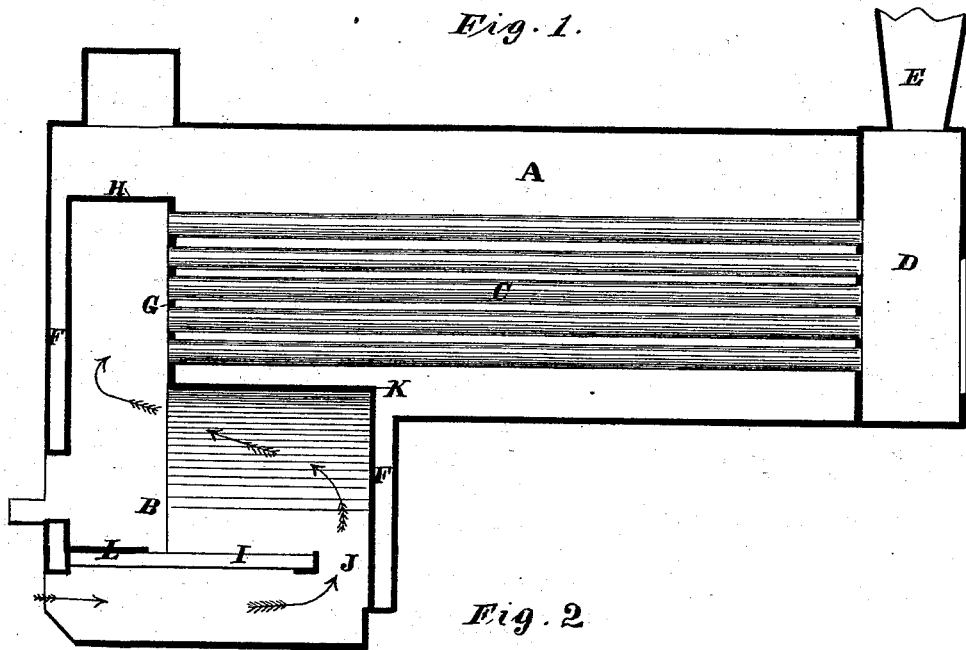


M. N. LAUFENBURG.  
Steam Boiler and Furnace.

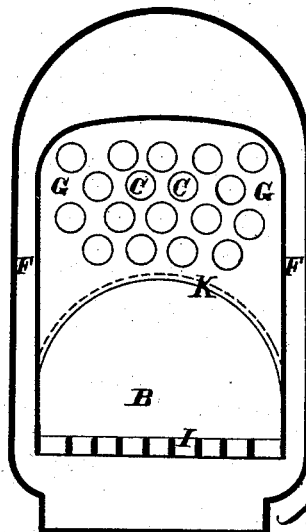
No. 215,466.

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*Fig. 1.*



*Fig. 2.*



Witnesses

*Geo. H. Strong.*  
*Frank A. Brooks*

Inventor

*Michael N. Laufenberg*  
*By Dewey & Co.*  
*attys*

# UNITED STATES PATENT OFFICE

MICHAEL N. LAUFENBURG, OF SAN FRANCISCO, CALIFORNIA, ASSIGNOR  
TO BAKER & HAMILTON.

## IMPROVEMENT IN STEAM-BOILER AND FURNACE.

Specification forming part of Letters Patent No. **215,466**, dated May 20, 1879; application filed  
February 24, 1879.

*To all whom it may concern:*

Be it known that I, MICHAEL N. LAUFENBURG, of the city and county of San Francisco, and State of California, have invented an Improved Steam-Boiler and Furnace; and I do hereby declare the following to be a full, clear, and exact description thereof, reference being had to the accompanying drawings.

My invention relates to certain improvements in the boilers and furnaces employed to make steam, usually for engines; and it consists of a novel construction of the boiler and fire-box, and the parts relating thereto, so that I obtain more heating and tube surface, utilize a certain portion of the fire-box without decreasing its capacity, and prevent the clogging of the tubes by inducing certain draft-currents in the fire-box, depending upon its peculiar shape, the grate, and the draft-openings.

While my invention is applicable to all kinds of boilers and furnaces, it is especially applicable to those where it is intended to use straw and other light fuels, which the draft has a tendency to carry into and against the ends of the tubes, so as to clog them.

The objects above described I accomplish by extending the tubes into the upper part of the fire-box, and securing them into a tube-sheet, which depends from the crown-sheet at a point between the front and rear walls of the fire-box, said tube-sheet extending across the fire-box, so as to be united with the side walls, while the plate beneath the tubes is made in the form of an arch, so as to concentrate and intensify the flame at that point, and also for the purpose of preventing deposits beneath the tubes.

In combination with this construction I employ a peculiar partial grate, having a draft opening or space at the rear, and a plate in front, extending a short distance back from the door, so as to direct the currents of air and assist the combustion, as will be more fully described by referring to the accompanying drawings, in which—

Figure 1 is a longitudinal vertical section of my boiler and fire-box. Fig. 2 is a transverse section.

I have shown my invention as applied to a boiler, A, having a fire-box, B, at one end,

and tubes C extending from this fire-box B to a smoke-box, D, at the opposite end, whence the waste products of combustion escape by a stack or chimney, E.

My fire-box is made with the usual water-legs or walls F F; but instead of the usual rectangular form, I have shown the flue-sheet G projecting downward from the crown-sheet H at a point nearly or about midway between the front and rear walls of the fire-box. I do not confine myself to the exact distance, but I make it sufficient to bring the flame forward against the water-space in front, in which the door is placed.

The crown-sheet is sufficiently arched for strength, as shown, and the sheet K, below the tubes, is made concave or arched, as shown, the sides uniting with the sides of the fire-box, so that any sediment will pass down into the space between the walls around the fire-box. The most important effect produced by this arch, however, is the concentration of the flame and heat which it causes, and this, in combination with the grate and draft-director, hereinafter described, is especially valuable for burning straw, &c.

The tubes C are thus extended into the upper part of the fire-box, being secured into the flue-sheet in any convenient manner, and, besides giving a large extension of the heating-surface, they occupy a part of the fire-box which is usually comparatively valueless; but the great advantage gained by this arrangement is its adaptation to the burning of light fuels, such as straw, without clogging the tubes.

Heretofore, when straw was used as a fuel in this class of tubular boiler-furnaces, it has been necessary to extend a sort of vertical grating up in front of the tubes, to prevent the light cinders from being carried against the ends of the tubes, so as to clog them and interfere with the proper combustion and the making of steam, and even this device had to be cleaned frequently, and was also open to the same objection; but in my invention the grate I is placed low, as shown, and the draft entering through the bottom carries the cinders and products of combustion against the rear wall of the fire-box, and thence they are deflected, so as to pass beneath the over-

hang or arch K below the tubes and toward the front of the fire-box, from this point being again turned upward against the crown-sheet and deflected, so as to allow the smoke, heat, and products of combustion to enter the tubes, so as to pass into the smoke-box, while at the same time a fresh supply of air and straw from the door meets this returning flame, and greatly intensifies the combustion. The grate I extends from the front of the fire-box, beneath the door, to a point near the rear end. I prefer to leave a space, J, behind the grate for the free passage of air from below the grate into the rear end of the fire-box, and this open space serves to direct the air-current. The front of the grate is closed at L, so that the air entering from below must pass to the rear before entering the fire-box. As the straw or other fuel is fed in from the front, the fiercest combustion will take place at the rear of the fire-box, and the flame and products of combustion will move forward in the direction indicated by the arrows. This change of direction will give more time to allow the cinders to become consumed, and those which are not so consumed will fall upon the top of the fresh fuel near the front of the fire-box, and will not be carried against the ends of the tubes C, so as to clog them.

As the flame rolls toward the front of the fire-box it is met by a supply of fresh air from the door, and this increases the combustion, and also turns the flame toward the tubes, so that an almost clear body of flame enters the tubes. It is a well-known fact that when the flame passes above a surface its heating effect is very small, and when it passes by the sides of a wall, as the sides of a boiler, the effect is correspondingly diminished.

For this reason I have formed the arched surface K below the tubes where they project into the fire-box, and continued it until it unites with the walls of the fire-box, and this concentrates the heat and flame, so as to produce the greatest heating effect and circulation, instead of distributing and separating it, as would be done if the surface were convex.

The concentration of heat in the center of the arch causes the strongest ebullition at that point, and the consequent course of the circulation of the water is from the sides toward the center and thence upward.

This is an important feature of my boiler, and the arched form produces a positive circulation, which cannot be accomplished by a convex form, or in return-flue boilers, where the heat passes through the center and back at the sides.

This method of protruding the flues into the fire-box above the grate and the arched sheet below prevents the incandescent fuel from being piled up against the ends of the flues, and thus burning out the thimbles or beads, so as to cause leaking flues.

By my method of forming the draft from the rear of the grate, the straw being fed in front, the front is continually pushed back to meet the returning flame, and the effect of this and the fresh draft admitted to meet the flame is such as to entirely consume the fuel, so that no cinders and but very little ashes will result.

By this construction I insure a perfect combustion of the fuel, and almost entirely obviate the clogging of the tubes which ordinarily takes places.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. The improved boiler and furnace consisting of the extended tubes C, united to the flue-sheet G at a point between the front and rear walls of the fire-box, and the walls of the fire-box united beneath the tubes by the arch K, substantially as set forth.

2. The fire-box B, having the tubes projecting into its upper part, and the flue-sheet G, depending from and united to the crown-sheet and the arch K beneath the tubes, in combination with the grate I and rear draft-openings, J, substantially as shown, and for the purpose herein described.

3. The fire-box B of an engine-furnace, having the tubes C projecting into it, as shown, and provided with the concentrating-arch K beneath, in combination with the grate I, closed in front and provided with the rear draft-opening, J, substantially as shown, and for the purpose herein described.

In witness whereof I hereunto set my hand.

MICHAEL N. LAUFENBURG.

Witnesses:

GEO. H. STRONG,  
FRANK A. BROOKS.