L. L. KNOX.

REGENERATIVE REVERSING FURNACE.

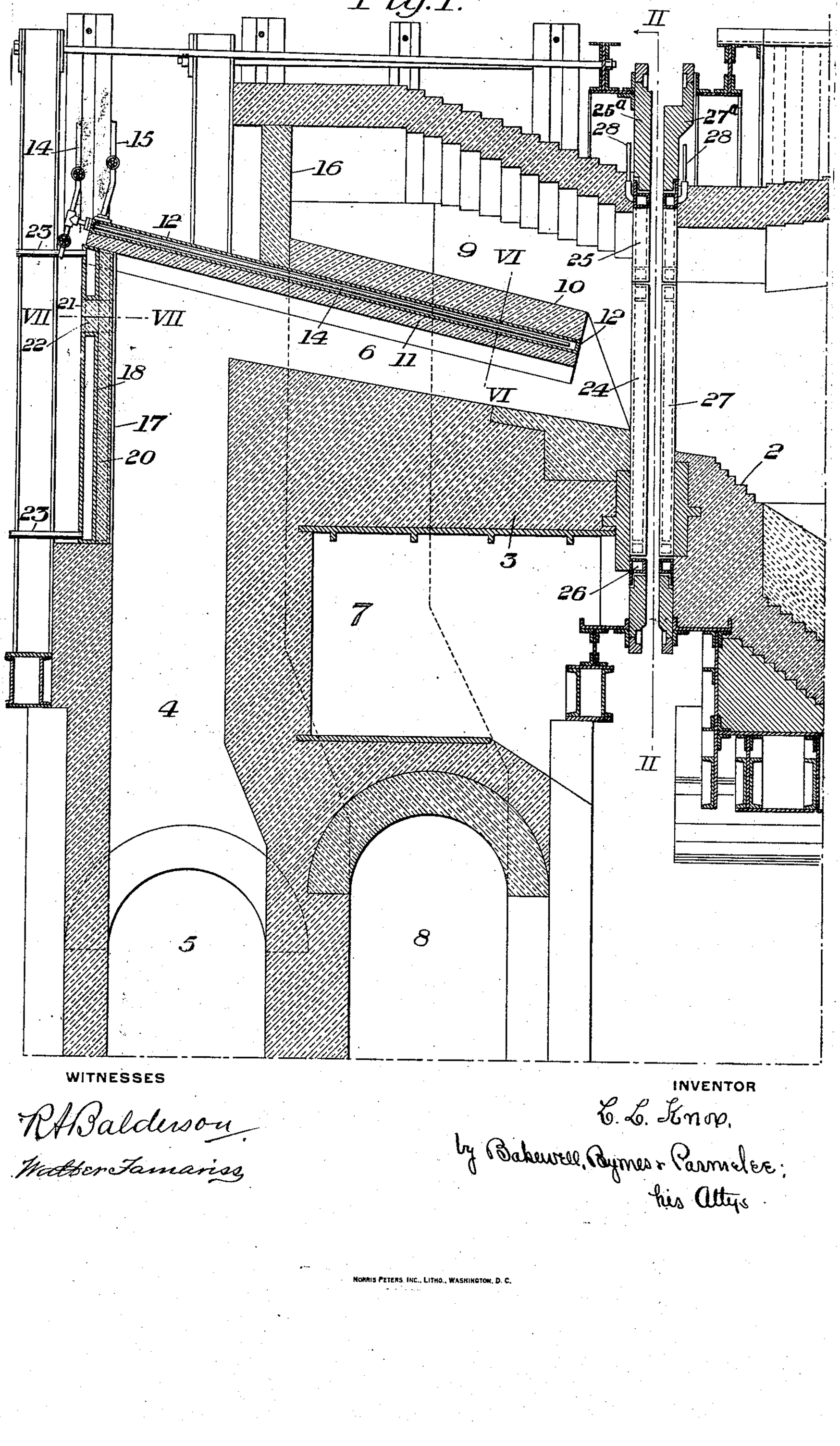
APPLICATION FILED OCT. 15, 1909.

956,367.

Patented Apr. 26, 1910.

4 SHEETS—SHEET 1.

Fig. 1.



WITNESSES

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Walter Tamariss

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4 SHEETS—SHEET 2.

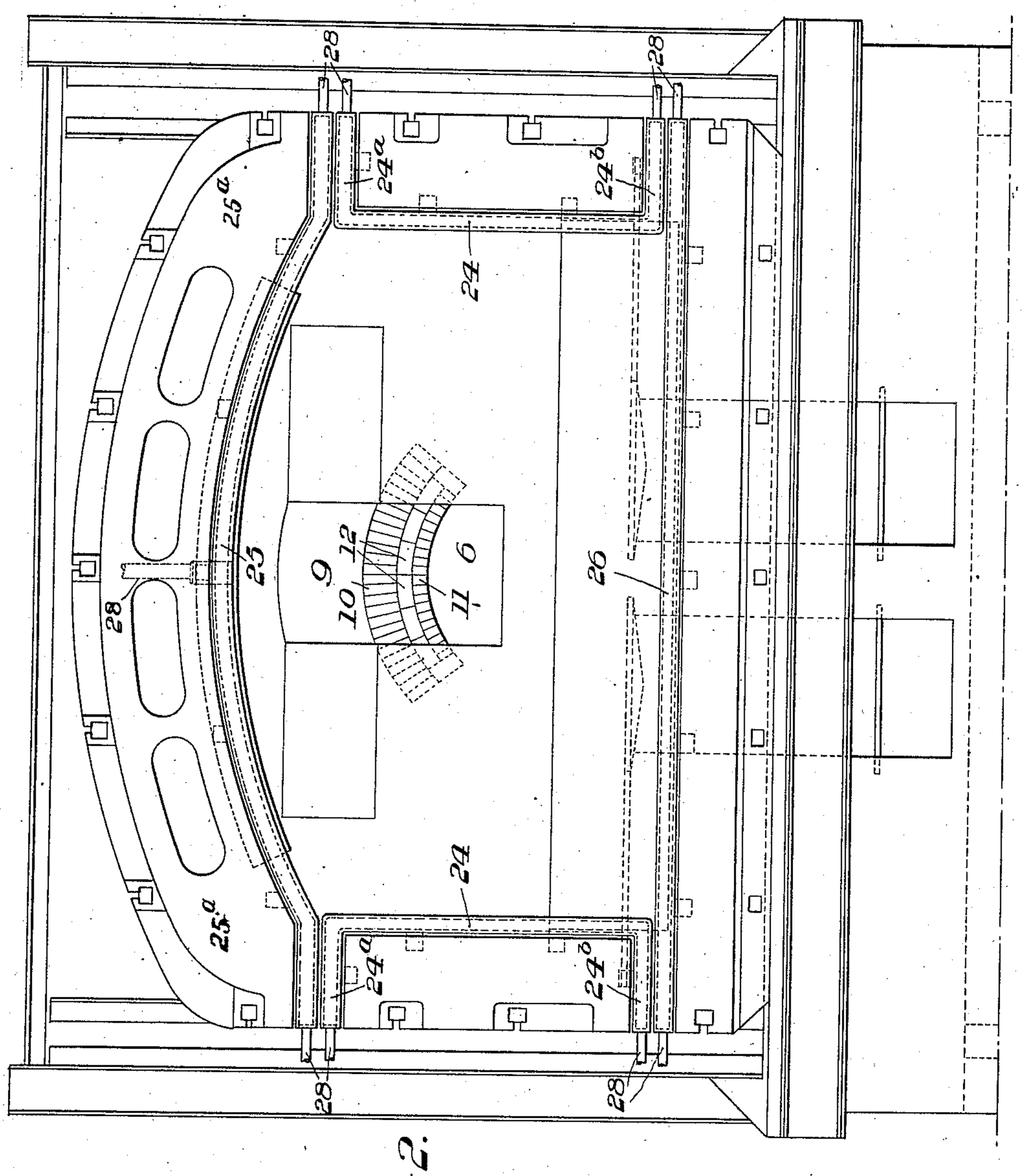

Fig. 2.

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4 SHEETS—SHEET 3.

Fig. 3.

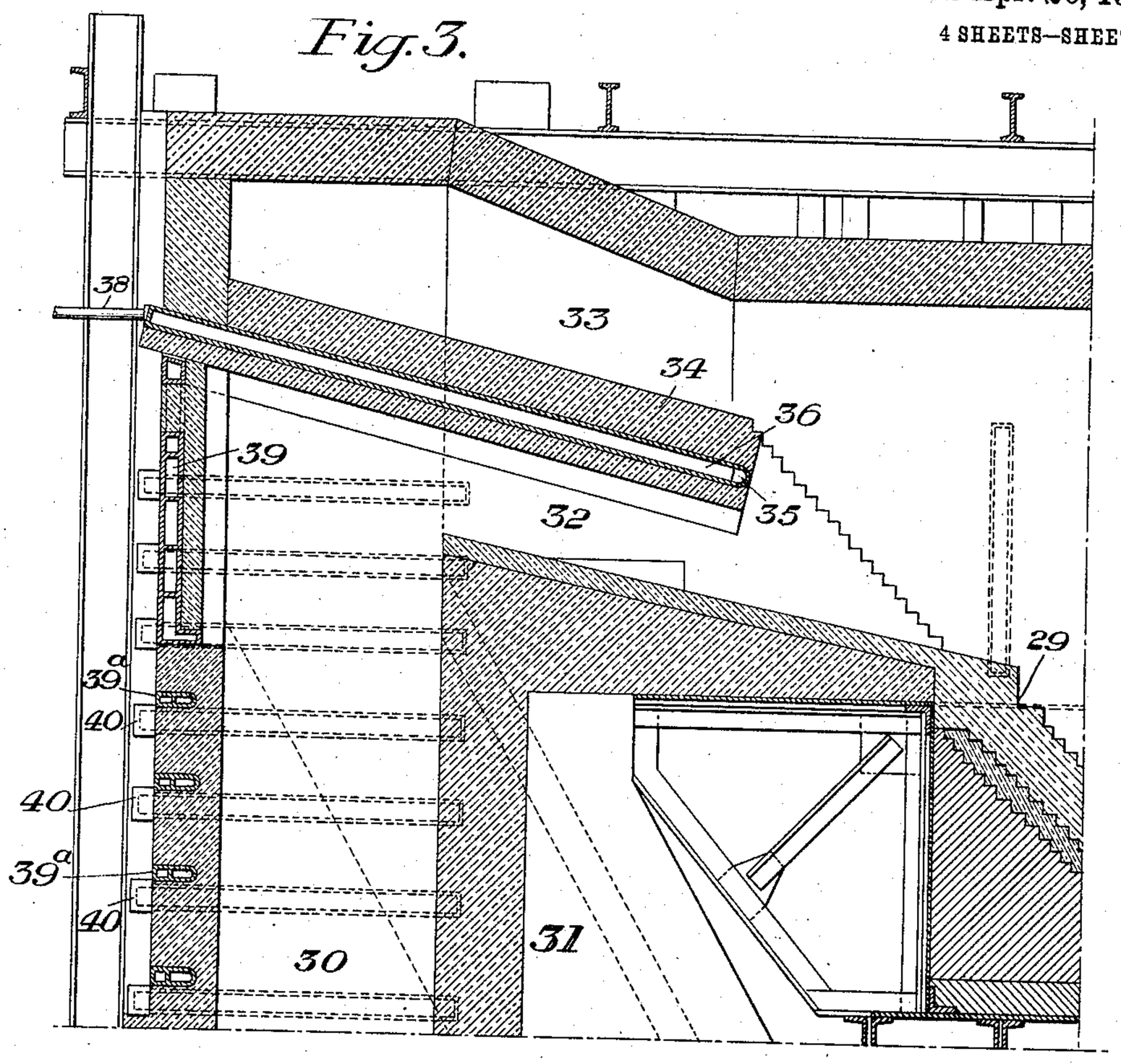


Fig. 4.

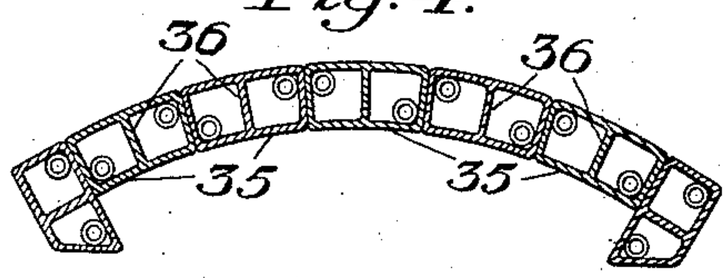
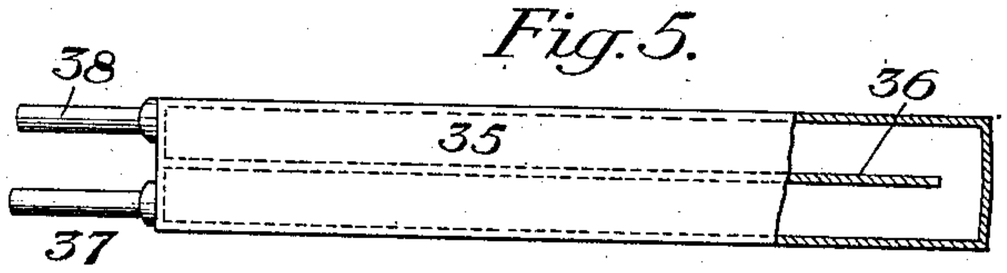


Fig. 5.



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4 SHEETS—SHEET 4.

Fig. 6.

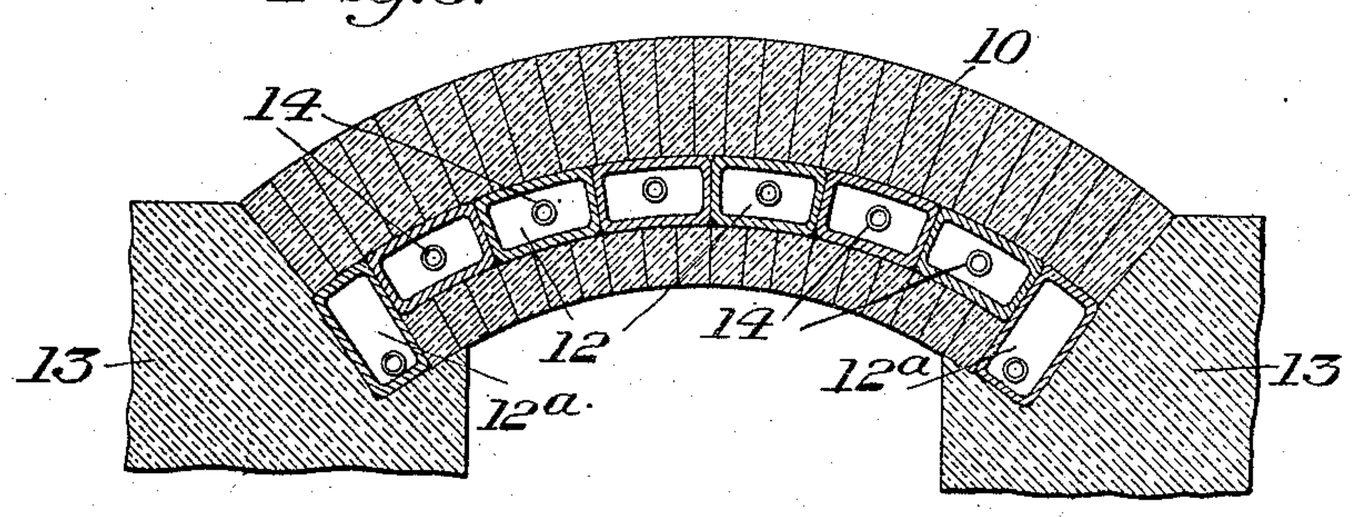


Fig 7.

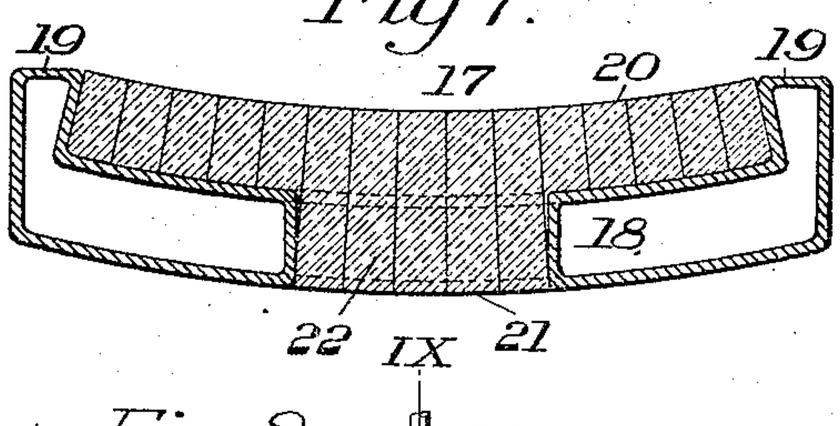


Fig. 8.

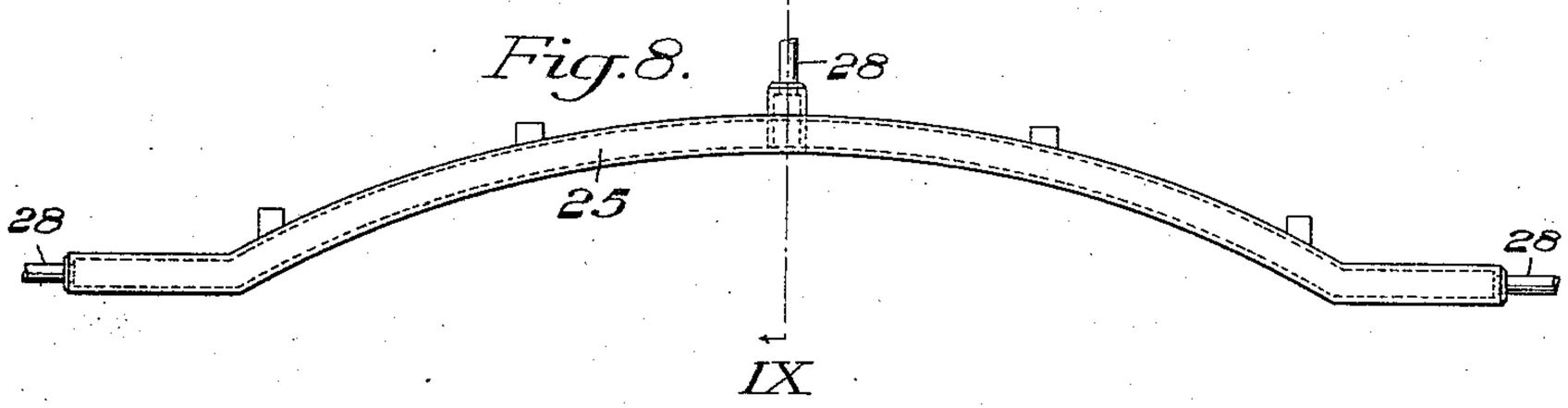
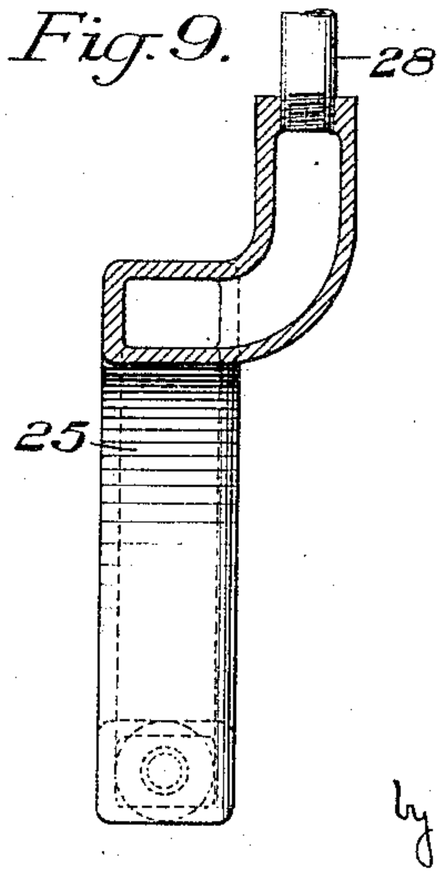


Fig. 9.



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UNITED STATES PATENT OFFICE.

LUTHER L. KNOX, OF BEN AVON, PENNSYLVANIA, ASSIGNOR TO KEYSTONE FURNACE CONSTRUCTION COMPANY, OF PITTSBURG, PENNSYLVANIA, A CORPORATION OF PENNSYLVANIA.

REGENERATIVE REVERSING-FURNACE.

956,367. Specification of Letters Patent. **Patented Apr. 26, 1910.**

Application filed October 15, 1909. Serial No. 522,701.

To all whom it may concern:

Be it known that I, LUTHER L. KNOX, of Ben Avon, Allegheny county, 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 of one end portion of the furnace embodying my invention; Fig. 2 is an elevation looking to the left from the line II—II of Fig. 1; Fig. 3 is a view similar in character to Fig. 1, but showing a modification; Fig. 4 is a cross-section of the middle portion of the arch between the gas and air ports in the construction shown in Fig. 3; Fig. 5 is a plan view partly broken away of one of the sections of the arch; Fig. 6 is a cross-section on the line VI—VI of Fig. 1; Fig. 7 is a cross-section on the line VII—VII of Fig. 1; Fig. 8 is a detail view of one of the cooling members; and Fig. 9 is a cross-section on the line IX—IX of Fig. 8.

My invention has relation to regenerative reversing furnaces, and is designed to provide means of novel and effective character for protecting certain portions of the furnace against the destructive action of heat.

With this object in view, my invention consists in the novel construction, combination and arrangement of the parts by which certain portions of the furnace are effectively water-cooled in a manner more fully hereinafter described.

In the construction shown in Figs. 1, 2, 6, 7, 8 and 9, I have shown my invention applied to an open-hearth furnace of the tilting hearth type. The numeral 2 designates a portion of the tilting hearth, which is in general of any well known or suitable type, and which is mounted and operated in the well known manner. 3 designates the stationary end or "dog house" of the furnace. 4 designates the gas up-take, which extends upwardly within the dog house from the regenerator connection 5 and communicates at its upper end with the gas port 6 leading to the furnace. 7 indicates one of the air-up-takes leading from the regenerator connection 8 and opening at its upper end into the port 9 also leading to the furnace. The gas and air ports 6 and 9 are separated by an intervening wall or arch, consisting of an upper covering or floor 10 of refractory material, a lower covering 11 of refractory material, and a plurality of metal cooling boxes or sections 12 interposed between the upper and lower refractory material. These cooling boxes or sections 12 are arranged, as clearly shown in Fig. 6, to form an arch, the side sections 12^a being deeper and forming skew backs to support the refractory material 11. The arch is supported at its ends upon the side walls 13. 14 designates a water-supply pipe, which extends downwardly within each of the hollow sections 12 to a point near its lower end, as shown in Fig. 1, where it discharges, the outlet for each section being at the upper end at substantially the highest point thereof, to which is connected a discharge pipe 15. In the construction shown in Fig. 1, the refractory material 10 extends only to the end wall 16 of the air port, and beyond this wall and over the top of the up-take 4 the hollow sections 12 are preferably directly exposed to the atmosphere so as to receive the cooling effect thereof. The front end of the wall or arch rests upon the bulk head 17, which constitutes the outer wall of the upper portion of the gas up-take 4. This bulk head consists of a removable hollow box or casting 18, which is curved in transverse section, as shown in Fig. 7, and is provided with the skew backs 19 at its ends for the purpose of carrying a refractory lining 20. The box or casting 18 is preferably provided with a poke hole 21, which is normally filled by an extension 22 of refractory lining 20, as shown in Figs. 1 and 7. The box 18 is also provided with the water circulating connections 23. The inner end of the overhanging portion of the dog house containing the gas port 6 and the air port 9 is preferably provided with a hollow cooling frame, as shown in Figs. 1 and 2. This frame may conveniently consist of the side members 24, the top member 25 (shown in detail in Fig. 8), and the bottom member 26. The top member 25 is of arched form with straight end portions, which rest upon the outwardly turned end portions 24^a of the side members 24. These side members have similar outwardly turned lower end portions 24^b which rest upon the end portions of the lower member 26. The outer end of the tilting hearth 2 is also preferably provided with a cooling frame 27, which is of similar con-

struction to the frame 24, 25 and 26, the two frames being opposed to each other and separated by a sufficient space to allow the necessary tilting movement of the hearth. The cooling sections 24, 25, 26 are removably set within the furnace chill 25ª, and their inner faces are directly exposed to the furnace. The cooling sections 27 are, in a similar manner set within the port chill 27ª. 28 wherever seen designates water-circulating connections for these hollow frames. These connections are so arranged that it will take the cold water into the lowest portion of the frame members, while the heated water is taken off at the upper portions thereof.

In Fig. 3 I have shown my invention applied to an open hearth furnace of the non-tilting type. In this figure 29 designates the furnace hearth; 30 the gas up-take; 31 one of the air up-takes; 32 the gas port; 33 the air port; and 34 the arch separating the gas and air ports. This arch is similar in construction to that shown in Figs. 1 and 6, except that instead of extending the cold water pipes downwardly within the hollow metal sections 35, each of these sections is provided with a longitudinally extending partition or baffle wall 36, as shown in Figs. 4 and 5. The cold water enters each section at the lower portion thereof from a supply pipe 37, and after flowing around the end of the partition 36 and back to the end of the wall or arch, is discharged by the pipe 38. The bulk head 39 is preferably of the same construction as shown in Figs. 1 and 7. 39ª designates cooling boxes, which are set in the front wall of the gas up-take 30 below the bulk head 39, and 40 indicates a series of hollow cooling boxes, which are inserted in the side walls of the up-take port 30, or those walls which separate the gas up-take from the air up-take.

The advantages of my invention will be readily appreciated by those skilled in the art, since it provides means of effective character for protecting those portions of the furnace which are subject to the most rapid destructive action in service.

I do not limit myself to the precise forms of my invention which I have herein shown and described, since it is obvious that the improvements may be readily adapted by those skilled in the art to other constructions of furnaces; that modifications may be made in the form of the cooling boxes and in the circulating connections therefor; and that various other changes may be made within the spirit and scope of the appended claims.

While I have shown my invention as applied to but one end portion of the furnace, it will be understood that in practice both ends of the furnace will be of similar character.

What I claim is:—

1. In a regenerative reversing furnace, a wall or arch separating the gas and air ports and consisting of a body of refractory material having embedded therein a plurality of hollow cooling boxes or sections, arranged side by side and extending longitudinally throughout the major portion of the length of the arch the outer or side boxes or sections having skew-back portions which support the refractory material throughout substantially the length of the wall or arch, together with circulating connections for said boxes or sections; substantially as described.

2. In a regenerative reversing furnace, a wall or arch separating the gas and air ports of the furnace and consisting of a body of refractory material having embedded therein a metallic arch composed of a plurality of hollow abutted, longitudinally extending boxes or sections; substantially as described.

3. In a regenerative reversing furnace, a wall or arch separating the gas and air ports of the furnace and consisting of a body of refractory material having embedded therein a metallic arch composed of a plurality of hollow abutted, longitudinally extending boxes or sections, said boxes or sections supporting part at least of the refractory material; substantially as described.

4. In a regenerative reversing furnace, a wall or arch separating the gas and air ports of the furnace and consisting of a body of refractory material having embedded therein a metallic arch composed of a plurality of hollow abutted, longitudinally extending boxes or sections, the end boxes or sections having skew-back extensions at their ends for carrying a portion of the refractory material; substantially as described.

5. In a regenerative reversing furnace, an uptake having a removable bulk head portion consisting of a hollow water-cooled box or casting, of curved or arch form in transverse section, and a body of refractory material supported thereby; substantially as described.

6. In a regenerative reversing furnace, an uptake having a portion of its wall formed by a removable bulk head consisting of a hollow water-cooled box or casting curved or arched in transverse section and having skew-back extensions, and a lining of refractory material carried by said casting and extensions; substantially as described.

7. In a regenerative reversing furnace having a wall or arch separating the gas and air ports of the furnace and comprising a body of refractory material and cooling means embedded therein, said wall or arch having an end extension forming the top of the gas uptake, and the cooling means therein being exposed to the atmosphere above the uptake, the cooling means having skew-backs supporting the refractory material throughout the length of the arch; substantially as described.

8. In a regenerative reversing furnace, having a tilting hearth, a chill at the end of the furnace, and a hollow water cooled frame removably seated within the chill, around the end opening of the furnace, said frame forming the inner exposed surface of the chill; substantially as described.

9. In a regenerative reversing furnace having a tilting hearth, a hollow water-cooled frame surrounding the ends of the gas and air ports where they discharge into the furnace, said frame being composed of a plurality of separate members having separate water-circulating connections, substantially as described.

10. In a regenerative reversing furnace, having a tilting hearth, and relatively fixed gas and air ports communicating therewith, a chill surrounding the inner ends of said ports, and a water cooled frame removably seated within said chill and forming the inner exposed surface thereof; substantially as described.

11. In a regenerative reversing furnace, a tilting hearth having an opening at the end to communicate with gas and air ports, and a hollow water-cooled frame surrounding said opening, said frame being formed in a plurality of separate parts having separate water-circulating connections; substantially as described.

In testimony whereof, I have hereunto set my hand.

LUTHER L. KNOX.

Witnesses:
G. M. VIERS,
H. M. CORWIN.