(No Model.)

2 Sheets—Sheet 1.

O. D. ORVIS.

STEAM BOILER FURNACE.

No. 526,048. Patented Sept. 18, 1894.

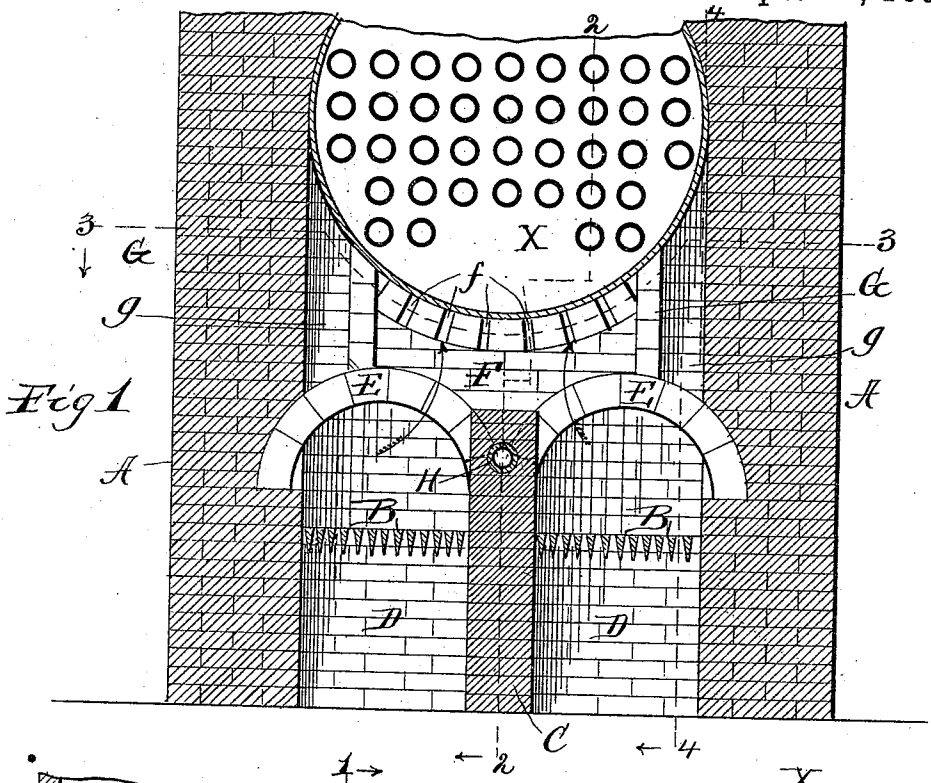

Fig 1

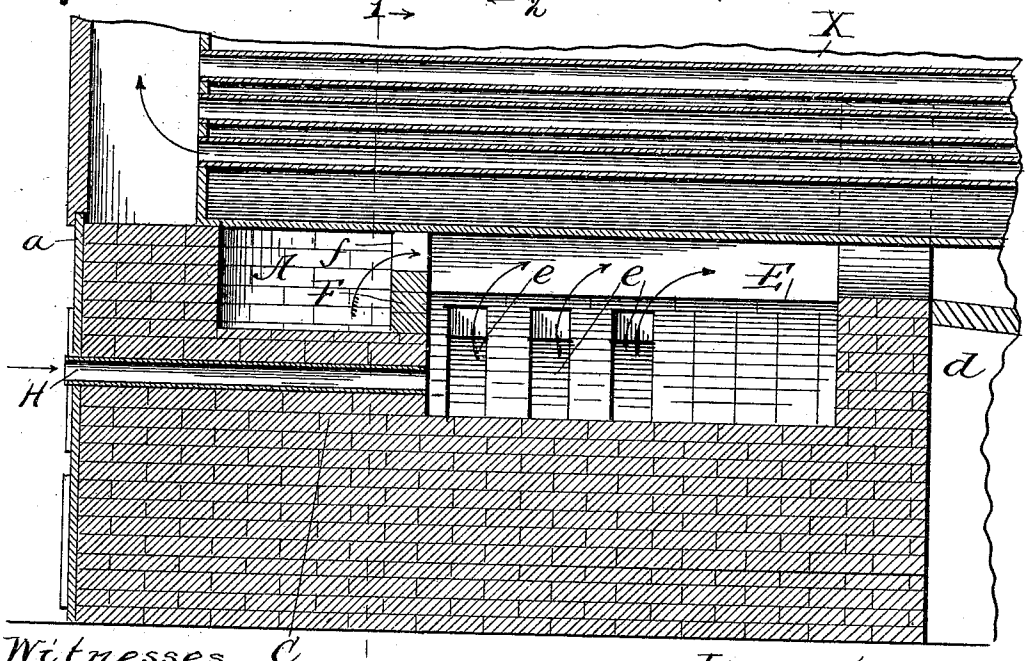

Fig 2

Witnesses
W. C. Coles
Jno. A. Christianson.

Inventor
Orel D. Orvis
By Louis K. Gillson
Attorney.

(No Model.) 2 Sheets—Sheet 2.

O. D. ORVIS.

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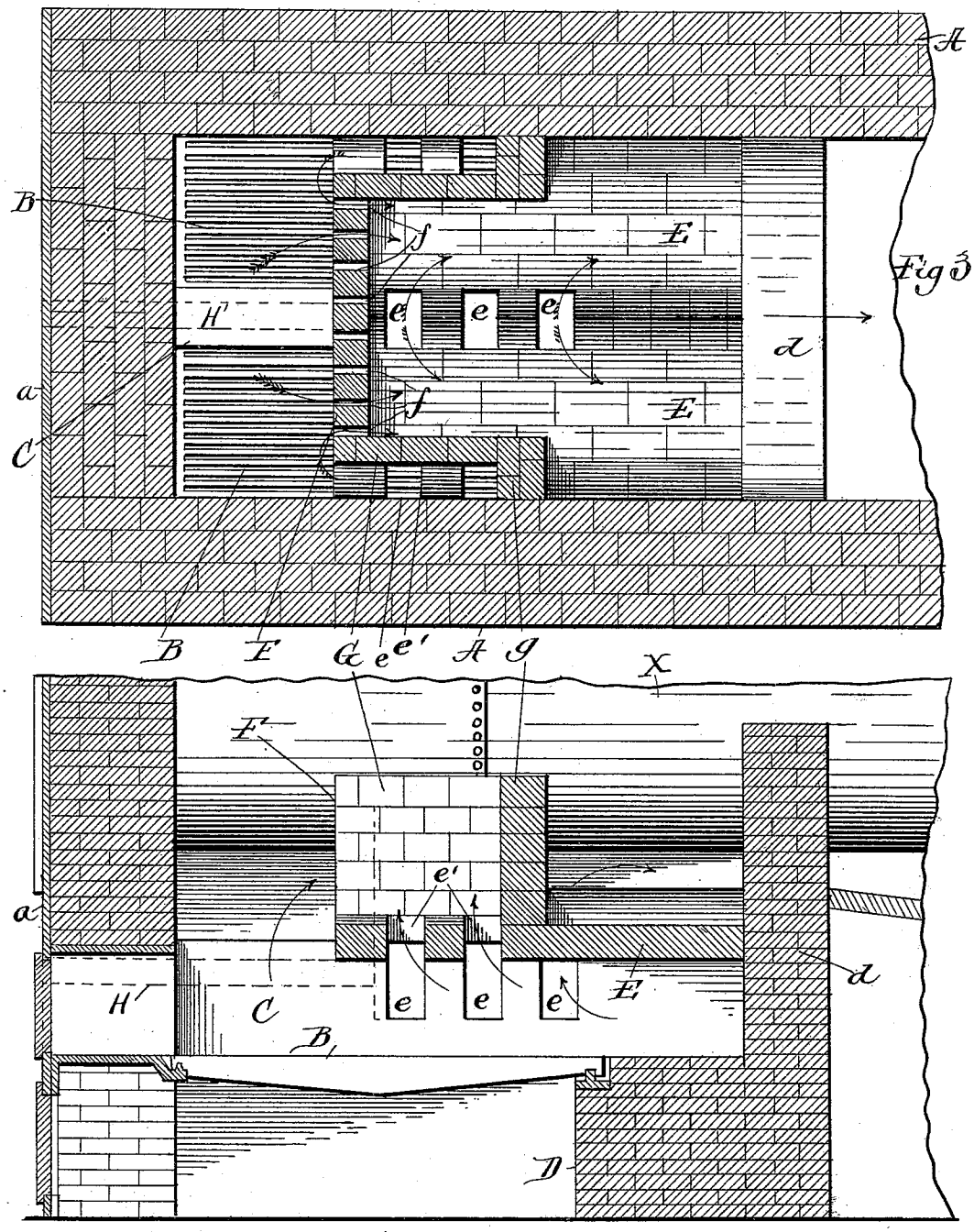

Fig 4

Witnesses
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UNITED STATES PATENT OFFICE.

OREL D. ORVIS, OF CHICAGO, ILLINOIS.

STEAM-BOILER FURNACE.

SPECIFICATION forming part of Letters Patent No. 526,048, dated September 18, 1894.

Application filed May 21, 1894. Serial No. 511,906. (No model.)

To all whom it may concern:

Be it known that I, OREL D. ORVIS, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Steam-Boiler Furnaces; and I do declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

The object of my invention is to secure a construction of furnaces for the generation of steam or for other kindred uses in which complete combustion of the gases distilled from the fuel is accomplished, and in which this result is secured in such manner as to increase the efficiency of the furnace. To accomplish this object I regard it as necessary to maintain a high and even temperature within the fire box; to concentrate the combustible gases in a very hot chamber with ample supply of oxygen, burning them before they come into contact with a water surface and are thereby chilled, and yet, to so construct the furnace that the direct radiation from these burning gases is upon the boiler.

To this end, the invention consists in the use of arches covering the rearward portion of the grates and being perforated for the escape of the gases; and such an arrangement of partition walls within the furnace as to form smoke chambers and a restricted combustion chamber; together with an air feed to the combustion chamber.

This construction is fully illustrated in the accompanying drawings, in which—

Figure 1 is a transverse vertical section of the furnace on the line 1—1 of Fig. 2. Fig. 2, is a vertical longitudinal section on the line 2—2 of Fig. 1. Fig. 3, is a plan section on the line 3—3 of Fig. 1. Fig. 4, is a vertical longitudinal section on the line 4—4 of Fig. 1.

The furnace is especially adapted to be used in connection with the ordinary tubular boiler shown at X, and it has the usual side walls, A, A, and front wall *a*. A pair of grates B B are used and are separated by a pier, C, of masonry, which for a considerable distance back from the wall *a* extends above the surface of the grates several courses of brick, but preferably does not reach to the boiler. Backwardly from this higher portion of the pier C its top is but a few inches above the surface of the grates, and from it is sprung the arches E, E, which span the grates and whose outer ends are supported by the walls A, A. These arches E, E, extend backwardly to the bridge wall *d*, which is located some distance back of the rearward ends of the grates—as shown, about one-third of their length. That part of the chambers inclosed by the arches which lies back of the grates constitutes coking ovens. The floors of these ovens are on a level with the grates and are provided by building up a mass of masonry, *d*.

The adjacent sides of the arches, E, E, are provided with flue apertures, *e*, *e*, *e*. These apertures are located over the grates only, and do not extend back of them, the only outlet from the coking ovens being over the grates to the apertures, *e*, *e*. At the front of the arches E, E, and supported by them and extending from the crown of the one to the crown of the other and reaching to the crown sheet of the boiler is a wall or partition of masonry, F. The top course of this wall is laid open so as to provide numerous flue apertures, *f*. From each side of the wall F a wall or partition G, extends backwardly a short distance—as shown nearly to the rear end of the grates,—resting upon the arch, E, and reaching to the boiler. The rearward end of the space between the wall G, and the wall A, is closed by a wall, *g*, so that a dead air space or smoke chamber is formed at each side of the furnace, above the arches and having its front end open. The arches E, E, have apertures *e' e'*, opening to these smoke chambers.

The walls, F, G, G, inclose a somewhat contracted combustion chamber into which the burning gases are discharged through the apertures *e*, *e*, but back of the walls G, G, this chamber widens to the side walls A, A, so that the flame has ample opportunity to spread be-

fore it reaches the bridge wall and over which it goes in a sheet the entire width of the furnace and in close contact with the boiler as the bridge wall is in the form of an inverted arch. An air tube, H, enters through the front wall, *a*, passes back through the upper part of the pier C, and discharges across the apertures, *e*, *e*. The main draft from the fire boxes is through the apertures, *e*, *e*, *e*. The streams of gases from the two fire boxes meet as they emerge from these apertures and the temperature at this point is very high. The introduction of a blast of air through the pipe, H, directly across these highly heated gases insures their complete combustion. The walls, F, G, G, assist in maintaining the temperature, yet leave the crown-sheet of the boiler exposed to the intense heat of these burning gases.

The use of a multiple number of flue openings in the arches concentrates the flames into jets or streams. The openings in the two arches are opposite each other, and by this construction the currents from the two fire boxes come together with great velocity and are thoroughly intermingled, and their combustion is completed before they come into contact with a water surface and are thereby chilled. The forward portion of the furnace is open from the grates to the boiler, thereby securing the advantage of direct radiation from the burning fuel.

If the draft passages of a furnace are large enough to promptly carry away the excessive development of gases immediately following fresh firing their capacity is greater than necessary after their volume has somewhat decreased, and as a result the hot vapors pass too rapidly to the stack to part with as much of their heat as should be utilized in generating steam. The smoke chambers inclosed by the wall G, G, and *g*, *g*, serve to accumulate this excess of smoke until it can pass off more gradually and be consumed. Apertures *e'* *e'* are formed in the arches E, E, for ingress to these chambers and the smoke slowly finds its way forward to the front of the furnace and thence through the apertures in the wall F, or is drawn back through the fire box. After the excessive development of gases incident to fresh firing has ceased these smoke chambers perform a useful function in concentrating the radiated heat upon the boiler surface above them. The walls of these chambers become highly heated and as a result there is a concentration of heat upon a portion of the boiler surface which ordinarily remains comparatively cool. There being practically no draft through these chambers the heated vapors which rise through the apertures *e'* from the natural tendency to ascend are retained until they part with a large percentage of their heat. So much of the combustible gases as pass through the apertures *f*, of the wall F, is mixed with air entering at the feeding doors and at once comes into contact with the burning gases emerging from the apertures *e*, *e*, and their combustion is made certain.

The coking ovens back of the grates are for the purpose of maintaining a uniform temperature. Fuel is thrown into them through the feeding doors, and burns out slowly. No air feed is provided to support combustion in this part of the furnace and in consequence no flame is developed therein but the gases distilled work forward and being caught in the current setting through the rearward of the apertures *e*, are consumed. When the volatile parts of the fuel have passed off from this fuel it glows intensely for a long time, finally crumbling to ashes. In practice it is found that this slow combustion in the coking ovens is strongly conducive to evenness of temperature, and by heating the rearward portions of the arches E, E, to a high degree, assists greatly in burning the smoke which passes through the apertures *e*, *e*, and over the upper surfaces of these arches. These ovens also supplement the smoke chambers in holding back the smoke generated from fresh fuel thrown upon the grates until the discharge flues can convey it away in quantities which can be consumed.

I claim as my invention—

1. In a steam boiler furnace the combination with a pair of grates, B, and with the boiler located above the grates, of arches E, covering the rearward portion of the grates and having draft apertures *e*, *e*, and a transverse wall extending upwardly from the forward end of the arches to the boiler and having draft apertures, *f*, substantially as described.

2. In a steam boiler furnace the combination with a pair of grates, B, and with the boiler located above the grates, of arches E, covering the rearward portion of the grates and having draft apertures *e*, *e*, a transverse wall extending upwardly from the forward end of the arches to the boiler and having draft apertures, *f*, and an air pipe leading from without the furnace through the transverse wall and being adapted to discharge a current of air across the draft apertures of the arches, substantially as described.

3. The combination with a set of grates, and with a solid floor extending back from the grates, of an arch covering the grates and the floor and having flue openings above the grates and being solid above the floor, and a solid wall closing the rearward end of the arch, substantially as described.

4. The combination with a pair of grates, of arches covering the rearward portion of the grates and being prolonged beyond them and having their rearward ends closed and flue openings, *e*, *e*, in their adjacent sides over the grates, a transverse apertured wall over the front end of the arches and extending to

the boiler, smoke chambers at the sides of the furnace in communication with the fire boxes through their covering arches and to the space in front of the transverse wall, and an air pipe leading from without the furnace and opening through the transverse wall so as to discharge an air current across the flue openings *e*, *e*, substantially as described.

In testimony whereof I affix my signature in presence of two witnesses.

OREL D. ORVIS.

Witnesses:
LOUIS K. GILLSON,
SPENCER WARD.