

G. C. MARDEN.
STEAM BOILER AND FURNACE.

Patented Aug. 18, 1891.

Francis E. Galloupe.
R. L. Roberts.

George C Marden

UNITED STATES PATENT OFFICE.

GEORGE C. MARDEN, OF WINTHROP, MASSACHUSETTS.

STEAM-BOILER AND FURNACE.

SPECIFICATION forming part of Letters Patent No. 458,118, dated August 18, 1891.

Application filed May 7, 1891. Serial No. 391,991. (No model.)

To all whom it may concern:

Be it known that I, GEORGE C. MARDEN, a citizen of the United States, residing at Wintthrop, in the county of Suffolk and State of Massachusetts, have invented certain new and useful Improvements in Steam-Boilers and Furnaces, of which the following description, with the drawings accompanying the same, is a specification.

My invention relates chiefly to furnaces known as "downward-draft furnaces," used in connection with tubular boilers; and it consists in an improved arrangement of water-tube grate-bars and in their connection with the water-spaces of the boiler, and also in the manner of protecting the walls of the furnace around the combustion-chamber, and in the construction of the front of the furnace to accommodate the movement incident to the expansion and contraction of the grate-bars and other horizontal parts of the furnace connected with its front.

My improvements are in rigidly connecting the tubular grate-bars at their outer ends with the inner plate of the water-front of the furnace and at their inner ends with the front tube-sheet of the boiler, in arranging within the combustion-chamber, beneath the grate, near to and around the inner surface of the shell, and substantially concentric with it, a series of water-tubes, which are also rigidly connected at their respective ends with the said water-front and tube-sheet; and, further, in so connecting the arch or crown sheet of the furnace with the front tube-sheet of the boiler as to divide the fire-tubes into two groups, by which arrangement I obtain in a simple manner a return-tube boiler which is very effective; and, also, in making the front plate of the furnace independent of and unattached to the cylindrical shell of the boiler, so that it may readily move or slide within the shell to accommodate the expansion and contraction of the grate-bars and other internal parts of the furnace which are connected with the said front plate.

Referring to the drawings, Figure 1 is a diametrical longitudinal vertical section of my improved furnace and boiler. Fig. 2 is a front end elevation of the furnace, with the right half of the front plate and water-front removed. Fig. 3 is a vertical section of the fur-

nace on line *x x*, Fig. 2, showing a modification of the construction of the furnace-arch sheet.

Similar letters are used to designate the same parts of the apparatus wherever shown.

A indicates the fuel-chamber; B, the combustion-chamber beneath the grate, and C the tubular grate-bars.

In Fig. 1, D indicates a supplemental water-space, bolted to the front tube-sheet H, and into which the ends of the grate-bars are screwed.

As illustrated in Fig. 3, the supplemental chamber D is omitted and the grate-bars are screwed directly into the tube-sheet H.

E is the water-front of the furnace, into the inner plate of which the grate-bars are fastened.

F F indicate the water-tubes, each connected with the water-front E and the tube-sheet H and arranged around near the shell of the furnace within the combustion-chamber B to serve as a protection to the shell and at the same time present a large water-heating surface.

G indicates the arch or crown sheet of the furnace, which may be a metal sheet lined with a fire-resisting material *g*, or it may be made wholly of fire-brick or other suitable material.

H indicates the front tube-sheet, and K the back tube-sheet, of the boiler, into which the fire-tubes I I' are fastened.

L is a smoke-chamber at the rear end of the boiler, and M another chamber at the front of the boiler over the crown or arch sheet of the furnace, and out of which the "uptake" N of the furnace leads.

O indicates the back plate of the boiler, in which there is an opening covered by a door P, having a lining Q of asbestos or equivalent material.

W indicates the main water-space of the boiler having a steam-pipe S leading therefrom and a man-hole R.

V indicates a hand-hole, through which the lower part *m* of the chamber M may be cleaned.

T indicates a fusible plug in back tube-sheet K at the prescribed low-water line of the boiler.

The front plate of the furnace, including

the water-space E, is detached from the shell, but is made to fit closely into the end of the outer shell of the boiler, although not bolted thereto. The grate-tubes C, tubes F, and the furnace arch G, all being securely attached to the said front plate of the furnace and to the front tube-sheet H of the boiler hold the said front plate in position and in proper relation with the shell of the boiler; but as it is not bolted to the shell it is free to move out or in upon its bearing-surfaces, as at *e e*, when the grate-tubes and other parts connected with the said front plate expand or contract, and thus relieve those portions of the boiler from all undue strain which might otherwise result therefrom.

a indicates one of the doors through which fuel is fed to the furnace and through which draft is given to it, and *b* is a door opening into the combustion-chamber and through which that chamber may be cleaned.

U indicates a blow-off pipe at the bottom of the water-front E.

In the modified construction shown in Fig. 3 the furnace-arch sheet G is turned upward at the inner end (indicated at *d*) for the purpose of protecting the fire-clay or other material with which the sheet G is lined from injury by blows of the hoe or other implement used in manipulating the fire. In some instances it may be found advantageous to construct the arch of the furnace as a water-space instead of protecting the sheet G with fire-clay, or a series of water-tubes may be arranged therein beneath the arch.

Although the operation of the furnace and boiler would be the same, whether constructed as illustrated in Fig. 1 or Fig. 3, I prefer that shown in Fig. 1, with the supplemental water-chamber D bolted to and extending across the front tube-sheet, because it gives greater strength to that sheet and a more rigid support for the inner ends of the tubular grate-bars.

The course of the heated air and products of combustion through my downward-draft furnace and boiler will be readily understood by the indicating-arrows, Fig. 1. When the doors *a* are opened, the current is through the fuel, downward into the combustion-chamber, thence through the lower group of fire-tubes I into the smoke-chamber L, upward, and back through the upper group of tubes I', into the chamber M, and through the uptake, N to the chimney.

I claim as my invention—

1. In a downward-draft furnace for a tubular boiler, the combination, with the shell, of a detached water-front, and a series of tubular grate-bars rigidly attached to said water-front and to the front tube-sheet of the boiler, substantially as described.

2. In a downward-draft furnace of a tubular boiler, the combination of a movable water-front, a series of tubular grate-bars which connect the main water-space of the boiler with said water-front, and a furnace-arch sheet which extends across the furnace and is attached to said water-front and to the front tube-sheet of the boiler at an intermediate position thereon, substantially as described.

3. In a downward-draft furnace of a tubular boiler, the combination of a series of tubular grate-bars connected with the water-front and with the front tube-sheet of the boiler, and a series of water-tubes arranged near the walls of the combustion-chamber beneath the grate, substantially as described, and for the purpose specified.

4. In a downward-draft furnace of a steam-boiler, the combination of a detached water-front, a tube-sheet provided with a supplemental water-chamber which extends across its width, and a series of tubular grate-bars connected with said water-front and with the supplemental water-chamber, substantially as described.

5. In a tubular steam-boiler provided with a downward-draft furnace, the combination of a detached front plate and a furnace-arch attached to said plate and to the front tube-sheet of the boiler at an intermediate location thereof, whereby the tube-openings in said sheet are divided into separate groups, substantially as described, and for the purpose specified.

6. In a steam-boiler provided with a downward-draft furnace, the combination of a movable front plate, a furnace-arch which extends from said front plate to an intermediate location of the front tube-sheet of the boiler, and a series of tubular grate-bars and water-tubes beneath, within the combustion-chamber, all connected with the said front plate and with the said front tube-sheet, substantially as described.

GEORGE C. MARDEN.

Witnesses:

FRANCIS E. GALLOUPE,
R. L. ROBERTS.