2 Sheets—Sheet 1.

C. W. REED.

Steam Boilers and Furnaces.

No. 209,514. **Patented Oct. 29, 1878.**

Fig. 1.

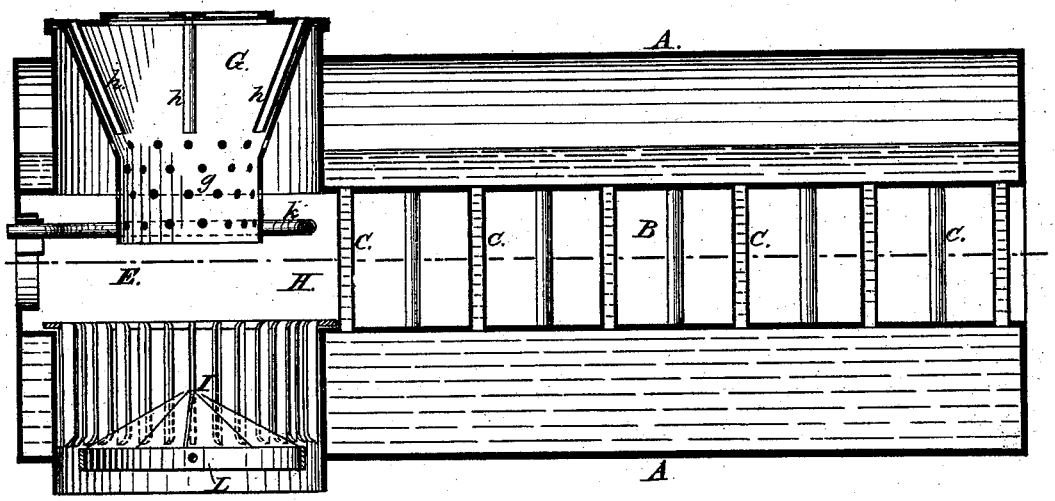

Fig. 2.

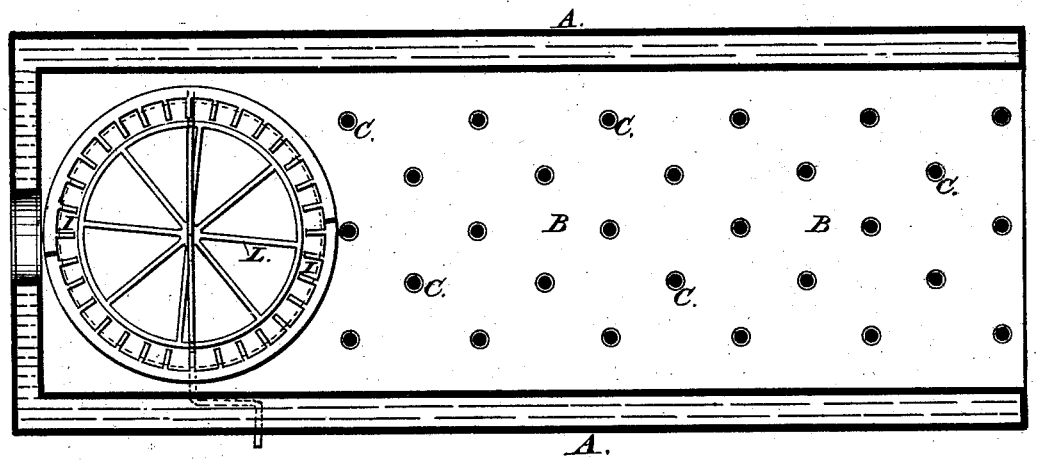

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Fig. 3.

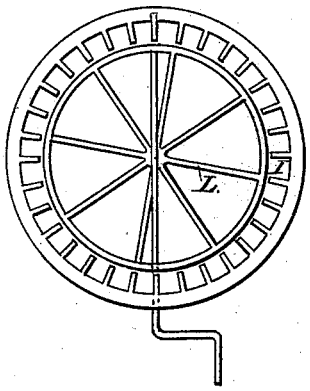


Fig. 4.

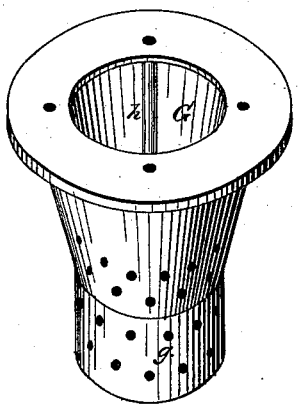


Fig. 5.

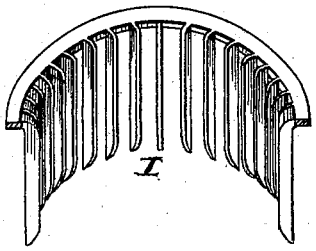


Fig. 6.

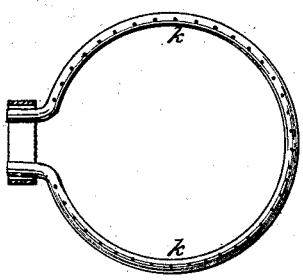
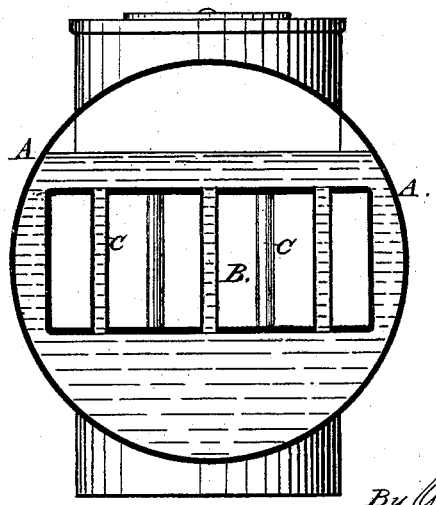


Fig. 7.



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UNITED STATES PATENT OFFICE.

CULLIN W. REED, OF CHAGRIN FALLS, OHIO.

IMPROVEMENT IN STEAM-BOILERS AND FURNACES.

Specification forming part of Letters Patent No. **209,514**, dated October 29, 1878; application filed September 25, 1878.

To all whom it may concern:

Be it known that I, CULLIN W. REED, of Chagrin Falls, in the county of Cuyahoga and State of Ohio, have invented certain new and useful Improvements in Steam-Boilers and Furnaces, of which the following is a specification:

This invention relates to certain improvements in steam-boilers and furnaces and other steam-generators, its object being to secure the most perfect combustion of the fuel and the smoke, soot, and gaseous products arising therefrom; to facilitate the coking of the bituminous varieties of coal when such are employed as fuel; to secure a perfect and thorough circulation of the water, and prevent the deposition of sediment within the tubes and other portions of the boiler which are subjected to the direct action of the heat from the furnace, whereby the overheating of such parts is prevented; and to collect the sediment that may be deposited in the cooler part of the boiler, from whence it may be readily removed.

My invention consists in the combination, with a horizontal boiler having a horizontal flue, through which extend a series of vertical flues, of a furnace provided with a vertical grate and a magazine located in the upper part, the lower part of said magazine being perforated and surrounded by an annular air-tube communicating with the open air, the upper part of the magazine being provided with a series of air-tubes extending from the top of said magazine to the perforated portion, the vertical grate, air-tube, and the tubes and perforations in the magazine all operating in conjunction to supply a large amount of air to the combustion-chamber, in order to consume the tar and gases generated in the lower part of the magazine, whereby the magazine is prevented from becoming clogged and an intense heat is produced.

In the drawings, Figure 1 represents a vertical longitudinal section of my improved boiler; Fig. 2, a horizontal section of the same. Fig. 3 represents a top view of the fire-box with the top and magazine removed. Fig. 4 represents a detached perspective view of the magazine; Fig. 5, a detached perspective view of the vertical portion of the grate. Fig. 6 is a plan view of the annular perforated tube for applying air to the combustion flue or chamber. Fig. 7 is a front view of the boiler and furnace.

The letter A represents a cylindrical shell or outer casing of a horizontal boiler, and B a rectangular flue, extending from end to end thereof, and united at the heads of the same. Said flue is of such size as to leave a continuous water-space around it, and is stay-bolted to the boiler, in order to hold said flue firmly in position. Within the flue, and extending through it, are set a series of water-tubes or small flues, C, which connect the upper and lower portions of the water-space. These tubes are shouldered near their ends, and are calked on the water-surface of the flue-sheets, instead of on the fire-surface of the same, whereby all liability of the ends of said tubes to be burned out is entirely obviated. The tubes are arranged in transverse parallel rows, those of each row standing opposite the spaces between the tubes of the rows on each side of it, whereby the products of combustion are compelled to take a zigzag course through the rectangular flue and around the tubes, by means of which the heat is effectually absorbed and thoroughly utilized.

The letter E represents the furnace, which is located at the forward end of the boiler. Said furnace is formed in three sections, the upper section forming a receptacle for a magazine, the intermediate section a combustion flue or chamber, and the lower section forming the fire-box of the furnace. In the upper section is located a magazine, G, consisting of an inverted frustum-shaped shell, having a short cylindrical downward extension, *g*, at its lower end. The lower part of said section and the cylindrical extension are preferably perforated, as shown, in order to permit the tar and gases generated from the heated coil to escape into the combustion-chamber and be consumed. The perforations, however, may be omitted, and the tarry matters will escape from the open lower end of the magazine. From the upper part of the magazine extend downward a series of air flues or tubes, *h*, which communicate with the open air at their upper ends, and terminate at their lower ends on or about a line with the upper series of per-

forations in said magazine when it is perforated. These flues serve to admit air to the gases generated in the lower part of the magazine, so as to insure the combustion of the same in the combustion-chamber.

The letter H represents the combustion chamber or flue, in which the lower end of the magazine extends. Said combustion-chamber is located in the forward end of the flue B, and the burning gases and heated products of combustion pass directly from said chamber into the flue, and through the same toward the smoke-stack. The letter *k* represents an annular pipe, perforated on the lower side, located within the combustion-chamber, and surrounding the lower part of the magazine, its ends communicating with the open air, whereby a current of air is admitted into the combustion-chamber, to facilitate the combustion of the gases therein. The letter I represents the fire-box, which may be of any desired shape, in the present instance being cylindrical, which is the most convenient form. Within said fire-chamber is located a vertical grate, or series of grate-bars along the sides of the fire-box, said grate being of a configuration to correspond with the fire-box. In the present instance the said grate is cylindrical in shape, and is made in two sections for convenience of insertion and removal. The top of the grate is constructed with an annular flange, which rests upon the upper edge of the fire-box and holds it in place.

The letter L represents the grate, pivoted at the lower part of the fire-box in such manner that it can be readily and conveniently dumped.

The operation of my invention is as follows: The fire is started in the furnace and the magazine properly filled with coal at the top. The air, entering from below the furnace, passes up through the conical grate into the center of the fuel, and at the same time up between the vertical grate-bars, insuring perfect combustion of the fuel, and preventing the same from coming into actual contact with the walls of the fire-box, whereby all liability of injury to the same by the intense heat of the burning fuel is obviated. The flames and products of combustion pass upward into the combustion or flue chamber, where they are met by the tarry matter and gases escaping from the magazine, and by the current of air from the annular pipe in the combustion-chamber. These tarry matters and gases are ignited, and the combined products of the combustion of these and the burning fuel in the fire-box pass into the rectangular flue, where they are compelled to circulate thoroughly between and around the short pipes, by means of which the heat is thoroughly absorbed on the passage of the heated products to the smoke-stack.

The vertical grate, the annular tube, and the perforated magazine, with the air-tubes in its upper part extending downward to the perforated part of the magazine, all operate to supply a large amount of air to the combustion-chamber, which is necessary, when burning bituminous coal, to consume the tarry matter and gases generated in the magazine, and which, if not consumed, would clog the magazine, and would cause deposits in the flues, and entail the loss of valuable combustible material.

It will be seen that as thus constructed the boiler has the combined advantages of a horizontal and vertical boiler, inasmuch as the tubes or flues in the horizontal flue provide for direct upward currents of water in the same manner as in a vertical boiler, which is the most effective arrangement, as the circulation of the water is much more rapid in such than where it has to circulate through horizontal tubes. As the furnace is entirely surrounded by water, it will be evident that no heat can be lost by reduction.

The furnace is adapted to the use of any variety of coals, bituminous as well as anthracite, as the tarry matters and gases are burned off in the magazine, coking the coal as it reaches the lower part of the same, in which condition it readily feeds downwardly into the fire-pot.

The perpendicular wedge-like space around the upper part of the magazine is a hot-air space, which assists to heat the coal when first put into the magazine, and also aids in keeping the steam in the steam-space heated.

By reason of the large number of water-tubes, the water is divided into numerous small columns, whereby the steam is much more rapidly generated than in boilers of ordinary construction, averaging only about thirty minutes to sixty pounds pressure from cold water, and as the main body of the water is at the bottom of the boiler, where it is least agitated, all sediment settles there, entirely away from the fire-surface, rendering it less likely to burn the boiler by reason of the collection of such sediment, thereby obviating the most serious danger attendant upon the use of steam-boilers; and by means of suitable man-holes at the top and bottom, with ample room to work above and below the rectangular flue, provision is made for readily cleaning and repairing the boiler.

All cold drafts at the time of charging the furnace, which are most objectionable in the ordinary furnaces, are wholly done away with, as there are no doors leading directly into the combustion-chamber or fire-box, the coal being charged into the magazines. Consequently the fires are never deadened or the heating-surfaces cooled, as in other boilers.

It requires little attention, and combines simplicity, strength, durability, safety, adaptability, and economy; does not exceed in cost the fire-box tubular boiler, and is adapted to locomotive, marine, or stationary work, as well as general heating purposes.

What I claim is—

In combination with a boiler having a horizontal flue, a furnace having a vertical grate

and a magazine in its upper part, the lower part of said magazine being perforated and surrounded with a perforated air-tube communicating with the open air, the upper part of the magazine being provided with a series of air-tubes extending from the top to the perforated portion, all operating in conjunction to supply a large amount of air to the combustion-chamber, whereby the tar and gases generated in the magazine are consumed, in order to prevent clogging and intensify the heat, substantially as specified.

In testimony that I claim the foregoing I have hereunto set my hand in the presence of the subscribing witnesses.

CULLIN W. REED.

Witnesses:
A. C. BARBER,
S. L. WILKINSON.