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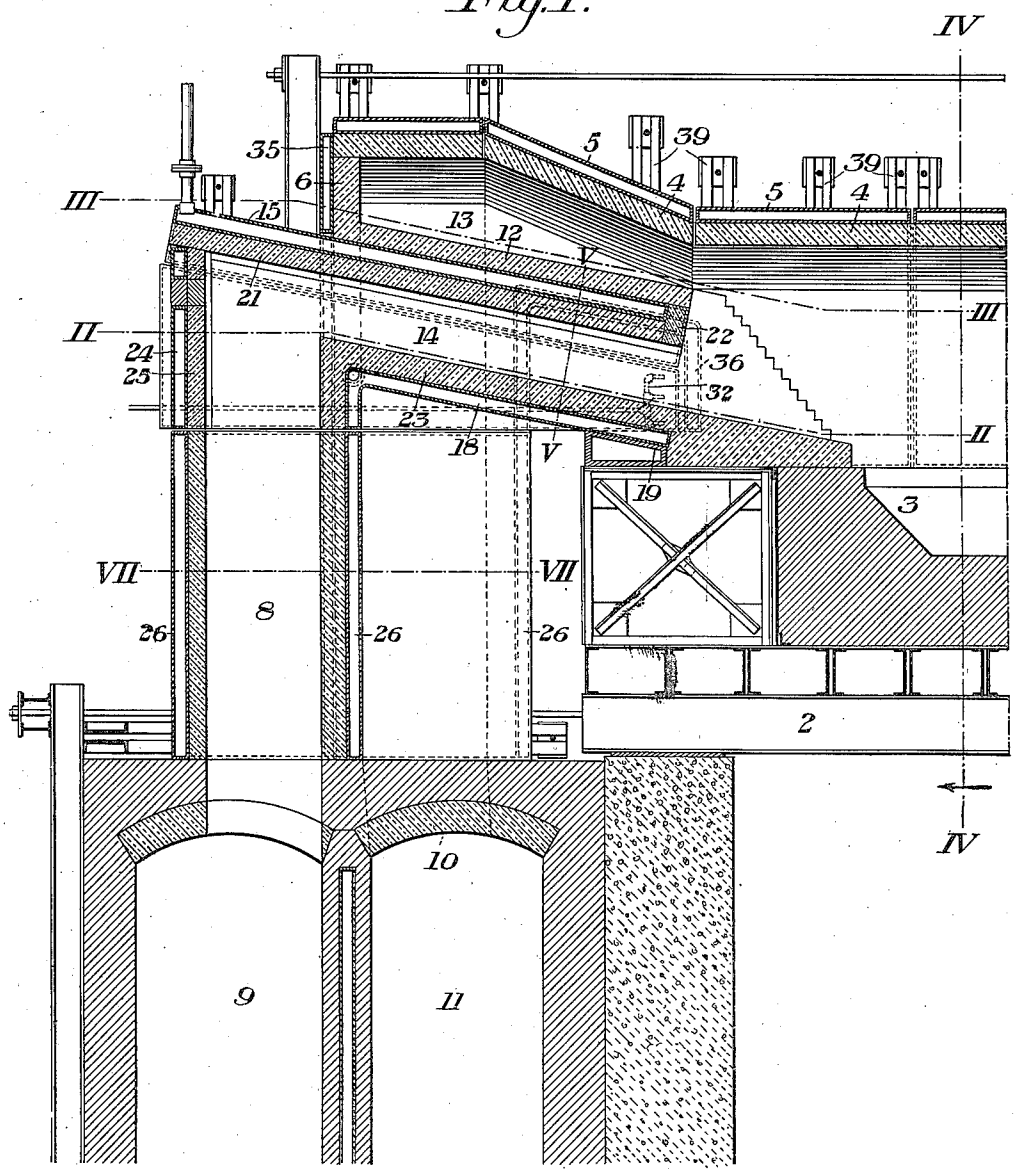
REGENERATIVE REVERSING FURNACE.

APPLICATION FILED MAR. 14, 1911. RENEWED MAR. 8, 1912.

1,041,814. Patented Oct. 22, 1912.

5 SHEETS—SHEET 1.

Fig. 1.



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5 SHEETS—SHEET 2.

Fig. 2.

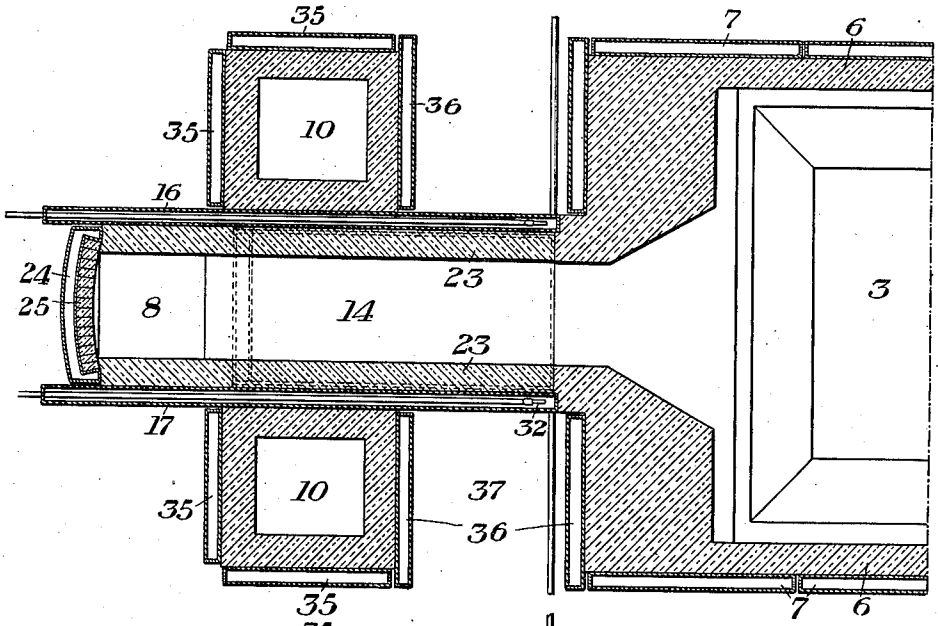
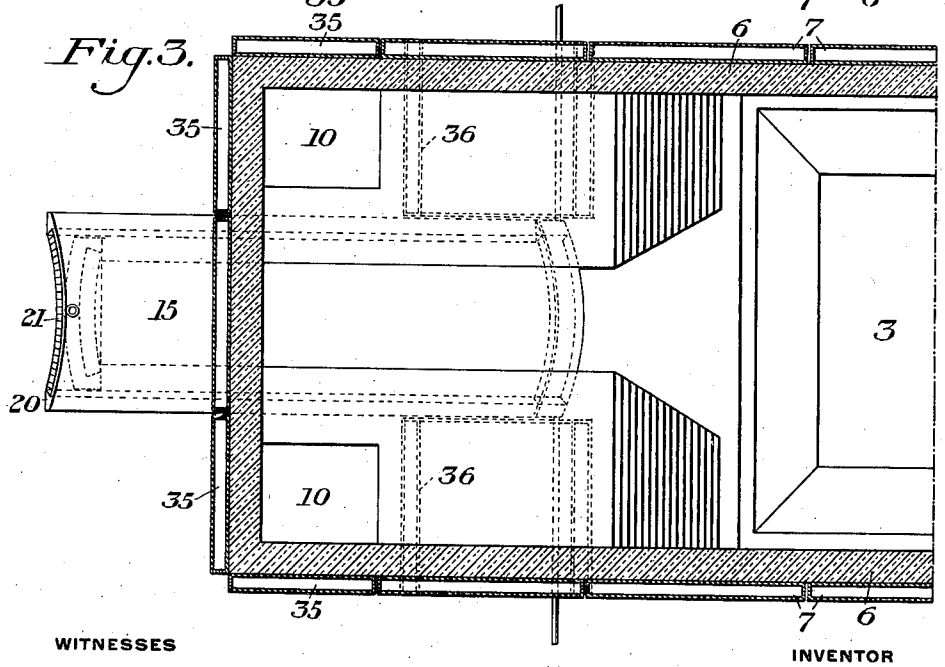


Fig. 3.



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5 SHEETS—SHEET 3.

Fig. 4.

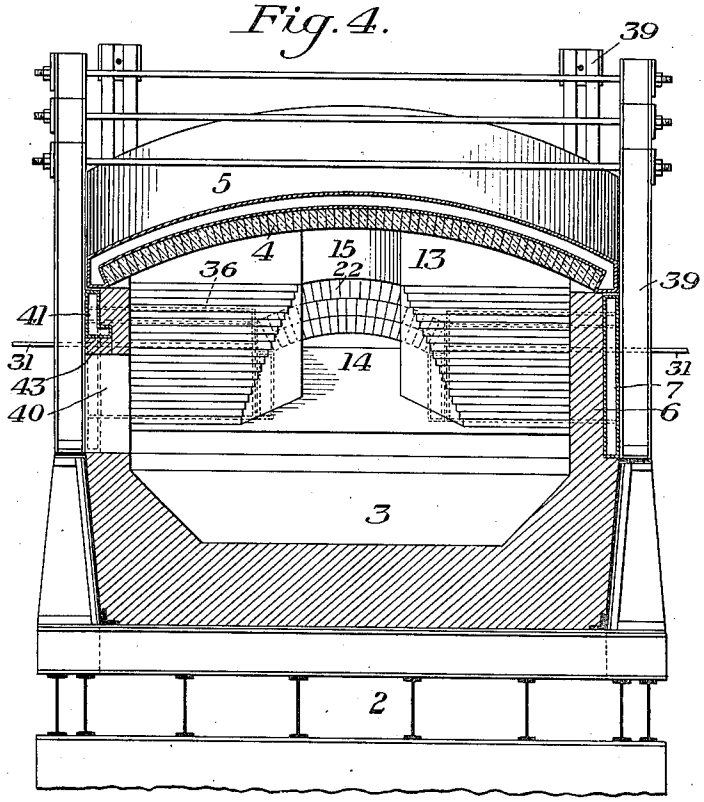


Fig. 5.

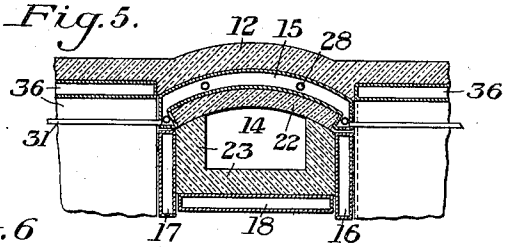
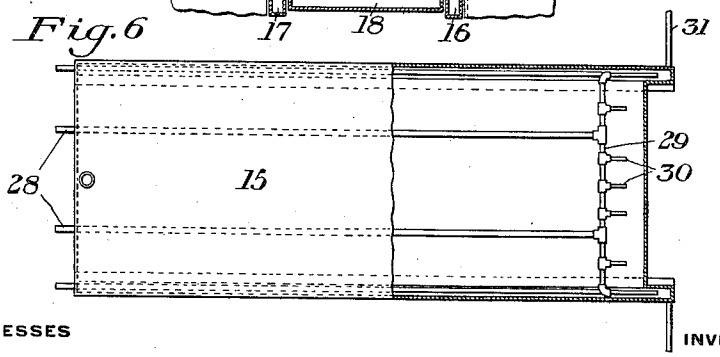


Fig. 6



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5 SHEETS—SHEET 4.

Fig. 7.

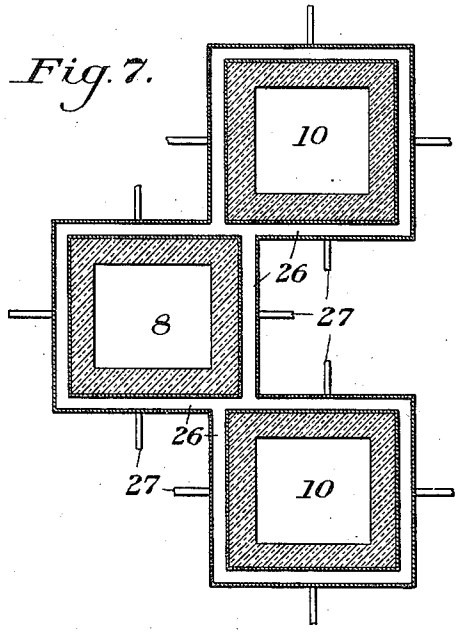
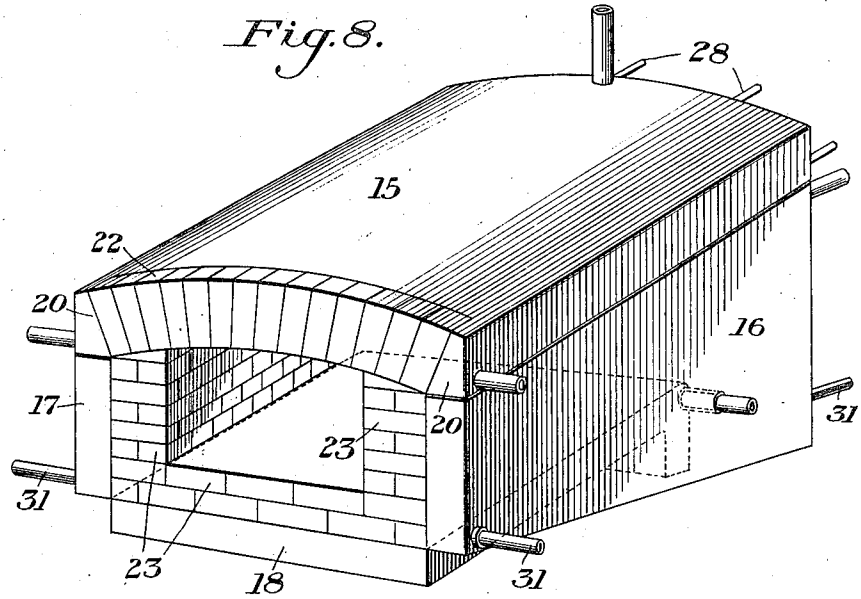


Fig. 8.



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5 SHEETS—SHEET 5.

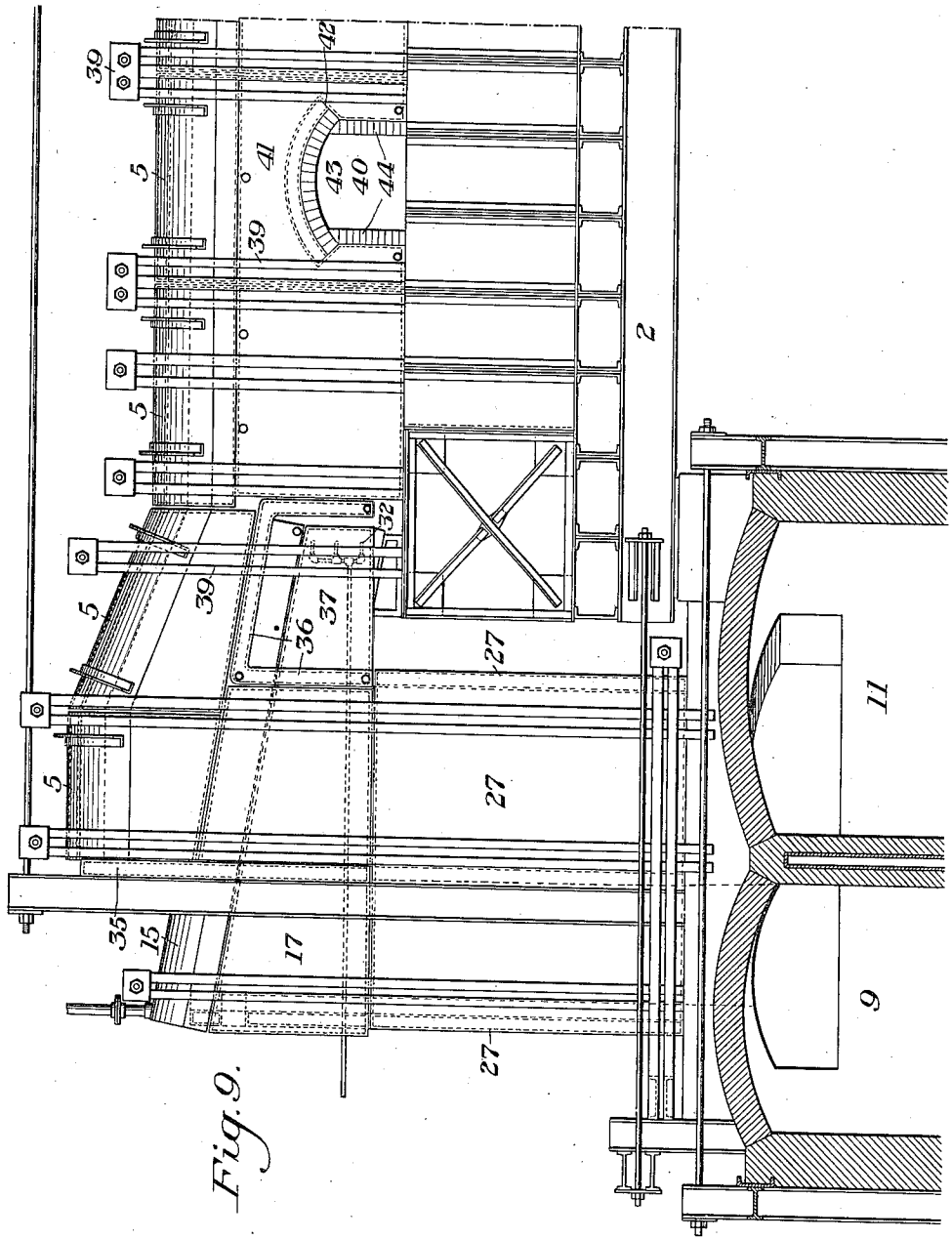


Fig. 9.

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UNITED STATES PATENT OFFICE.

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REGENERATIVE REVERSING-FURNACE.

1,041,814. Specification of Letters Patent. Patented Oct. 22, 1912.

Application filed March 14, 1911, Serial No. 614,507. Renewed March 8, 1912. Serial No. 682,518.

To all whom it may concern:

Be it known that I, LUTHER L. KNOX, a resident of Avalon, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Regenerative Reversing-Furnaces, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming part of this specification, in which—

Figure 1 is a vertical section through one end portion of an open hearth furnace embodying my invention; Figs. 2 and 3 are sections taken on the lines II—II and III respectively of Fig. 1; Fig. 4 is a section on the line IV—IV of Fig. 1 looking in the direction of the arrow on that figure; Fig. 5 is a section through the port cooler and arch; Fig. 6 is a plan view, partly broken away, of the port cooler; Fig. 7 is a section on the line VII—VII of Fig. 1; Fig. 8 is a perspective view of a portion of the port cooler removed; and Fig. 9 is a view partly in side elevation, and partly in vertical section, of one end portion of the furnace.

My invention has relation to regenerative reversing furnaces; and is designed to provide means of novel character for forming and cooling the gas ports of such furnaces, and also for cooling the gas and air uptakes, and the side walls and door openings of the furnace.

The nature of my invention will be best understood by reference to the accompanying drawings in which I have shown the preferred embodiment thereof, applied to a furnace of the open hearth type, and which will now be described, it being premised, however, that various changes may be made in the details of construction and arrangement of the several parts, without departing from the spirit and scope of my invention.

In the accompanying drawings, the numeral 2 designates the frame of the furnace, 3 a portion of the hearth of the furnace, and 4 a portion of the roof wall of the furnace, which I have shown as consisting of a plurality of water cooled plates 5 each carrying a portion of the refractory material 4, as in my prior Patent No. 973,943, dated Oct. 25, 1910. The side and end walls 6 of the furnace are also shown as being provided with a water jacket composed of the hollow coolers 7, hereinafter more fully described.

8 designates the gas up-take leading upwardly from the slag pocket 9, and 10 are the air up-takes leading upwardly from the slag pockets 11, these slag pockets being connected to the regenerators in the usual way.

12 designates a refractory arch which separates the air port 13 from the gas port 14. The gas port 13 communicates with the upper ends of the air up-takes 10 in the usual manner; and the gas port 14 connects with the upper end of the gas port 8. The port 14, together with its connection to the up-take 8, is formed by a port cooler which comprises a top cooling plate 15, two side cooling plates 16 and 17, and a bottom cooling plate 18. These several plates are separately formed, the bottom and side plates being supported on the upper ends of the walls of the up-take 8 and on the frame of the furnace at 19. The side plates support the top plate 15. The top plate is formed with skew-backs 20 which support an inner refractory lining 21 forming the roof wall of the gas port, these skew-backs being extended at the inner end of the top plate to receive and support an insert or setting 22 of refractory bricks or blocks which extend underneath the inner end of the wall 12 and form the inner nose end of the port. The side and bottom plates or coolers each have a refractory lining 23. The outer end of the port cooler is closed by a separable wall composed of a cooling plate 24 having a refractory lining 25.

The gas-uptake is arranged centrally of the air-uptakes 10 and is also offset away from the end of the furnace with respect to the air-uptakes, as best shown in Figs. 2 and 7. Each of the three uptakes below the connection to the gas port is entirely surrounded by a cooling jacket 26, formed of inner and outer plates, with suitable water circulating connections 27, and inclosing chambers for the circulation of a cooling fluid, the chambers around the three uptakes being connected at their junctions so as to form a continuous water space, as shown in Fig. 7.

Above the upper ends of the air-uptakes proper, the connections of these air-uptakes leading to the air ports are provided on three sides with the coolers 35 and 36, their four or inner sides being protected by the side coolers of the gas port, as shown in Fig.

2. These uptake connections are separated from the end of the furnace proper by the laterally open chambers 37 which extend inwardly to the side coolers of the gas port; and the coolers 36 are of inverted U-shape, (see Fig. 9). One leg of each of these coolers 36 covers the adjacent wall of the uptake connection, its other leg forms a cooler for the opposed end wall of the furnace; and its horizontal portion forms the roof of the chamber 37 and also a cooler for the floor of the air port at each side of the gas port.

The upper cooling section 15 of the gas port is shown as having a plurality of water inlet pipes 28 extending longitudinally therein from the outer end to a point near the inner end connected at the inner ends of a cross-pipe 29 having a plurality of spraying nozzles or discharges 30, arranged to direct the cooling liquid against the inner end wall of the cooler. The side and bottom coolers are supplied by the circulating pipes 31 of any suitable character. Preferably the circulating pipes for all the cooling members shown are so arranged that the cold water will enter at a low portion thereof and will escape at the highest point, thereby preventing the formation of steam pockets or spaces. The side members 16—17 may also have their inlet pipes provided with spraying heads, as indicated at 32 in Fig. 1.

It will be seen that the gas port, together with its connection with the gas up-take is formed entirely by a removable structure having separable water cooled walls. This structure in the particular furnace shown, extends outwardly beyond the end wall of the air port 13 so as to connect with the upper end of the offset gas-uptake. By this construction of the gas port, all the walls thereof are effectively protected by the cooling members which are capable of being rapidly removed and repaired or replaced without dismantling the entire furnace.

The side wall coolers 7 are formed in sections arranged side by side (see Fig. 9) held in place by buck-stays 39 (Figs. 4 and 9). The sections which carry the door openings, (one of which is shown at 40 in Figs. 4 and 9) are formed with arches 41 over said openings, with skew-backs 42 which support a refractory arch 43. The side walls of the door openings of the coolers are preferably provided with the refractory linings 44. In this manner, the coolers are made to support and cool a portion of the door arches.

It will be seen that my invention provides effective means for water cooling all those parts of the furnace which are most subjected to the destructive action of the heat.

While I have shown my invention as applied to one end only of a furnace, it will be understood that the construction is preferably substantially the same at both ends for both sets of ports and uptakes.

It will be obvious that the exact construction and arrangement of the various cooling members, together with their circulating connections may be varied without departing from the spirit and scope of my invention as defined in the appended claims.

What I claim is:

1. In a regenerative furnace, a gas port forming and cooling structure, comprising separate top, side and bottom members, each of said members having a hollow cooling plate and a refractory lining, the top member being arched and supported by the side members which are vertical, the hollow cooling plates in the top and side members extending from the discharge end of the gas port as far back, at least, as the gas uptake; substantially as described.

2. In a regenerative furnace, a gas port forming and cooling structure, comprising separate top, side and bottom members, each of said members having a hollow cooling plate and a refractory lining, the top member being arched and supported by the side members which are vertical, the hollow cooling plates in the top and side members extending from the discharge end of the gas port as far back, at least, as the gas uptake, the structure having also a separate water-cooled end wall which forms the outer wall of the upper portion of the gas uptake; substantially as described.

3. In a regenerative furnace, a gas port forming and cooling structure, comprising separate top, side and bottom members, each of said members having a hollow cooling plate and a refractory lining, the top member being arched and supported by the side members which are vertical, the hollow cooling plates in the top and side members being extended to inclose and form the upper portion of the gas uptake; substantially as described.

4. In a furnace of the class described, having gas and air ports, a refractory wall separating said ports, and a cooling member extending inwardly through the end wall of the furnace underneath said refractory wall, said cooling member having supports for a refractory lining and also having a refractory nose portion at its inner end and supported by it; substantially as described.

5. A furnace of the class described, having its air and gas up-takes surrounded by hollow cooling jackets, the chambers of said jackets being connected at their junctions to form a continuous space for a cooling medium; substantially as described.

6. A regenerative furnace having gas and air ports, an uptake therefor, and a refractory wall separating said ports, and a gas port forming and cooling structure inserted

between the air uptakes and extending underneath said wall, said structure being formed by separate and separable hollow members having supports for a refractory lining, said hollow members extending outwardly from the discharge end of the gas port to inclose and form the upper portion of the gas uptake; substantially as described.

7. In a furnace of the class described, a gas port forming a cooling structure, comprising a flat bottom member, vertical side members, and an arched top member supported by the side members, each of said members having an outer hollow water-cooled plate, said members being separable and having separate water-circulating connections; substantially as described.

In testimony whereof, I have hereunto set my hand.

LUTHER L. KNOX.

Witnesses:
GEO. H. PARMELEE,
H. M. CORWIN.