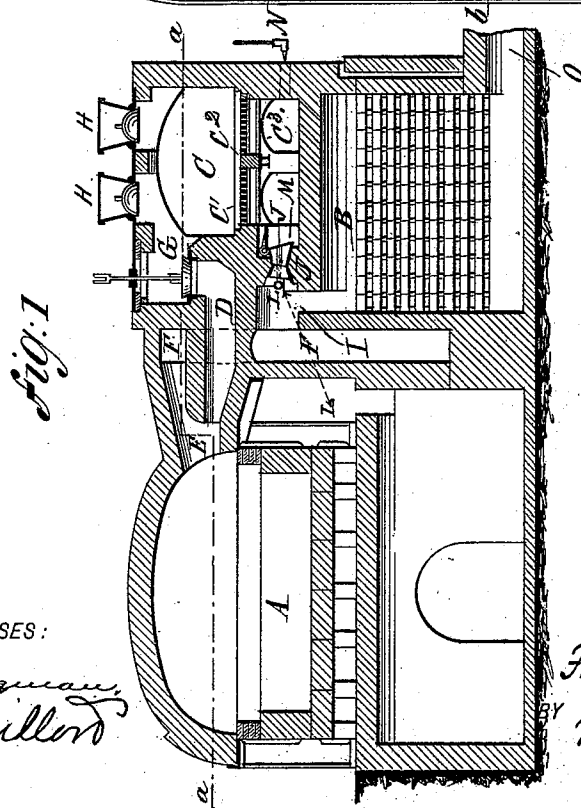
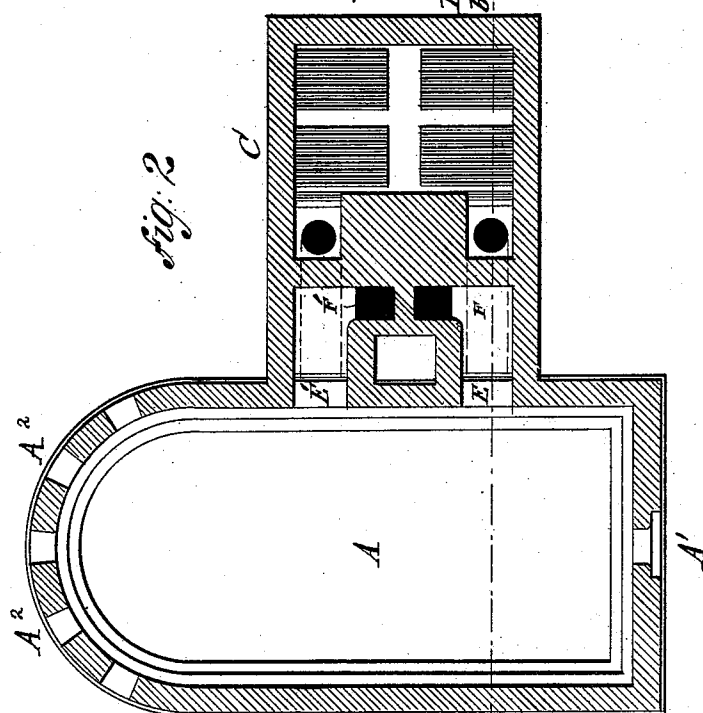


(No Model.)

F. SIEMENS.
REGENERATIVE FURNACE.

No. 534,408.

Patented Feb. 19, 1895.



WITNESSES :

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UNITED STATES PATENT OFFICE.

FREDERICK SIEMENS, OF DRESDEN, GERMANY.

REGENERATIVE FURNACE.

SPECIFICATION forming part of Letters Patent No. 534,408, dated February 19, 1895.

Application filed May 11, 1892. Serial No. 432,679. (No model.) Patented in England March 16, 1889, No. 4,644, and December 13, 1889, No. 20,083.

To all whom it may concern:

Be it known that I, FREDERICK SIEMENS, a subject of the Emperor of Germany, residing at Dresden, German Empire, have invented new and useful Improvements in Regenerative Gas-Furnaces and Producers, (which invention is described in part in Letters Patent of Great Britain, No. 4,644, dated March 16, 1889, and in part in Letters Patent of Great Britain, No. 20,083, dated December 13, 1889,) of which the following is a specification.

My invention relates to "regenerative gas furnaces and producers," of the type in which the gas producer is located close to the furnace chamber, and over, or in close proximity to the air regenerators, whereby the gas producer may be supplied with heated air from the upper part of the regenerators, or with heated air from the upper part of the regenerators mixed or not with a portion of the products of combustion from the furnace, or with cold air in any desired proportion.

My invention also relates to "regenerative gas furnaces and producers" of the type in which only the air employed in the furnace is regenerated, and this regenerated air mingles with the hot gases from the producer, prior to the entrance of the combined gas and air into the furnace chamber.

The object of my invention is to effect an economy of the fuel used in the producer, which results, when heated air is used in the producer, in combination with a portion of the products of combustion; or in combination with a portion of cold air; or in combination with a portion of the products of combustion, and a portion of cold air.

In carrying my invention into effect, I prefer to use the air employed in the producer, in as highly heated a condition as it can conveniently be obtained, and, therefore, I arrange to take the air from the top of the regenerators where it is most highly heated, and to convey it through suitable flues to the producer, and deliver it under the hearth or grate of such producer.

In the accompanying drawings which illustrate my invention, I have shown my invention as embodied in a "tank furnace," for the continuous melting of glass.

In the drawings similar letters of reference indicate like parts.

Figure 1, is a transverse vertical section of a continuous glass melting tank furnace, and the gas producer connected thereto, taken on the line *b b* of Fig. 2. Fig. 2, is a horizontal section on the line *a a* of Fig. 1.

In the drawings, A represents the melting tank, which may be given any convenient size, shape, or depth. Preferably the tank should be given such a depth as to permit the melting and fining of the glass to take place in a vertical direction, and yet allow a layer of semi-fluid or partially solid glass to be formed over the bottom of the tank, the object of which arrangement is fully set forth in Letters Patent of the United States, No. 261,054, granted to me July 11, 1882. I also prefer that the crown or roof of the tank should be so constructed, as to permit the free development of flame, as set forth in Letters Patent of the United States, No. 341,285, granted to me May 4, 1886.

A' is a door through which the batch or glass making materials are fed into the tank.

A², A², are doors through which the melted and planed glass is gathered by the blowers from the tank.

Located at one side of the tank, and nearest to the charging end, are the regenerators B and B'.

Arranged over the regenerators B and B' is the gas producer C, formed as a single chamber, with double grates C' and C², supported above the hearth upon suitable arches C³, or in any other suitable manner.

It will be obvious that in place of locating the producer over the air regenerators, the producer may be placed between the regenerators, or the producer and regenerators may be independently placed. To obtain the best results, however, I prefer to place the producer over the regenerators, as by so doing, the heated air taken from the regenerators, and carried to the producer, has but a short distance to go, and reaches the producer in the most highly heated condition.

The vertical section shown in Fig. 1 is taken on the line *b, b* of Fig. 2, and hence only shows a section of the combustion chamber, one-

half of the gas producer, one set of flues, and one regenerator.

It should be understood that the parts mentioned by letter in the following description are duplicated; that is to say, if the description refers to flues D D', or other parts by letter, it means that the flues D are shown, D' not shown, but exist on the opposite side of the furnace.

D and D' are flues which connect the opposite sides of the top of the producer with the furnace ports E and E', and a similar flue D', not shown, connects the gas producer on the opposite side of the furnace with the flame port E'.

F and F' are flues which connect the air regenerators B and B' with the furnace ports E and E'.

G and G' are valves in the flues D and D', and are provided with suitable operating mechanism, by which they may be alternately opened and closed in reversing the flame in the furnace.

H H are coal-hoppers arranged over the top of the gas producer.

I and I' are flues which connect the regenerators B and B' with the flues F and F'.

J and J' are flues which connect the flues I and I' with the space K, under the grates of the producer.

L and L' are steam or air-jets in the flues J and J'.

M and M' are valves in the flues J J', by which they may be closed.

N is the steam or air-blast pipe, by which cold air may be injected under the hearth of the producer.

O is the flue from the regenerators to the chimney stack.

The operation of my improved device is as follows: The valve G in the flue D being opened, the highly heated gas from one side of the producer, and the highly heated air from the regenerator B are brought together and emitted into the furnace chamber through the furnace port E. The flame due to the combined gas and air, sweeps around the chamber, and leaves the chamber by the port E'. A part of the products of combustion leaving the furnace, passes downward through the flue F', and thence through the regenerator B', which it heats in its passage. The other portion of the products of combustion pass by flue D' to flue J', and under the hearth of the producer. At the same time, a portion of heated air is drawn from the top of the regenerator B' through flue I' and flue J' and mingles with the products of combustion under the hearth of the producer, and from thence passes upward through the fuel in the producer. Simultaneously with this action at the regenerator B' side of the producer, a portion of heated air is drawn through the flues I and J from the regenerator B, and introduced on the opposite side of the producer.

In each case, the hot air or gases are injected under the grates of the producer by the action of the steam or air-jets L L'.

If desired, a portion of the products of combustion may be introduced on one side of the producer, and a portion of hot air from a regenerator upon the other side of the producer, or a portion of the products of combustion introduced upon one side, mingled with cold air introduced through the jet N.

By closing either of the valves M or M', one side of the furnace may be fed wholly with the products of combustion, or wholly with heated air.

It will be readily understood that by suitably arranging the valves and jets, the producer may, as before stated, be fed with the heated air, mixed or not with the products of combustion, or with cold air in any desired proportion. As the regenerators become heated, the furnace can be reversed by opening and closing the valves G and G'.

Having thus described my invention, I claim—

1. The combination with the melting tank of a continuous glass melting furnace, of a gas producer, reversible air heating regenerators, flues which connect each side of the gas producer at its top with the melting tank, valves in said flues, flues which connect the regenerators to the melting tank, and independent flues which connect the regenerators with the gas producer at each side of its bottom portion, substantially as and for the purpose set forth.

2. The combination with the melting tank of a glass melting furnace, of a gas producer, reversible air heating regenerators, and independent flues which connect the top portion of such regenerators with the bottom portion of the gas producer, substantially as and for the purpose set forth.

3. The combination with the melting tank of a continuous glass melting furnace, of a gas producer, reversible air heating regenerators, independent flues which connect the top portion of such regenerators with the bottom portion of the gas producer, and suitable flues and valves between said melting tank, gas producer, and air regenerators, whereby the gas and air may be conveyed to the melting tank, and the products of combustion therefrom, alternately at intervals, substantially as and for the purpose set forth.

4. The herein described method of operating a regenerative gas furnace which consists in extracting the heat from the products of combustion, thereby heating the air used in combustion, and in the gas producer; in injecting a portion of the air so heated taken from the top of the regenerators, directly through a mass of fuel in the producer, in transmitting the remaining portion of heated air directly to the combustion chamber, and there combining it with the gases from the

producer, and finally burning the resultant gases in said furnace.

5 The herein described method of operating a regenerative gas furnace which consists in extracting the heat from the products of combustion, thereby heating the air used in combustion and in the gas producer, in injecting a portion of the air so heated taken from the top of the regenerators simultaneously
10 with a portion of cold air, through a mass of fuel in the producer, in transmitting the remaining portion of heated air to the combustion chamber, and there combining it with the gases from the producer, and finally burning the resultant gases in said furnace, substantially as and for the purpose set forth.
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6. A step in the method of operating regenerative gas furnaces, which consists in sup-

plying to the gas producer a portion of heated air taken from the top of the regenerator or 20 regenerators, substantially as and for the purpose set forth.

7. A step in the method of operating regenerative gas furnaces, which consists in supplying to the gas producer a portion of heated 25 air taken from the top of the regenerator or regenerators, and a portion of cold air, substantially as and for the purpose set forth.

In testimony whereof I affix my signature in the presence of two witnesses.

FREDERICK SIEMENS.

Witnesses:

C. MAX HERRMANN,
Of Dresden.
HERNANDO DE SOTO.