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PATENTED MAY 1, 1906.

B. E. ELDRED.

MEANS FOR CONTROLLING GAS VELOCITY IN REVERBERATORY FURNACES.

APPLICATION FILED FEB. 8, 1905.

2 SHEETS—SHEET 1.

Fig. 1.

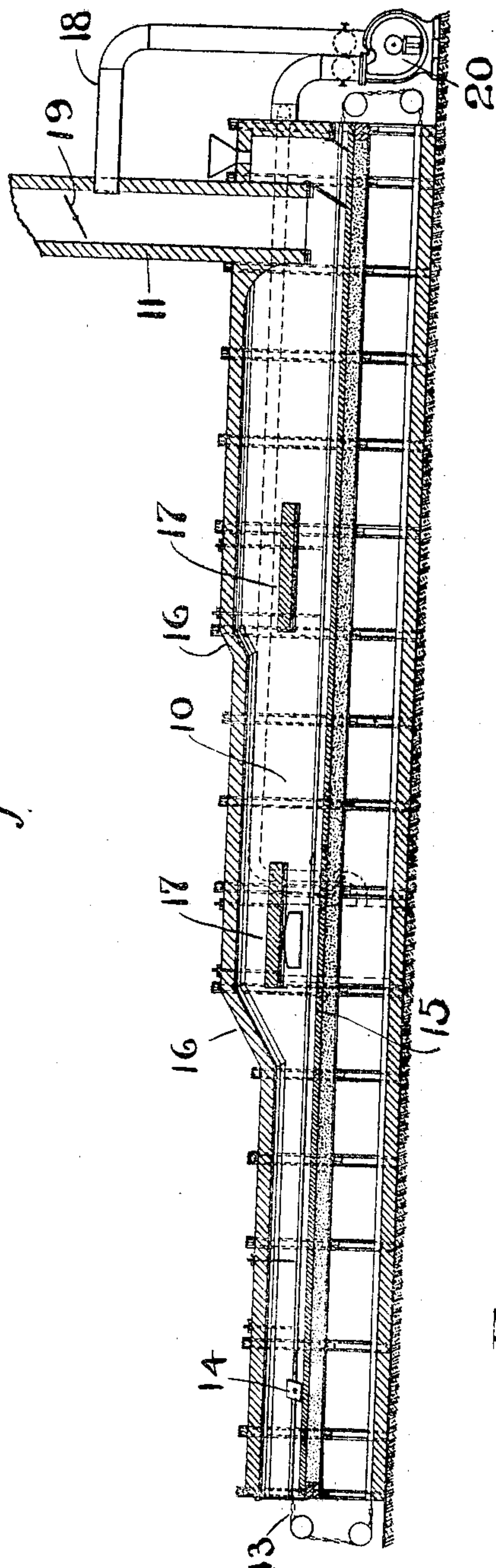
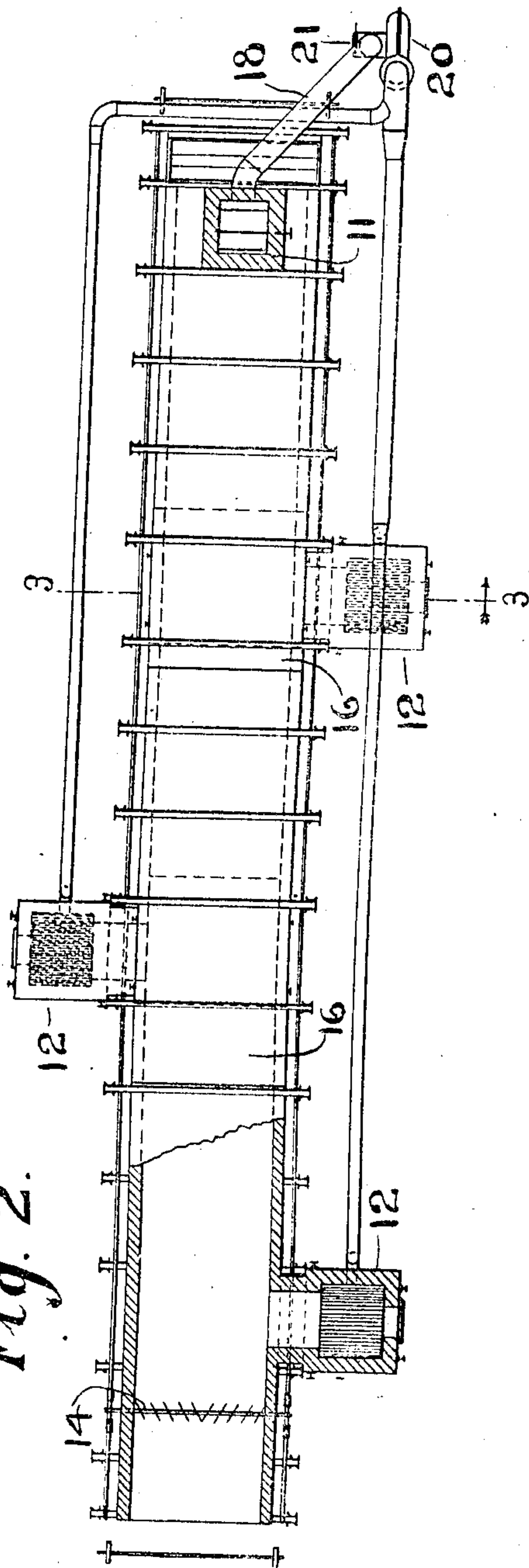


Fig. 2.



Witnesses

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Inventor  
By his Attorneys  
Bentley and Pearson

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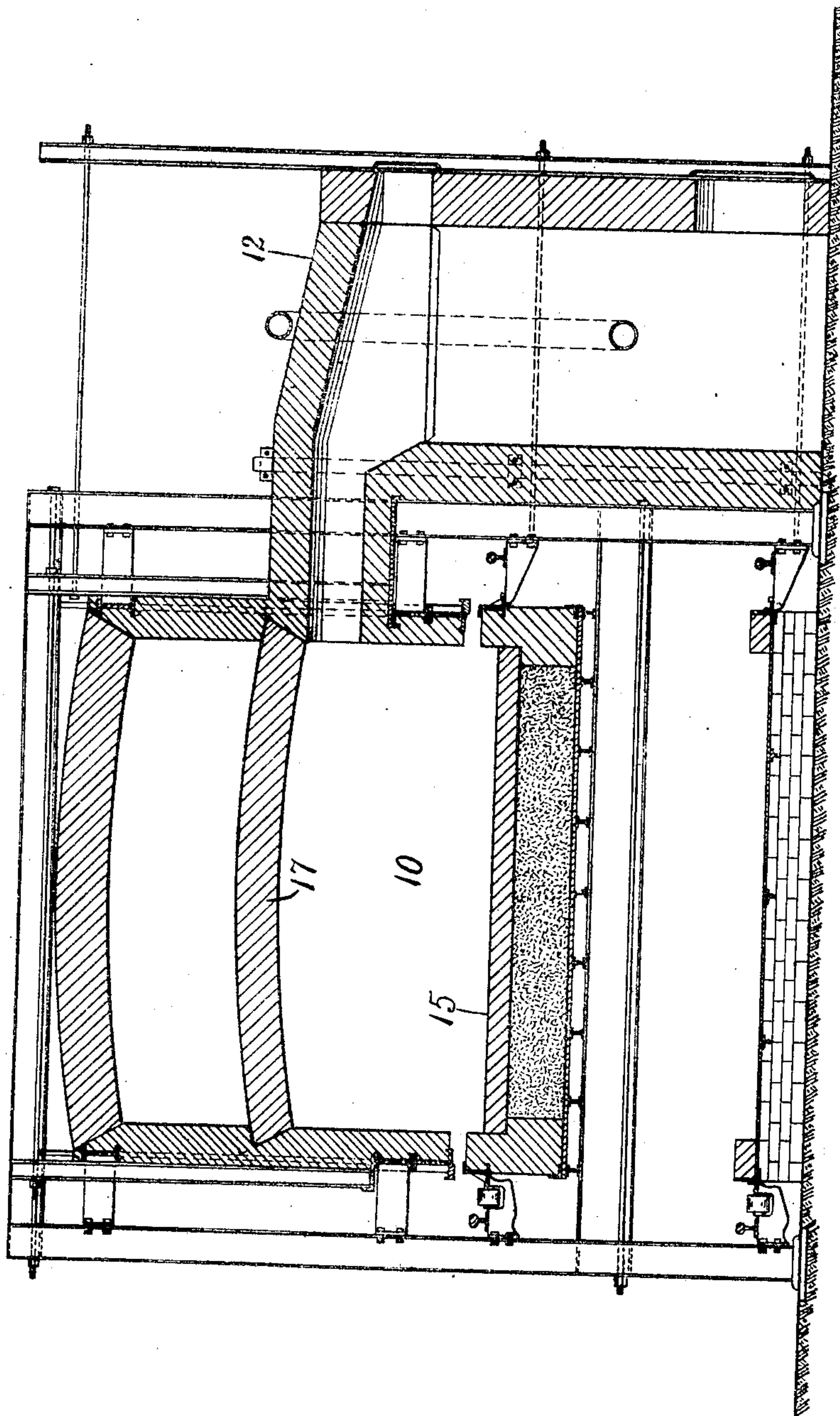
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2 SHEETS—SHEET 2.

Fig. 3.



Witnesses

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# UNITED STATES PATENT OFFICE.

BYRON E. ELDRED, OF BRONXVILLE, NEW YORK, ASSIGNOR TO COMBUSTION UTILITIES COMPANY, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK.

MEANS FOR CONTROLLING GAS VELOCITY IN REVERBERATORY FURNACES.

No. 819,046.

Specification of Letters Patent.

Patented May 1, 1906.

Application filed February 8, 1905. Serial No. 244,738.

*To all whom it may concern:*

Be it known that I, BYRON E. ELDRED, a citizen of the United States, residing at Bronxville, county of Westchester, State of New York, have invented certain new and useful Improvements in Means for Controlling Gas Velocity in Reverberatory Furnaces, of which the following specification and accompanying drawings illustrate one form of the invention which I now regard as the best out of the various forms in which the invention may be embodied.

This invention relates to reverberatory furnaces in which several fire-boxes are employed, distributed at intervals along and opening into the hearth-chamber wherein the materials under treatment are roasted or calcined or subjected to heating operations of a like character. Heretofore inadequate provision has been made for regulating the velocity of the flame-current—that is to say, whereas each succeeding fire-box, reckoning in a direction toward the chimney, adds its flame increment to the total quantity of gases passing through the hearth-chamber there is commonly no provision made in the ordinary straight-line furnaces for regulating the consequent velocity of the gases in order to secure their maximum effect upon the materials under treatment. The consequence is that while at points remote from the chimney the flame-current may be traveling at a proper velocity to yield up its heat to the materials in an effective manner, at points nearer to the chimney, where the gases have received an increment by the addition of other flame-currents, the current must travel at a faster rate, since its increase of volume can only be accommodated longitudinally of the combustion-chamber. Hence in that locality they do not properly yield their heat to the materials. With each successive increment of volume the velocity increases. If the chimney-damper be adjusted to diminish the velocity of the gases nearest the chimney to the proper point, those in the more remote portions of the furnace will have insufficient velocity, and the fires at those more remote points will not draw properly.

The foregoing defective conditions are observable when ordinary fires are employed on furnaces of the character stated. They are perhaps exaggerated when the fires are oper-

ated by the process described in my Patent No. 692,257. It should be mentioned that the process of said patent is applied with great advantage to reverberatory operations, owing to the cooler fires, voluminous flame brought close to the materials, great length of flame, and fuel economy, and when so applied the process constitutes an invention which I have made the subject of a separate application, Serial No. 223,880, September 9, 1904. The increment of volume from each succeeding fire-box is here very noticeable, and there is, when the flame is allowed its natural development, probably less theoretical contraction of the gas-current from the more or less abrupt transition from the monoxid condition to the dioxid condition characteristic of an ordinary flame.

This invention furnishes a remedy for the defective conditions above mentioned by successively increasing the cross-sectional area of the gas-current in approaching the chimney at or just before the points at which the successive increases of volume take place from the additional fire-boxes. If the increase of cross-sectional area be made proportional to the increase of volume, the velocity of the gas-current will remain the same as before. I find that this result can be attained in a simple manner by increasing the aperture of the hearth-chamber at the desired point or points.

My invention consists in a furnace having this characteristic construction; and it further consists in the novel method of treating the gas-current so that its velocity remains the same, or substantially so, with each successive increase in volume.

In the drawings, Figure 1 represents a longitudinal section of an ore-roasting furnace construction and arranged according to my invention and adapted to carry out the aforesaid process. Fig. 2 represents a top plan view partly in section. Fig. 3 represents a section on line 3 3 of Fig. 2, enlarged.

The same reference characters represent the same parts in all the figures.

In the drawings, 10 indicates the hearth-chamber or combustion-chamber, having a stack 11 at one end and fire-boxes 12 12 opening into said chamber at different points along its length and arranged alternately on opposite sides. I do not confine myself to this exact arrangement, as the fire-boxes may



be in pairs on opposite sides, or may be arranged along one side only.

13 indicates an endless conveyer carrying the usual rabbles or plows 14 for stirring the material and producing a travel thereof in a direction opposite to the direction of travel of the flame. At or about the points where the second and third fire-boxes 12, reckoning from left to right, open into the chamber 10, the roof thereof is offset or raised to an increased distance above the hearth 15, as indicated at 16 16. At these points also within the hearth-chamber are arranged transverse partitions or flame-septa 17 17, beneath which the entering flame-currents pass into the body of the hearth-chamber, while the gases from more remote points largely pass above these septa. While these septa aid in the separation of the currents at the points of entry of fresh currents, I do not limit myself to the provision of a septum at each point of entry and may omit the septa altogether.

18 is a pipe leading back from the stack 11 at a point below the damper 19 and branching to the ash-pits of the several fire-boxes 12, said pipe containing a fan-blower 20 and having an air-inlet 21 and suitable valves or gates for regulating the relative quantities of fresh air and stack-gases in the draft supplied to each fire-box. By this means each fire is supplied by a draft-current, preferably forced or artificially accelerated, containing predetermined quantities of free oxygen and neutral diluent, whereby the fires furnish long slow-burning voluminous flames, as described in my aforesaid patent and application.

In operation the fires are preferably started in the more remote fire-boxes first, and then successively in those nearer the stack after the first fires have warmed up the vicinity which they affect. By making the increase in capacity of the furnace at each point of increment correspond to that increment, the velocity of the gases remains uniform, giving a uniform period of heating effect to the flames from the several fire-boxes and enabling the drafts of the several fires to be regulated uniformly by the single damper 19. The volume of flame can be regulated by varying the proportion or velocity of the stack-gas current, and the apparatus can be adjusted to compensate for the naturally heavier draft nearer the chimney, due to frictional and heat effects. I do not broadly limit myself to the expansion of the gases in any single direction, as this expansion may be made to take place either laterally or vertically or in both directions.

What I claim as new, and desire to secure by Letters Patent, is—

1. A reverberatory furnace provided with a plurality of successive flame-introducing means at different points along its hearth-chamber and of an internal diameter in-

creased beyond each such flame-introducing means.

2. A reverberatory furnace provided with a plurality of successive flame-introducing means at different points along its hearth-chamber and with the arch of said hearth-chamber stepped up beyond each such flame-introducing means.

3. A reverberatory furnace provided with a plurality of fire-boxes feeding its hearth-chamber at different successive points along its length, and of an internal diameter increased beyond each such fire-box.

4. A reverberatory furnace provided with a plurality of fire-boxes feeding its hearth-chamber at different successive points along its length, and with the arch of said hearth-chamber stepped up beyond each such fire-box.

5. In a reverberatory furnace, means for successively increasing the volume of flame therein, and means beyond each point of increment in flame volume for increasing the cross-sectional area of the hearth-chamber to correspond to the increased volume of flame.

6. In a reverberatory furnace, a hearth-chamber of successively-increasing internal diameter, a chimney-stack therefor, fire-boxes opening into said hearth-chamber at different distances from the stack, and means for returning stack-gases to the draft-chambers of the several fire-boxes.

7. A reverberatory furnace provided with a hearth-chamber increased in internal diameter at a succession of points along its course and provided with a flame-septum at each point of increment.

8. In a reverberatory furnace, a hearth-chamber having points of successively-increasing internal diameter, one or more flame-septa at points of increment, and one or more fire-boxes opening into the hearth-chamber under said septa.

9. A reverberatory furnace comprising a long hearth-chamber with its roof stepped up at various points along its length to give increased chamber room, a source of flame at each such point of increased height, a horizontal flame-septum above each inlet for flame and mechanical means for advancing material through the furnace.

10. A reverberatory furnace comprising a long hearth-chamber with its roof stepped up at various points along its length to give increased chamber room, a fire-box opening into the chamber at each such point of increased height, a chimney-stack for the chamber, means for admitting a mixture of waste gases from the stack and air into each fire-box and mechanical means for advancing material through the furnace.

11. A reverberatory furnace comprising a long hearth-chamber with its roof stepped up at various points along its length to give increased chamber room, a fire-box opening



into the chamber at each such point of increased neight, a flame-septum above the opening from each fire-box, a chimney-stack for the chamber, means for admitting a mixture of waste gases from the stack and air into each fire-box, and mechanical means for advancing material through the furnace.

In witness whereof I have hereunto set my hand, before two subscribing witnesses, this 6th day of February, 1905.

BYRON E. ELDRED.

Witnesses:

CARLETON ELLIS,  
M. F. MANGELSDORFF.