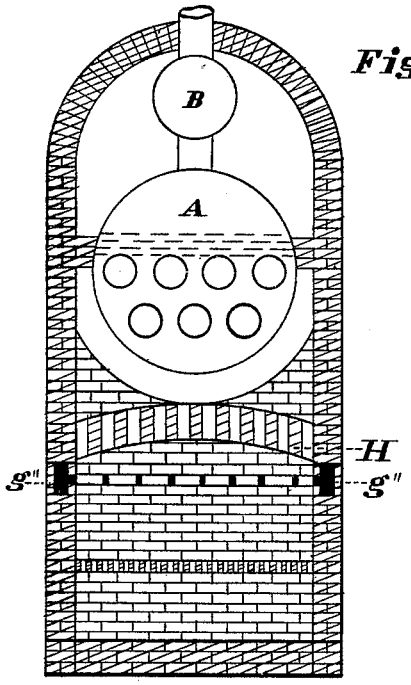
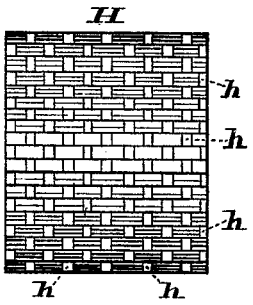


Fig. 3.



Attest.
Collingford Jr.
A. G. Collins

Inventor.
Edwin Reynolds
by
John H. Hill
Atty

UNITED STATES PATENT OFFICE

EDWIN REYNOLDS, OF MILWAUKEE, WISCONSIN.

IMPROVEMENT IN STEAM-BOILER FURNACES.

Specification forming part of Letters Patent No. **220,424**, dated October 7, 1879; application filed July 29, 1879.

To all whom it may concern:

Be it known that I, EDWIN REYNOLDS, of Milwaukee, in the county of Milwaukee and State of Wisconsin, have invented certain new and useful Improvements in Steam-Boiler Furnaces, of which the following is a specification.

This invention relates to certain improvements in the construction of steam-boiler furnaces; and it has for its object to provide for the thorough consumption of the products of combustion of the fuel in the fire-box, as more fully hereinafter described.

In constructing my improved furnace the grate is set in the usual manner, either inclined or horizontal, as may suit the fancy of the builder; but the side walls, instead of being solid, as in ordinary construction, are provided with longitudinal air ducts or passages, placed a proper distance above the grate to discharge the entering air through small apertures into the fire-chamber above the bed of fuel. Experience has shown the best position for the air ducts and openings into the fire-chamber to be close under the perforated reverberatory arch, to be described hereinafter.

The rear wall of the fire-chamber, which in my construction of furnace for steam-boiler use occupies the position of the ordinary bridge-wall, is provided with a lateral duct or air passage, from which small apertures open into the fire-chamber in line, or nearly so, with the openings from the air-ducts in the side walls.

The ends of the lateral air-duct in the rear or bridge wall of the fire-chamber unite with the inner ends of the side-wall air-ducts, and a single register at the front end of either of the side-wall air-ducts controls and regulates the inflow of air to the fire-chamber.

Over the grate, at a proper distance therefrom, I spring an arch of refractory material, through which, by means of the perforations shown, the products of combustion pass up under the shell of the boiler. This arch is supported on the side walls in any proper manner, and extends from the front wall to the rear wall of the fire-chamber, completely inclosing the same and forming an oven or reverberatory furnace, the distance between the top of the arch and the shell of the boiler being fixed in practice as in regulating the space over the bridge-wall in ordinary furnace construction.

In the front wall of the furnace a lateral air-duct is provided, from which small apertures lead into the space over the perforated arch.

In the accompanying drawings, Figure 1 is an elevation of the boiler and a longitudinal section of the fire-chamber and furnace. Fig. 2 is a cross-section of the boiler and furnace through the center of the fire-chamber.

Similar letters of reference indicate similar parts.

A is the shell portion of an ordinary return-flue boiler. B is the steam-drum, connected to the boiler by legs *b b*. C is the water drum and heater, into which the feed is introduced by the pipe *c*. C′ is the blow-out pipe from the mud-well C″. C‴ is the stand-pipe, and *a*′ the feed-pipe to the boiler. The lower end of the feed-pipe *a*′ is carried several inches below the water-line in the boiler.

a is the blow-off pipe from the boiler, and E is the steam-pipe leading off from the superheating-drum.

F is the fire-chamber; *f*, the grate; J, the ash-pit; G, the rear wall of the fire-chamber. H is the perforated arch, and *h h h* the perforations, the aggregate area of which is determined by the conditions under which the furnace works. *g* is the air-duct in the rear wall, and *g*′ *g*′ the air-ducts in the side walls, with openings or apertures *g*″ *g*″ into the fire-chamber. S is the air-duct in the front wall of furnace, with apertures *s*, leading into the space over the perforated arch.

In operation, coal or other fuel is charged on the grate in the usual manner, and furnished with air through the ash-pit **J**, as shown by the curved arrow, for the combustion of the fixed carbon. The combustion of the carbon generates heat sufficient to distill and separate from the carbon the volatile matter in the fuel, which matter is supplied with air (oxygen) by means of the perforated air-ducts *g* and *g*′ *g*′, and is converted into carbonic acid before passing through the perforations in the arch over the grate.

In all attempts heretofore to obtain complete combustion in steam-boiler furnaces one very essential condition has failed to obtain—*i. e.*,

the maintenance at a high temperature of the volatile gases while the conversion into carbonic acid is taking place. This condition of high temperature is obtained by the use of the arch of refractory material over the grate, which furnishes a very high and practically uniform temperature of combustion of the gases.

In all other constructions of furnace or fire-chamber for steam-boiler use, so far as I am aware, the under surface of the boiler forms the roof of the fire-chamber, and the facility with which the iron transfers and the water takes up heat prevents the maintenance of a high temperature in the upper part of the fire-chamber; and as the volatile matter, by reason of its low specific gravity, naturally ascends to the top of the fire-chamber, it follows that this condition which I have found essential for combustion of the gases cannot obtain in any but an oven type of fire-chamber.

The products of combustion from the fixed carbon and the gases pass through the perforations in the arch, thence under the boiler, and to the chimney by the route already described.

I am aware that air-ducts in the side and rear and front walls of steam-boiler furnaces are not new. These, considered independently, I do not claim as a part of my invention.

I am also aware that the turning of an arch over the top of the boiler and the formation of a flue between the arch and the upper surface of the boiler is also old and well known. This I do not consider a part of my invention.

Having described my invention, what I claim is—

1. The perforated arch H, above the grate of a steam-boiler furnace, in combination with the side walls and end walls of the fire-chamber F, grate *f*, and steam-boiler A, for the purpose and as specified.

2. The perforated arch H, air-ducts *g* and *g'* *g'*, in combination with the grate *f*, side and end walls of the fire-chamber F, and steam-boiler A, for the purpose and substantially as specified.

3. The perforated arch H, in combination with air-ducts *g* and *g'* below the arch and air-duct S above the arch, for the purpose and substantially as described.

In testimony whereof I have hereunto set my hand this 14th day of July, 1879.

EDWIN REYNOLDS.

Witnesses:
GEO. E. PALMER,
WM. W. ALLIS.