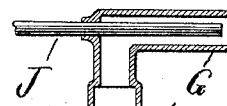
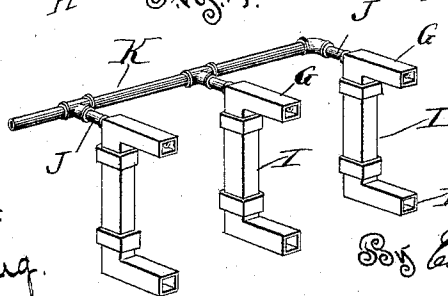
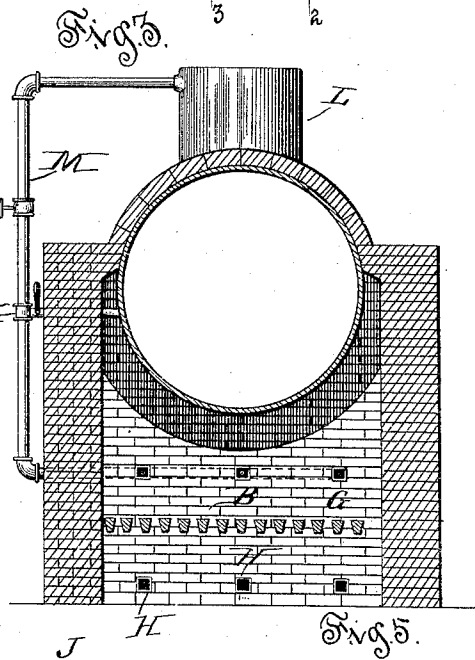
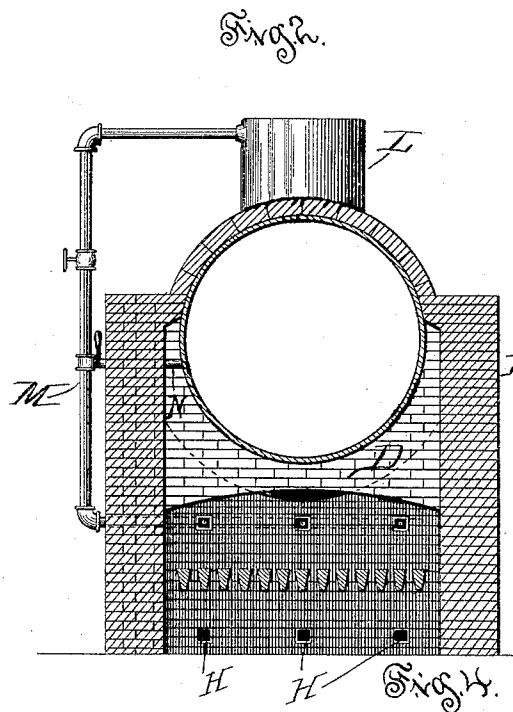
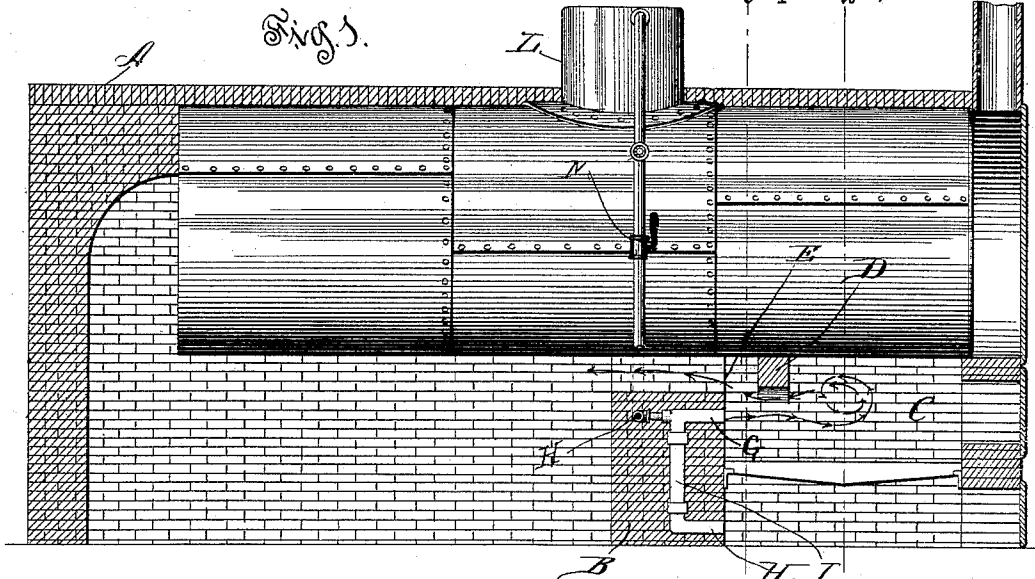


(No Model.)

F. L. HIGGINS.  
FURNACE.

No. 482,741.

Patented Sept. 20, 1892.



Witnesses.  
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# UNITED STATES PATENT OFFICE.

FRANK LEO HIGGINS, OF CHICAGO, ILLINOIS, ASSIGNOR OF ONE-HALF TO  
PERCY H. SLOAN, OF SAME PLACE.

## FURNACE.

SPECIFICATION forming part of Letters Patent No. 482,741, dated September 20, 1892.

Application filed March 8, 1892. Serial No. 424,222. (No model.)

*To all whom it may concern:*

Be it known that I, FRANK LEO HIGGINS, a citizen of the United States, residing at Chicago, county of Cook, and State of Illinois, have invented certain new and useful Improvements in Furnaces, of which the following is a full, clear, and exact specification.

My invention relates to improvements in furnaces, but more particularly to that class known as "steam-boiler furnaces," which employ buffer-drafts for retarding or detaining the smoke or products of combustion within the combustion-chamber until fully consumed.

The primary object of my invention is to cause or induce a natural draft in the combustion-chamber in such a direction as to oppose the rising products of combustion and force the same back into the combustion-chamber.

A further object of my invention is to so arrange the air-flues for discharging air into the combustion-chamber that their upper ends shall be heated to a very high degree, so as to induce an upward current of the air therein, and to accelerate this current by means of steam either drawn from some suitable source or produced by admitting water into the hot flue.

A still further object is to arrange a partition or deflector before the outlet or bridge-wall of the furnace and to guard the outlet over the bridge-wall by means of currents projected in such a direction as to force the products of combustion back into the combustion-chamber and behind such partition or deflector.

My invention consists in certain features of novelty in the construction, arrangement, and combination of parts by which these objects and other objects of minor importance are accomplished, hereinafter fully described with reference to the accompanying drawings, and more particularly pointed out in the claims.

In the drawings, Figure 1 is a vertical longitudinal section of a steam-boiler furnace embodying my improvements. Fig. 2 is a vertical transverse section taken on the line 2 2, Fig. 1. Fig. 3 is a similar section taken on the line 3 3, Fig. 1. Fig. 4 is a detail perspective view of the air-flues and the steam or water pipes leading thereinto; and Fig. 5 is a

detail sectional view of the upper end of one of the air-flues, showing the steam or water pipe leading thereinto.

In the drawings, wherein like signs of reference indicate like parts throughout the several views, A represents the boiler-setting, of any suitable construction, having a bridge-wall B, whose top side is preferably curved approximately parallel with the under surface of the boiler, as more clearly represented in Fig. 3.

Arranged within the fire-box C, against the under side of the boiler, is a deflector or partition D, whose underside is preferably curved, as shown in Fig. 2, in the opposite direction to the curve of the upper side of the bridge-wall, so as to project substantially below the opening between the bridge-wall and the boiler. This partition D, however, is arranged a short distance from the bridge-wall, so as to form an angular passage E between the opening over the bridge-wall and the combustion-chamber, through which the products of combustion must pass in order to escape.

Located preferably within the bridge-wall B are a number of vertical air-flues I, each of which is provided with horizontal branches G H at its upper and lower ends, respectively. The lower branches H of these flues may be connected with any suitable source of air-supply; but I prefer to lead them directly into the ash-pit, so that the air upon entering the flues will receive an initial heating. The upper branches G of these flues are arranged slightly below the upper edge of the bridge-wall and are adapted to project the air passing through the flues across the passage E, and thus force the ascending products of combustion back into the fire-chamber behind the partition or shield D. This current will take approximately the course illustrated by the line of arrows in Fig. 1—that is, upon first entering the fire-box it will be deflected slightly upward by the natural draft of the uptake until it has passed entirely under the shield D, where its force is overcome by the natural draft, which causes it to whirl around behind such partition against the under side of the boiler, and in being thus detained the smoke or products are fully consumed, and, being converted into highly-rarefied gases, pass un-

der the partition D and escape through the passage E over the bridge-wall. The air-flues I are metallic, and their horizontal branches G, being arranged at about the hottest point in the furnace, will ordinarily heat the air in such flues sufficiently to cause the desired upward current in the flues for forcing the products of combustion behind the partition D; but when the fires are first started or immediately after coaling-up, the smoke being very dense and the branches G being comparatively cool, the natural current passing through the flues is insufficient to fully accomplish the desired end. I therefore provide each of the horizontal branches G with a pipe J, which projects axially into such branch and terminates near the end thereof, as shown in Fig. 5, so as to constitute an injector-nozzle. These pipes J are in turn connected with a manifold pipe K, all arranged, preferably, within the bridge-wall, as shown, and this manifold K is in communication with the steam-dome L of the boiler through any suitable connection M. Thus upon starting the fires or immediately after coaling up a small quantity of steam may be turned on through the pipes K, which will induce a draft through the flues I and project the same across the passage E to the other side of the partition D, as already described, and thereby not only supplying the fire with steam and air, which in themselves promote combustion, but commingling these elements with the ascending products of combustion and holding them in the vicinity of the fire until fully consumed. In order, however, that a draft may be induced through the flues I before sufficient steam has been generated in the boiler, I connect the pipe M, by means of any suitable branch pipe N, directly with the boiler below its water-line, so that a small quantity of water may be allowed to drip down into the pipes J and the horizontal branches G, where it is instantly converted into steam and discharges into the combustion-chamber or fire-box, thus inducing the desired current across the passage E, it being understood, of course, that these pipes J and branches G become highly heated very shortly after the fire is started, owing to their interposition in the direct line of the natural draft.

In the drawings I have shown the flues I located within the bridge-wall, and while I prefer this arrangement for the sake of preventing such flues from burning out and for the further purpose of economizing space it is nevertheless very obvious that such flues might be arranged on the face of the bridge-wall within the fire-chamber. It is also obvious that the number of flues might be varied at will and that the lower edge of the partition D might be curved upward at its ends parallel with the upper sides of the bridge-wall B, if desired, without departing from the

spirit of my invention, such partition B being in the form shown and described for the sake of strength.

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

1. In a furnace, the combination, with the fire-box and the boiler, of air-flues having horizontal branches exposed to the heat of the fire-box and arranged to discharge thereinto against the natural draft of the furnace and pipes connected with the boiler and terminating within said horizontal branches, whereby water may be allowed to drip into said horizontal branches while heated, substantially as set forth.

2. In a furnace, the combination, with the fire-box, the ash-pit, and the boiler, of upright metallic air-flues communicating with the ash-pit and having horizontal branches exposed to the heat of the fire-box and arranged to discharge thereinto against the natural draft of the furnace and pipes connected with the boiler and terminating within said horizontal branches, whereby water may be allowed to drip into said horizontal branches, substantially as set forth.

3. In a furnace, the combination, with the fire-box and the bridge-wall, of upright air-flues having horizontal branches arranged to discharge into the fire-box away from the bridge-wall, the boiler, and the pipes extending into said horizontal branches of the air-flues and being connected with the boiler above and below its water-line, substantially as set forth.

4. In a furnace, the combination, with the fire-box and the bridge-wall, of a deflector arranged in said fire-box and projecting downwardly in front of the bridge-wall, upright air-flues arranged to discharge across the passage between the bridge-wall and said deflector against the natural draft of the furnace, the boiler, and pipes leading into said flues and being connected with said boiler above and below its water-line, substantially as set forth.

5. In a furnace, the combination, with the fire-box and the bridge-wall, of a deflector arranged within said fire-box and projecting downwardly in front of the bridge-wall, upright air-flues arranged within the bridge-wall and having horizontal branches at their upper and lower ends leading into the fire-box and the ash-pit, respectively, the pipes J, projecting into the horizontal branches at the upper ends of said flues, and the manifold pipe K, connecting with said pipes J and being connected with a steam-supply, substantially as set forth.

FRANK LEO HIGGINS.

Witnesses:

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F. A. HOPKINS.