(No Model.) 5 Sheets—Sheet 1.

W. SWINDELL.

FURNACE.

No. 501,236. Patented July 11, 1893.

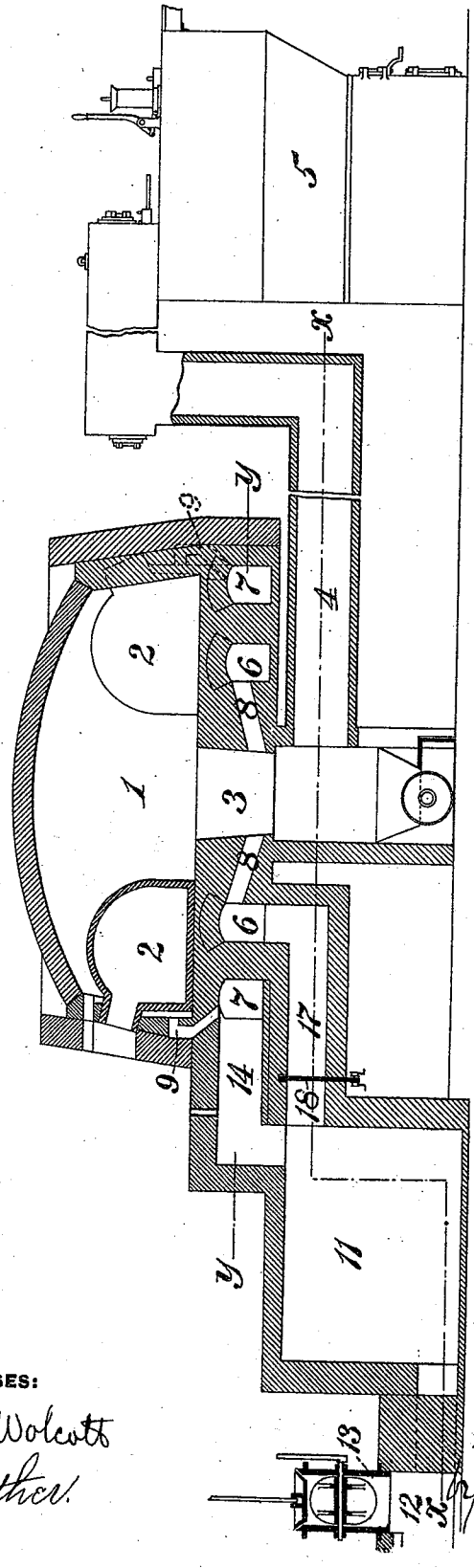

FIG. I.

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FIG. 2.

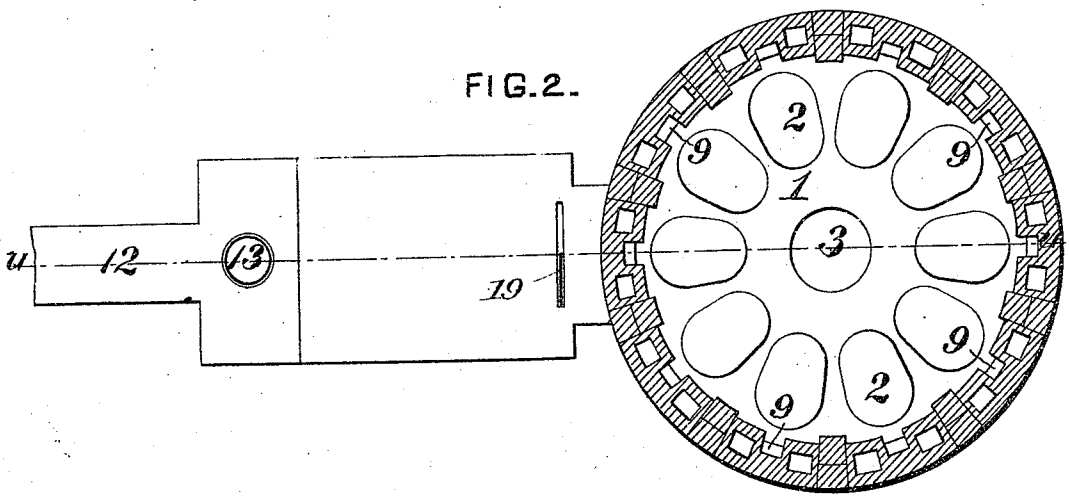


FIG. 3.

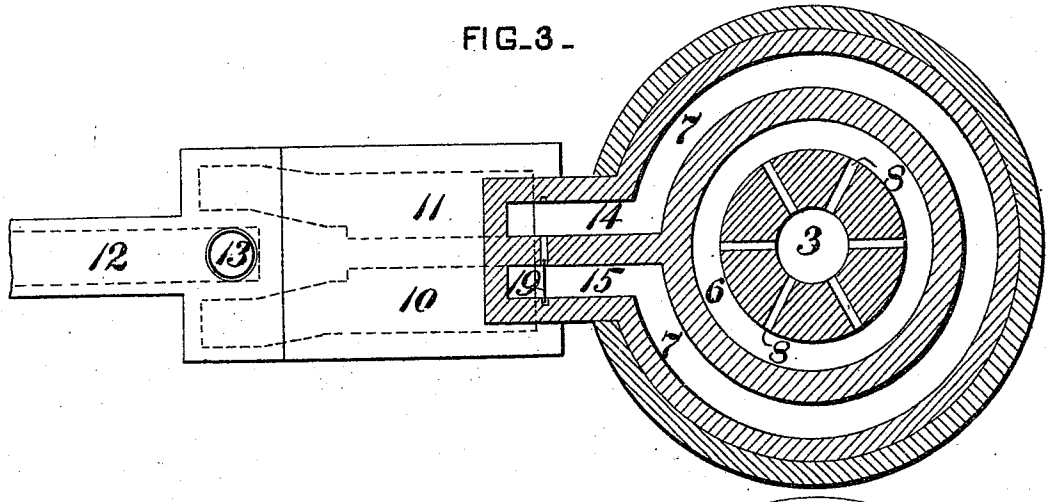
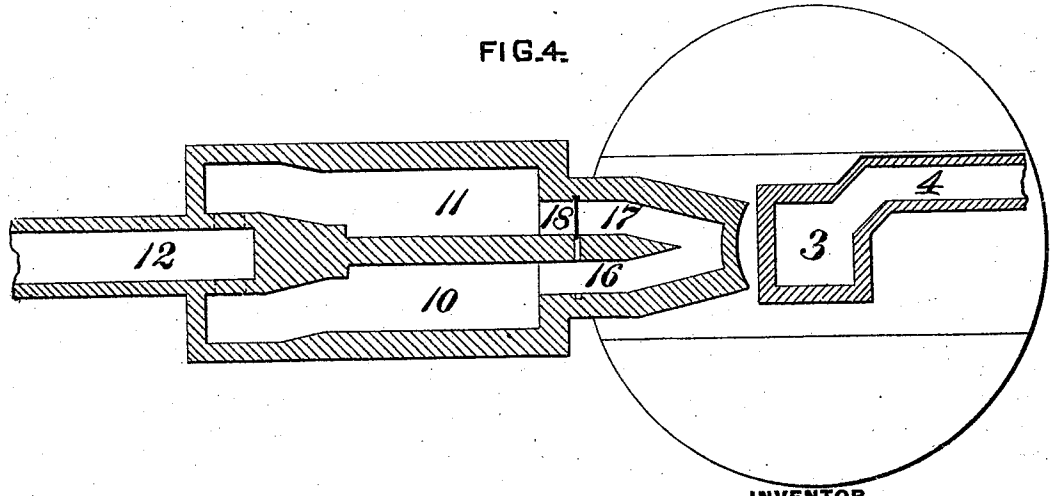


FIG. 4.



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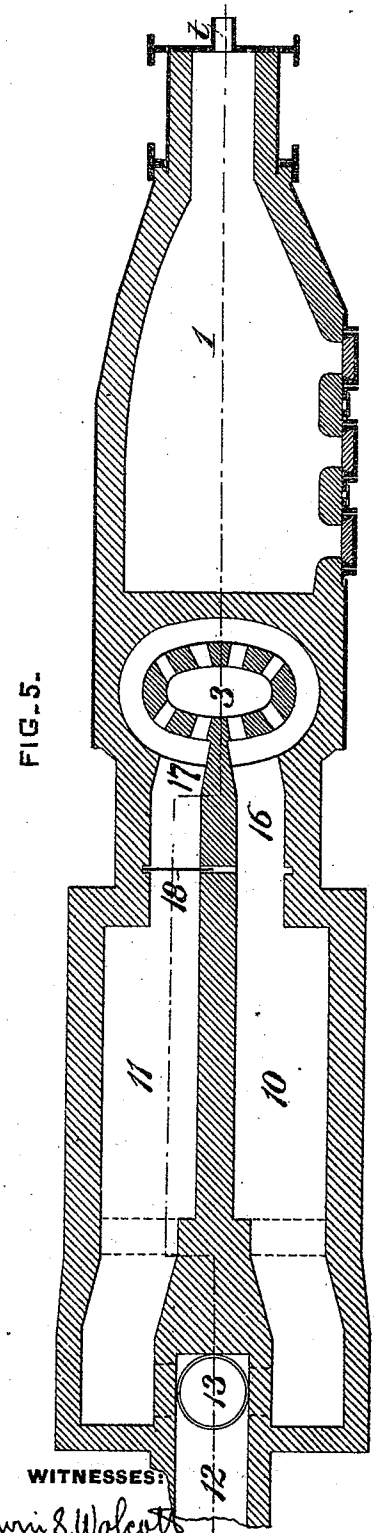

FIG. 5.

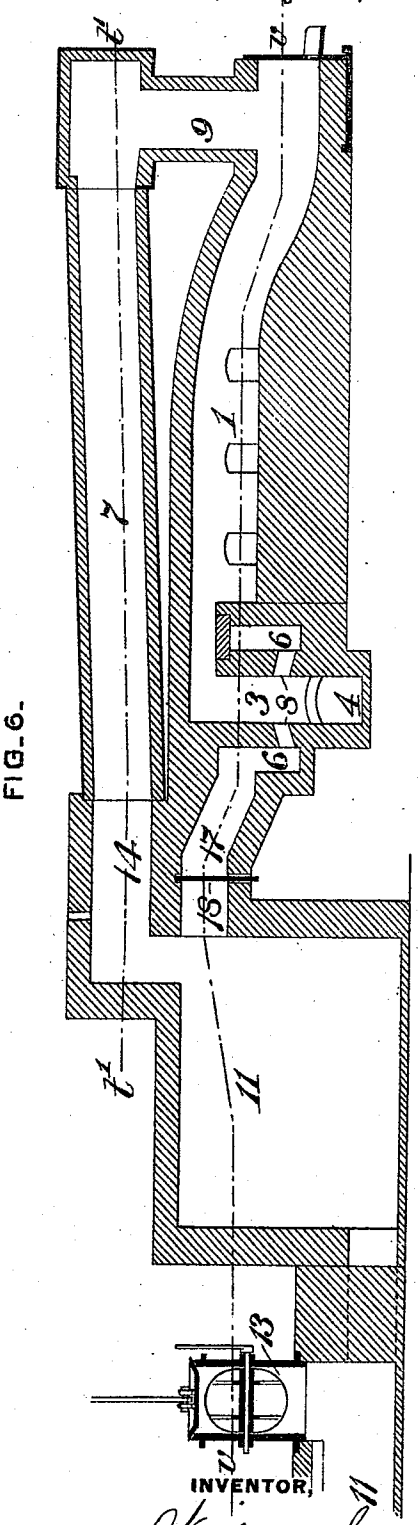

FIG. 6.

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(No Model.) 5 Sheets—Sheet 4.

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No. 501,236. Patented July 11, 1893.

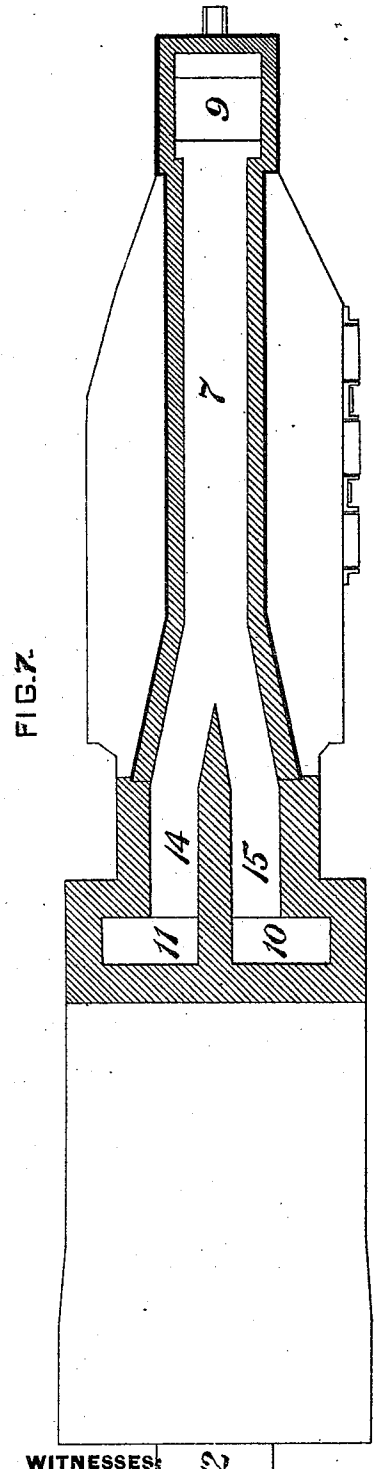

FIG. 2.

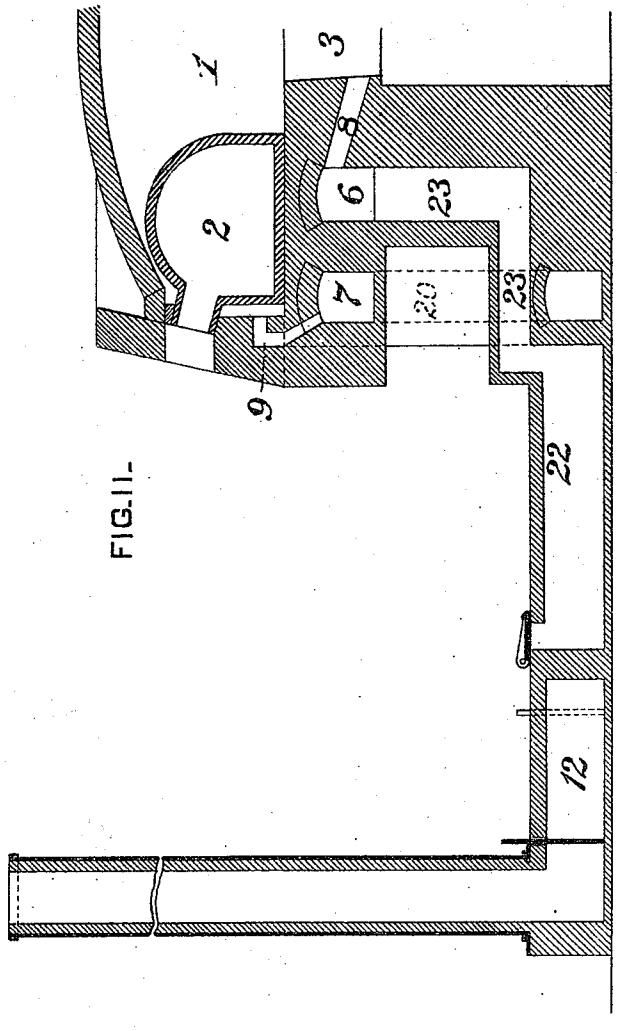

FIG. 1.

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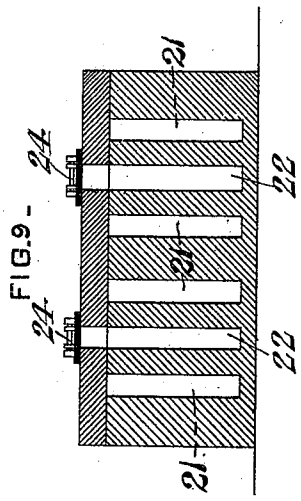

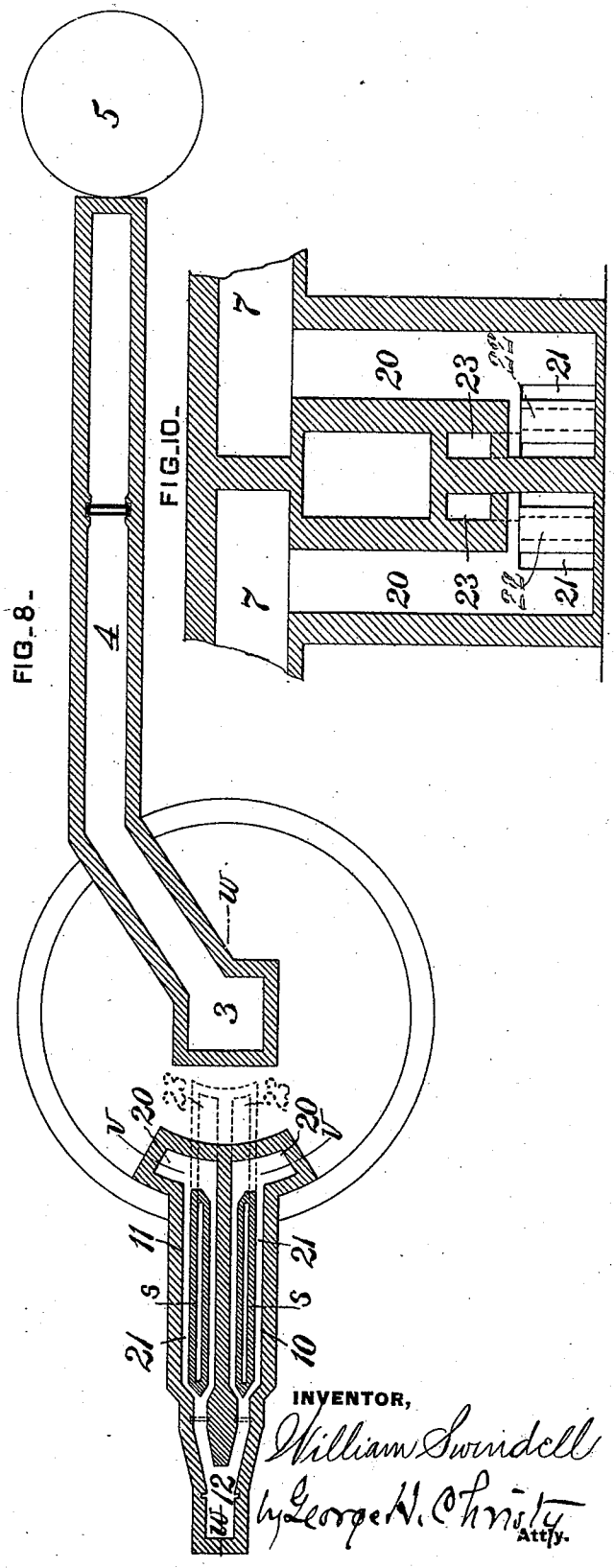

WITNESSES:
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UNITED STATES PATENT OFFICE.

WILLIAM SWINDELL, OF ALLEGHENY, PENNSYLVANIA.

FURNACE.

SPECIFICATION forming part of Letters Patent No. 501,236, dated July 11, 1893.

Application filed October 29, 1891. Serial No. 410,195. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM SWINDELL, a citizen of the United States, residing at Allegheny, in the county of Allegheny and State of Pennsylvania, have invented or discovered certain new and useful Improvements in Furnaces, of which improvements the following is a specification.

The invention described herein relates to certain improvements in furnaces for metallurgical purposes, and has for its object a construction whereby the products of combustion and heat are caused to traverse continuously in one direction through the furnace, while permitting of the exchange of the direction of flow of the products of combustion and the air to be pre-heated through the regenerating chambers. And in general terms the invention consists in the construction and combination substantially as hereinafter more fully described and particularly claimed.

In the accompanying drawings forming a part of this specification, Figure 1 is a sectional elevation of my improved furnace, the plane of section being indicated by the lines *u*, *u* Fig. 2 and the producer being shown in elevation. Fig. 2 is a plan view of the furnace and the regenerating chambers, the top of the furnace being removed so as to show the relative arrangement of the inlet and outlet flues in relation to the melting parts. Fig. 3 is a sectional plan view, the plane of section being indicated by the line *y*, *y*, Fig. 1. Fig. 4 is a similar view, the plane of section being indicated by the line *x*, *x*, Fig. 1. Fig. 5 is a sectional plan view showing the application of my improvement to heating and puddling furnaces, the plane of section being indicated by the line *v*, *v*, Fig. 6. Fig. 6 is a sectional elevation, the plane of section being indicated by the line *t*, *t*, Fig. 5. Fig. 7 is a sectional plan view on the line *t*, *t*, Fig. 6. Fig. 8 is a sectional plan view, showing the application of non-reversing regenerating chambers, with my improved furnace. Figs. 9, 10 and 11 are sectional views, the planes of section being indicated by the lines *s*, *s*, *v*, *v*, and *w*, *w*, Fig. 8, respectively.

It has heretofore been customary to employ regenerating chambers in connection with metallurgical furnaces, but such furnaces and regenerating chambers were so constructed and connected that the direction of flow of the products of combustion to the furnace chamber was changed each time it became necessary to reverse the operation of the regenerating chambers. This mode of operation is objectionable especially in pot furnaces for the manufacture of glass for the reason that when the valves are so adjusted that the gas and air enter through the flues around the perimeter of the furnace, the combustion of the two will not occur until they have passed some distance above the pots, and hence, the latter will not be subjected to the greatest heat, but are only subjected to such high heat when the combined gas and air enter through the central flue, or the products of combustion escape through the circumferential flues.

In the practice of my invention the heating or melting chamber 1 is of the usual form and provided around its perimeter with suitable seats for the pots 2, and with openings through its side walls permitting access to the mouths of the pots. The flue 3, in the center of the hearth is connected by a flue 4 with a gas producer 5, which may be of any suitable construction. In the body of the hearth are formed circular flues or passages 6 and 7, the former being connected by short passages 8, with a central flue 3, while the flue 7 is connected with the melting chamber by a series of vertical passages 9, as shown in Figs. 1 and 2. At one side of the furnace I place the regenerating chambers 10 and 11, each of which is connected by a flue 12, to the stack and to a valve chamber 13, for the admission of air to the regenerator. Each of these regenerating chambers is connected by flues 14 and 15 to the circular flue 7, and by flues 16 and 17 to the circular flue 6, as shown by reference to Figs. 1, 3 and 4. In order to reverse the operation of the regenerating chambers I provide valves 18 and 19, which are adapted to be shifted across the flues leading from the regenerating chambers to the circular flues 6 and 7, as hereinafter described.

In describing the operation of the furnace, it will be supposed that the regenerating chamber 11 has been cooled down, and it is desired to reverse the operation of the furnace. The valve 18 is then shifted so as to close the

flue 17, and the valve 19 is shifted so as to close the flue 15, as shown in Figs. 3 and 4. The passage of the air then is as follows, through the regenerating chamber 10, flue 16, circular flue 6, radial passages 8, into the central flue 3, where it commingles with the gas from the producer and enters the melting chamber 1. The products of combustion flow from the melting chamber down through the vertical passages 9, into the circular flue 7, thence by the flue 14 to the regenerating chamber 11, whence they escape by the flue 12 to the stack. As soon as the regenerating chamber 10 has become cooled down, the valves 18 and 19 are again shifted so as to close the flues 14 and 16, whereupon the air will flow, the valve mechanism 13 being properly adjusted, through the regenerating chamber 11, flue 17, circular flue 6, radial passages 8, into central flue 3, where it will commingle with the gas from the producer, and enter the melting chamber. When the valves are thus adjusted, the products of combustion will flow from the melting chamber down through the vertical passages 9, circular flue 7, flue 15, regenerating chamber 10, and flue 12 to the stack.

It has heretofore been customary to arrange the vertical peripheral passages, corresponding to the passages 9, between adjacent seats for pots, so that the front faces of the pots are subjected to comparatively little heat. In order to effect a uniform heating of all parts of the pots, the vertical passages 9, in my improved furnace, are arranged on radii from the center of the furnace passing through the centers of the pot seats 2, or approximately so, as shown in Figs. 1 and 2, so that the heat and products of combustion will be caused to pass around to the front of the pots as they flow to the vertical passages 9. This equal heating of all portions of the pots avoids the liability of cracking the pots, as is now of frequent occurrence.

When applying my improvement to heating or melting furnaces, as shown in Figs. 5 and 6, the inlet flue 3 for the gas and air is arranged at one end of the chamber 1, and the outlet flue or passage 9 at the opposite end of the chamber, and the flue 7 connecting said passage with the flues 14 and 15 leading to the regenerating chambers 10 and 11, is shown arranged to pass over the furnace, but may be arranged in any other convenient manner. The air is conducted from the regenerating chambers by flues 16 and 17 to the circular flue 6 connected by radial flues 8 to the inlet flue 3, whose lower end connects with the passage or flue 4 from the gas producer. The reversal of the regenerating chambers is effected by valves 18 and 19 adapted to be shifted across the flues 14, 15 and 16, 17, respectively. The regenerating chambers are connected by a flue 12 to the stack and to a valve chamber 13 for the admission of air to the regenerators.

It will be understood from the foregoing that the construction shown in Figs. 5 and 6 does not differ from the construction shown in Figs. 1 to 4 except as regards the shape and construction of the heating or melting chamber, and such slight changes in the shape of some of the flues as is necessitated by the difference in construction of the melting chamber. The operation of the two furnaces is the same.

In the form of regenerator shown in Figs. 8, 9, 10 and 11, the flue 7 of the furnace is connected to down-takes 20, which are connected to a series of passages 21 through the regenerator, said passages being connected at their outer ends to branches of the flue 12 leading to the stack. These passages 21 alternate with passages 22 having air inlets provided with valves 24 and connected at their inner ends to an uptake 23, leading to the flue 6. As the walls of the passages 21 and 22 are comparatively thin, they will be highly heated by the passage of the products of combustion along the passages 21 and will impart their heat to the air flowing along the passages 22.

Thus it will be seen that in my improved arrangement of flues, I am enabled to effect the orderly reversal of the operation of the regenerating chambers while maintaining a constant flow of the products of combustion in such a direction through the melting chamber, as will subject the charge therein to the highest uniform heat. And further, the introduction of the heated air in jets or a series of small streams, into the column of gas and on all sides thereof, effects a thorough commingling of the gas and air before their entrance into the melting chamber.

I claim herein as my invention—

1. A furnace having in combination a heating or melting chamber, an inlet flue for introducing gas and air into said chamber, an annular flue connected to the inlet flue, a second annular flue connected to the heating or melting chamber, two air regenerating chambers, each having independent connections to both of the annular flues, and valves controlling the flow of air and products of combustion along said connections, substantially as set forth.

2. A glass pot furnace having the combination of a melting chamber, a central flue for introducing gas and air into the melting chamber, a series of peripheral flues for the escape of the products of combustion from the melting chamber, a regenerating chamber, an annular flue connected to the regenerating chamber and having radial connections with the inlet flue, and an annular flue connected with the peripheral flues and with the regenerating chamber, substantially as set forth.

3. A glass pot furnace having in combination a melting chamber, a central inlet flue for introducing gas and air into the melting chamber, a series of peripheral flues for the

escape of the products of combustion from the melting chamber, two regenerating chambers, an annular flue having a valved connection to both of the regenerating chambers, a series of radial passages connecting the annular flue to the inlet flue at points intermediate between its outlet and the point of introduction of gas thereinto, and an annular flue connected with the peripheral flues and having a valved connection with each of the regenerating chambers, substantially as set forth.

In testimony whereof I have hereunto set my hand.

WILLIAM SWINDELL.

Witnesses:
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R. H. WHITTLESEY.