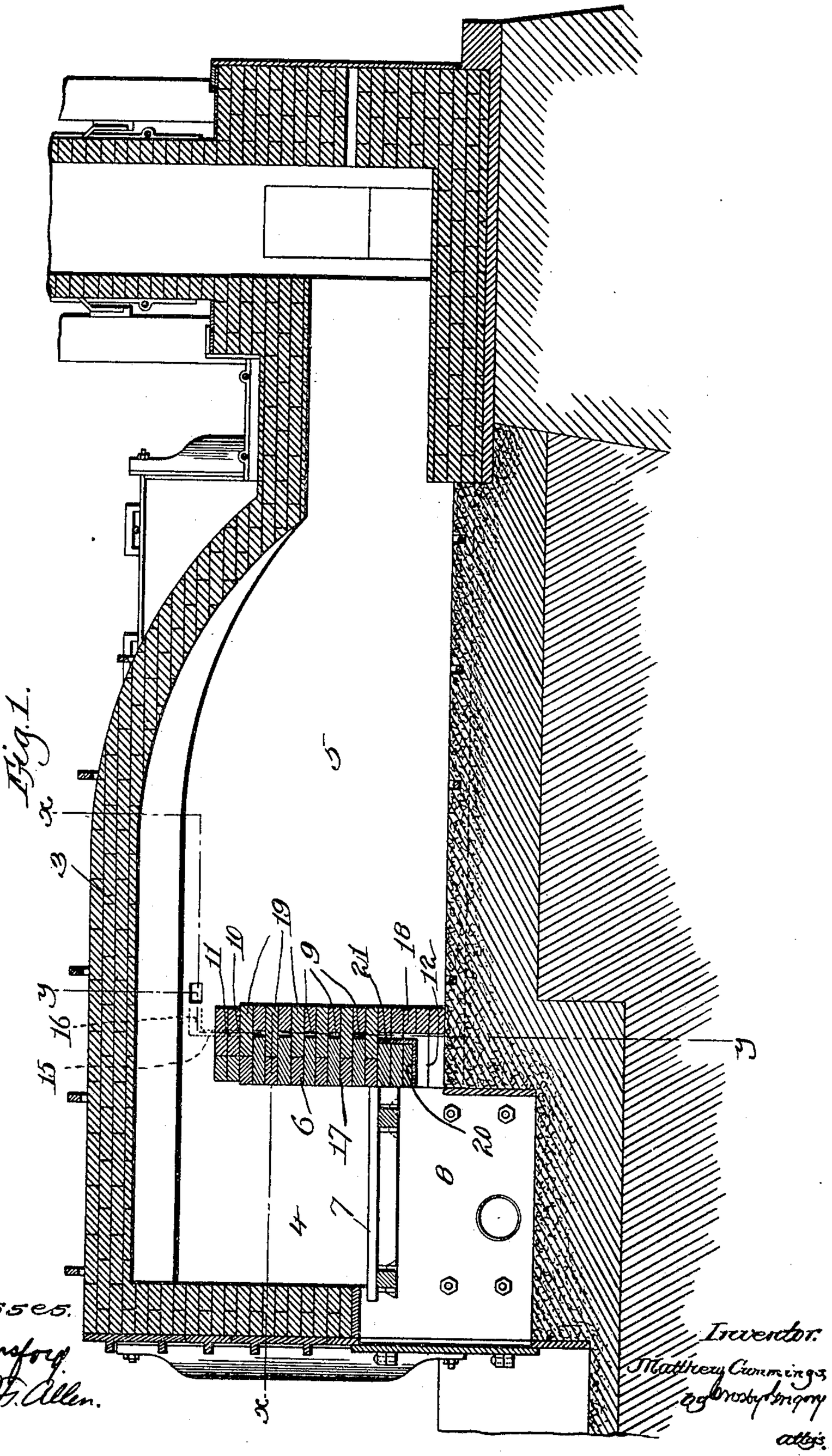
No. 819,043. PATENTED MAY 1, 1906.

M. CUMMINGS.

REVERBERATORY FURNACE.

APPLICATION FILED FEB. 6, 1905.

2 SHEETS—SHEET 1.



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2 SHEETS—SHEET 2.

Fig. 3.

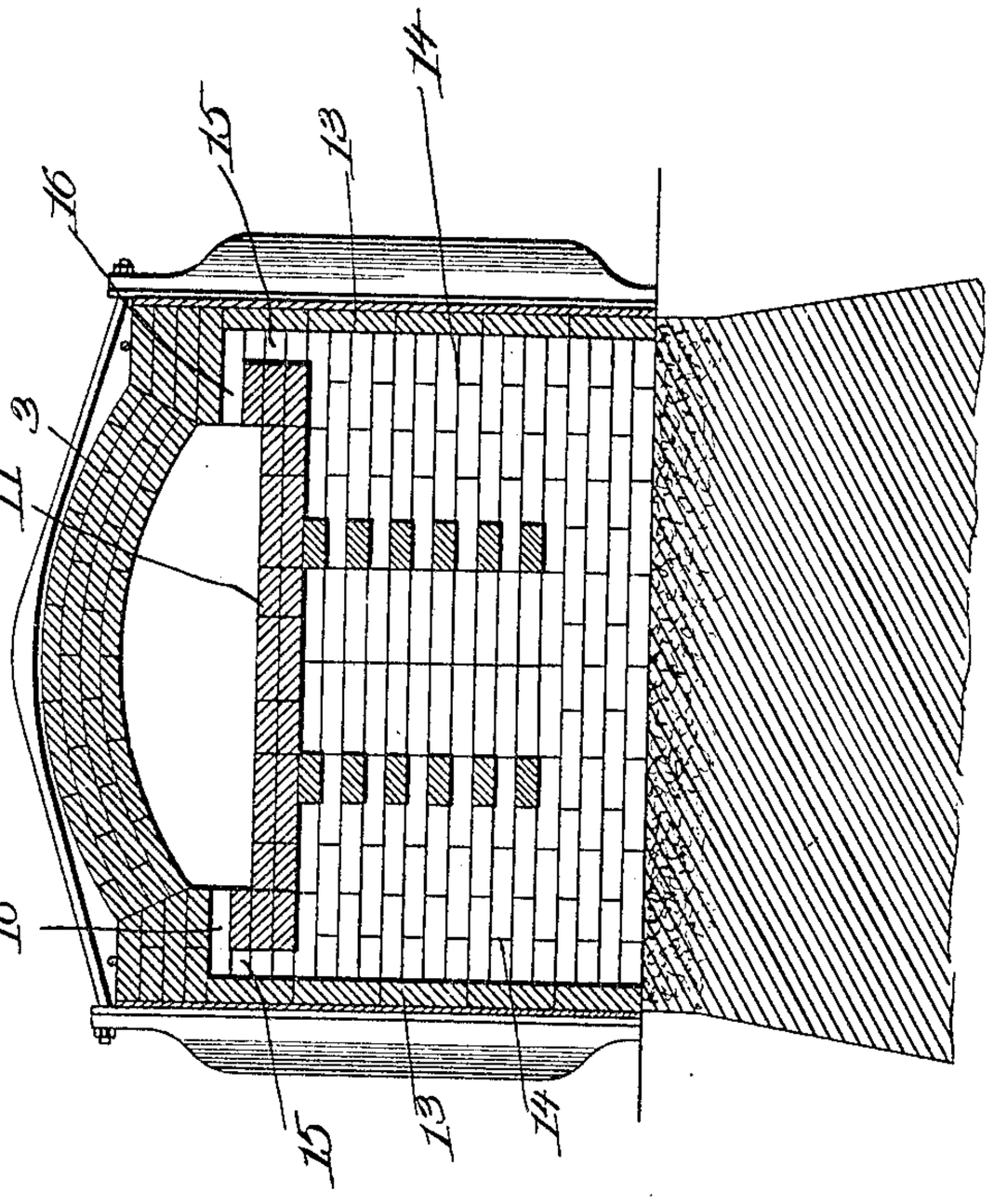
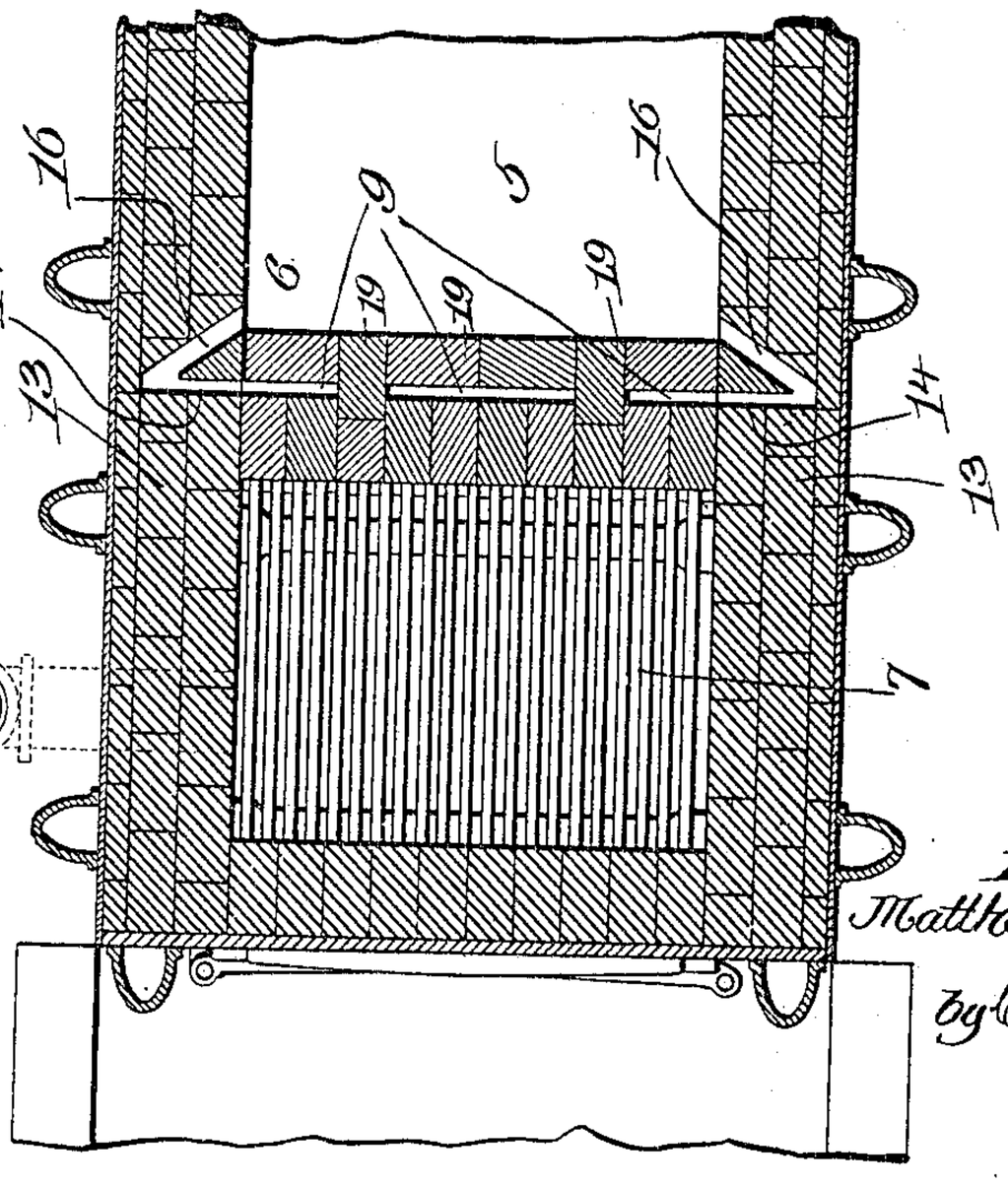


Fig. 2.



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UNITED STATES PATENT OFFICE.

MATTHEW CUMMINGS, OF BOSTON, MASSACHUSETTS.

REVERBERATORY FURNACE.

No. 819,043. Specification of Letters Patent. Patented May 1, 1906.

Application filed February 6, 1905. Serial No. 244,383.

To all whom it may concern:

Be it known that I, MATTHEW CUMMINGS, a citizen of the United States, and a resident of Boston, county of Suffolk, State of Massachusetts, have invented an Improvement in Reverberatory Furnaces, of which the following description, in connection with the accompanying drawings, is a specification, like figures on the drawings representing like parts.

In the ordinary reverberatory furnace in which the furnace-chamber and the hearth or heating-chamber are separated by a solid bridge-wall the intense heat generated in the furnace is so destructive of the bridge-wall that it has a comparatively short life. To avoid this objection and to provide a furnace in which an even heating can be obtained with a minimum consumption of fuel, I have devised the form of furnace which constitutes the basis for this application.

In the drawings, Figure 1 is a longitudinal central section through a furnace embodying the present invention. Fig. 2 is a section substantially on the line *x x*, Fig. 1; and Fig. 3 is a section on the line *y y*, Fig. 1.

The furnace is designated generally by 3, and like all other similar furnaces it comprises the furnace-chamber 4, in which the fuel is burned, the heating-chamber 5, in which articles are heated preparatory to being further treated, and the bridge-wall 6, which separates said chambers. The furnace-chamber is provided with the usual grates 7, on which the fuel is burned, and the usual ash-pit 8 beneath the grates. My improvements consist in constructing the bridge-wall with an air-space and so arranging the outlet-ducts from said air-space that more economy in the use of fuel is attained. The air-space in the bridge-wall is designated by 9, and it extends from the bottom of the bridge-wall nearly to the top thereof or to about the point 10. The top 11 of the bridge wall is solid, and such solid portion closes the top of the air-space 9. The bottom of the air-space communicates with the ash-pit 8 through an inlet-duct 12. The air-space extends laterally into the side walls of the furnace, as at 14, (see Figs. 2 and 3,) and such laterally-extending portions of the air-space also extend upwardly, as at 15, above the top of the bridge-wall and communicate with outlet ports or ducts 16, which lead into the heating-chamber at the rear of the bridge-wall. The outlet-ducts 16 are inclined, as shown in Fig. 2, and open into the heating-chamber 5 just behind and above the level of the top of the bridge-wall.

With the above-described construction the suction produced by the draft causes a current of air to enter the inlet-passage 12 and pass upwardly through the air-space 9, from which it is delivered to the heating-chamber through the ducts 14, 15, and 16. The construction which permits the air to thus circulate through the bridge-wall and by means of which the air is thus delivered to the heating-chamber produces several desirable results. In the first place this current of air keeps the temperature of the bridge-wall below the destructive point, and thus prevents said bridge-wall from burning out. In the second place the air which is drawn through the bridge-wall and which on its passage therethrough becomes highly heated is delivered to the heating-chamber at the right point to commingle with the gases just after they enter the heating-chamber, whereby combustion is entirely completed at this point and the temperature of the flame very much increased. This insures that no unburned gases will escape up the chimney and that all the heat available in the fuel will be liberated within the furnace, where it can be used. In the first place this construction and arrangement results in a much more even heat in the heating-chamber, for when fresh fuel is added to the fire, and thereby the draft through the body of fuel somewhat checked, the section produced by the forced-draft apparatus causes an added quantity of air to pass through the air-space and be delivered to the heating-chamber. Whenever fresh fuel is added to the fire, said fuel is first coked—that is, it is roasted by the heat generated—and the gases in the fuel are driven off. Unless an added quantity of air is admitted to these gases before they pass through the heating-chamber a considerable portion of them would escape to the chimney unconsumed, and therefore only a portion of the heat units in the coal would be liberated. By means of my improved construction, however, the checking of the draft through the fuel by the addition of fresh fuel causes an added quantity of air to be drawn through the air-space and delivered to the heating-chamber, this

added quantity when commingled with the unconsumed gases passing over the bridge-wall into said heating-chamber being sufficient to complete combustion at this point, and thereby insure the liberation of all the heat units in the fuel. When, however, the coal has become coked, the heat is then produced by burning of the coke rather than by burning of the gases which are driven off from the fuel. Consequently at this stage of the combustion of the fuel the necessity does not exist for delivering to the heating-chamber the added quantity of air. As soon as the fuel becomes coked the air can be more easily drawn therethrough, and hence more air will pass through the fuel and less through the air-space, thus producing the desired result.

I desire to call special attention to the fact that the top and back side of the bridge-wall are imperforate, so that none of the air in the air-space 9 can be delivered to the heating-chamber through apertures in the bridge-wall. This is important, because if such were the case and if the air should strike or come in contact with the material being heated in the heating-chamber a destructive effect on the material would be produced. I also desire to call special attention to the fact that the outlet end of each duct 16 is situated back of the bridge-wall and also above the top of the bridge-wall, and therefore above the flame passing over the bridge-wall. The heated air therefore is delivered into the heating-chamber and not into the throat or space directly above the bridge-wall. Further, since the outlet-ducts open into the heating-chamber above the level of the bridge-wall there will always be present a sheet or quantity of flame between the incoming air-currents and the materials in the heating-chamber, and therefore the air cannot come directly in contact with said materials, and thus burn them.

The air-space 9 may be made in the bridge-wall in any suitable way. One convenient way is to build the front portion 17 of the bridge-wall with bricks running lengthwise of the furnace and the back portion 18 thereof with bricks running crosswise or transversely of the furnace and separating the two portions 17 and 18 sufficiently to form the desired air-space. These two portions of the bridge-wall may be tied together in any suitable way—as, for instance, by means of tie-bricks 19. I have shown the front portions 17 of the bridge-wall as supported on an arch-plate 20, which extends across the furnace, said arch-plate having a flange 21 at its rear edge to prevent the bricks resting thereon from being forced backwardly to check the opening to the air-space. Other ways of building the bridge-wall so as to provide it with the air-space may be resorted to without departing from the invention.

Although I have described my invention as applied to a reverberatory furnace, I desire to state that the invention is also applicable to furnaces of other types in which sufficient heat is generated to burn out the bridge-wall.

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

1. In a furnace, a bridge-wall separating the furnace-chamber from the heating-chamber, said bridge-wall having within it an air-space which communicates at its lower end with the ash-pit and extends nearly to but terminates below the top of said bridge-wall, the back side and top of the bridge-wall being imperforate, said air-space extending laterally into each side wall of the furnace beyond the limits of the bridge-wall, and the laterally-extended portions and said air-space being extended upwardly above the level of the top of the bridge-wall to communicate with outlet-ducts which are directed into the heating-chamber above the level of the top of the bridge-wall and slightly to the rear thereof.

2. In a furnace, a bridge-wall separating the furnace-chamber from the heating-chamber, said bridge-wall having within it an air-space which communicates at its lower end with the ash-pit and extends nearly to but terminates below the top of said bridge-wall, said air-space extending laterally into each side wall of the furnace beyond the limits of the bridge-wall, and the laterally-extended portions and said air-space being extended upwardly above the level of the top of the bridge-wall to communicate with outlet-ducts which are directed into the heating-chamber above the level of the top of the bridge-wall and slightly to the rear thereof, said outlet-ducts being inclined relative to the length of the furnace.

3. In a furnace, a heating-chamber, a furnace-chamber, a bridge-wall separating said chambers, said bridge-wall being formed of two sections which are separated from each other to form between them an air-space, an angle-plate on which the front section of the bridge-wall rests, said bridge-wall having beneath the angle-plate an opening connecting the air-space in the bridge-wall with the ash-pit, the side walls of the furnace being provided with extensions of the air-space which communicate with inclined outlet-ducts leading into the heating-chamber above the bridge-wall and slightly back thereof.

4. In a furnace, a bridge-wall separating the furnace-chamber from the heating-chamber, said bridge-wall having within it an air-space which communicates at its lower end with an ash-pit and which extends nearly to but terminates below the top of the bridge-wall, the back side and top of the bridge-wall being imperforate, said air-space communicating with outlet-ducts in the wall of the

furnace, which ducts have their discharge ends above the level of the top of the bridge-wall and to the rear thereof, whereby the air heated in the air-space of the bridge-wall is delivered into the heating-chamber above the flame.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

MATTHEW CUMMINGS.

Witnesses:
LOUIS C. SMITH,
MARGARET A. DUNN.