(No Model.) 2 Sheets—Sheet 1.

F. SIEMENS.

METHOD OF WORKING REGENERATIVE GAS FURNACES AND GAS PRODUCERS

No. 468,835. Patented Feb. 16, 1892.

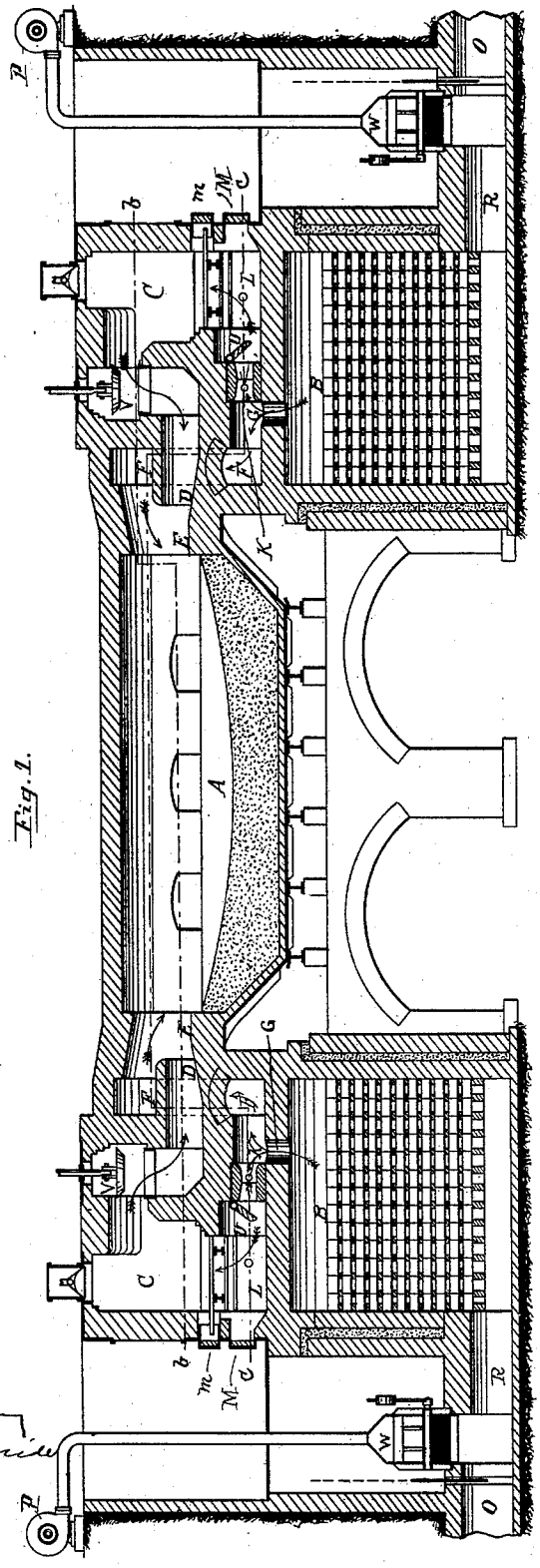

Fig. 1.

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(No Model.) 2 Sheets—Sheet 2.

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Fig. 2.

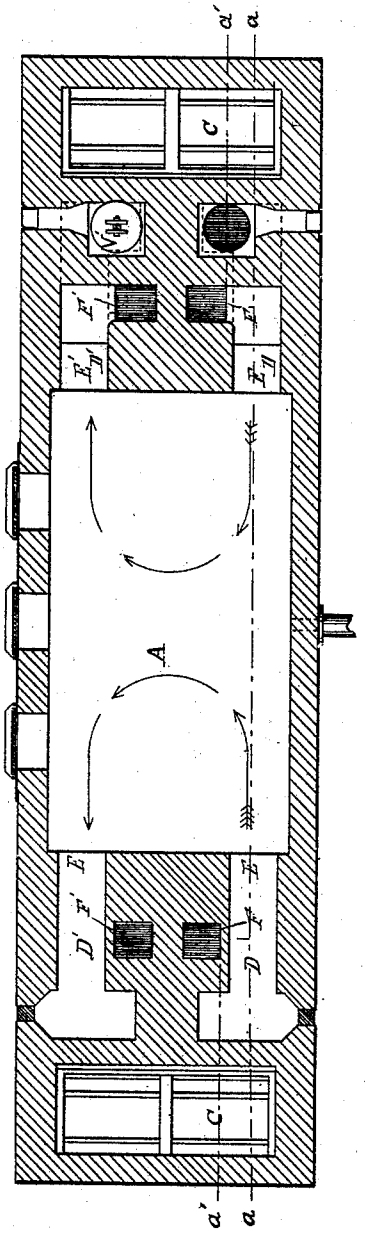
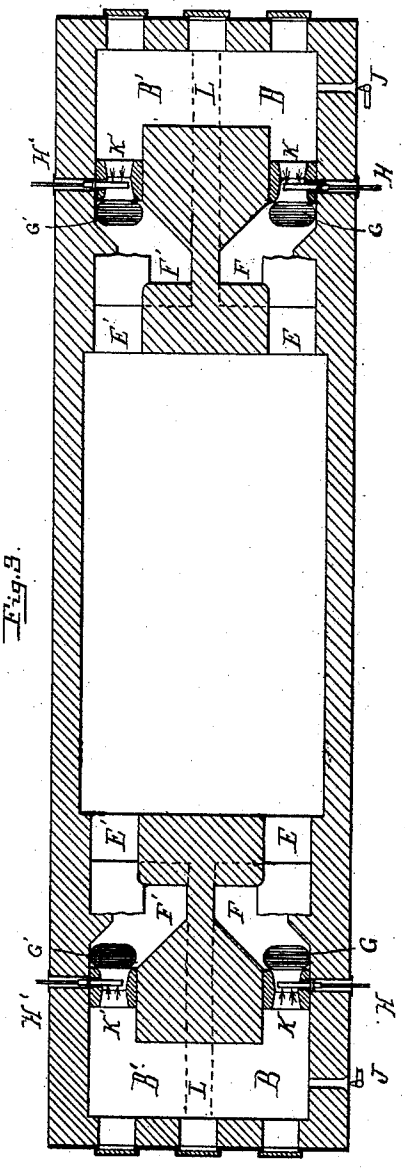


Fig. 3.



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FREDERICK SIEMENS, OF DRESDEN, GERMANY.

METHOD OF WORKING REGENERATIVE GAS-FURNACES AND GAS-PRODUCERS.

SPECIFICATION forming part of Letters Patent No. 468,835, dated February 16, 1892.

Application filed January 31, 1891. Serial No. 379,793. (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 citizen of Saxony, residing at Dresden, in the Empire of Germany, have invented an Improved Method of Working Regenerative Gas-Furnaces and Gas-Producers, (for which I have obtained Letters Patent of Great Britain, dated March 16, 1889, No. 4,644, and dated December 13, 1889, No. 20,083,) of which the following is a specification.

In an application for Letters Patent filed by me on the 28th day of January, 1891, I have described constructions of regenerative gas-furnaces and gas-producers arranged to operate in such a manner as to economize to a large extent the fuel employed for various furnace purposes, such as heating or melting metals, melting glass, and other operations.

My present invention relates to the method of working such furnaces and the gas-producers employed therewith so as to effect an economy of fuel.

My improved method of working such furnaces consists, essentially, in diverting a portion of the products of combustion, after they have performed their work in the furnace, through the incandescent fuel in the gas-producer, and also in injecting into the gas-producer a portion of the regenerated air from one of the regenerators or a portion of the regenerated air and cold air, whereby the gases which are transmitted through the producer take up fresh carbon and are rendered combustible, so that they may again serve in the furnace.

In order to carry my invention into practice, I may make use of such an apparatus as I will now proceed to describe.

In the accompanying drawings, which illustrate my invention, similar letters of reference indicate like parts.

Figure 1 is a section on the lines *a a* and *a' a'* of Fig. 2 of an open-hearth furnace with a producer located at each end. Figs. 2 and 3 are horizontal sections taken, respectively, on the lines *b b* and *c c* of Fig. 1.

In the drawings, A is the combustion-chamber.

B and B', Figs. 1 and 3, are reversible air-heating regenerators, two at each end of the furnace.

C represents gas-producers, one at each end of the furnace, which may be of any well-known type, and adapted to carry the fuel upon a hearth or grate, as desired.

D D' are gas-flues connecting the opposite sides of each producer with the furnace-chamber.

V V' are valves in the gas-flues.

F F' are flues which connect the regenerators B B' to the combustion-chamber.

K and K' are flues leading from the flues F and F' to the space beneath the grate of the producer.

H H' are steam-jets or blast-pipes in the flues K K'.

J represents air-injection pipes, through which air at the ordinary temperature may be introduced underneath the fuel in the producers.

G G' are flues leading from the top of the regenerators B B' and communicating with the flues K K'.

The regenerators which are employed are of the reversible type and provided with air-ducts R and reversing-valves W, as is usual with air-regenerators, and also flues O to the chimney-stack.

The gas-producers C consist of a single chamber at each end of the combustion-chamber, and are located immediately over the regenerators B and B'. (Shown in dotted lines, Fig. 3.) It will be evident that the regenerators B and B' may be placed in any other position relative to the gas-producers C—as, for instance, at either side.

Various constructions of producers and regenerators are shown in my application, to which I have heretofore referred. The gas-producers should preferably be located as near as possible to the combustion-chamber, so that the gases transmitted to the combustion-chamber will lose as little heat as possible.

In operating a furnace of the construction described the gas-producers C are first charged in the usual manner with gas-producing coal, and a sufficient amount of air is introduced through one of the doors M or by means of the injectors J to raise a portion of the fuel in the producers to a state of incandescence. As the gases are generated in the producers,

the valves V in the gas-flues D, leading from the producers to the combustion-chamber at each end of the furnace, are raised, and the gas flowing from the producers by the passages D meets the heated air rising through the flues F from the regenerators B, and is commingled with the gas at the ports E, where they form two flames, which flames, respectively, sweep around one-half of the combustion-chamber in horseshoe form and leave the combustion-chamber by the ports E′, passing downward through the flues F′, and thence a portion to the regenerators B′, and from thence through the flues O to the chimney-stack, and a portion through the flues K′, and the action of the jets or blast-pipes H′ to the spaces L under the fuel in the producers, and so upward through the body of the fuel in the producers. At the same time that this action is going on a portion of the heated air rising through flues G from regenerators B is caused by the action of the jet or blast-pipe H to flow through the flues K into the space L under the producers. Thus we have on one side of each of the producers a portion of the products of combustion introduced into the space L by the action of the jet or blast-pipe H′, and on the opposite side of the producer a portion of the heated air introduced into the space L by the action of the jet or blast-pipe H.

It will be understood from the above description that a similar action takes place at both ends of the furnace and that thereby there is formed within the combustion-chamber two horseshoe flames, each of which moves around one-half of the combustion-chamber.

My object in introducing a portion of the products of combustion and heated air into the producer is, first, to aid in maintaining the incandescence of the fuel in the producer, and, second, to have the heated air and gas transmitted through the producer pick up sufficient carbon in their passage to render them combustible.

I heat the air introduced into the producer in order to reduce the quantity of air necessary to effect combustion, and hence to reduce the quantity of nitrogen liberated and of carbonic-acid gas generated in the producer.

So far as I have described my invention I have shown the heated air as taken from regenerators located in immediate proximity to the furnace. It will be evident, however, that the heated air used in the combustion-chamber or to aid in supporting combustion in the producer may be obtained from independent regenerators.

I prefer to operate the furnace by supplying to the producer a proportion of heated air and a proportion of the products of combustion. Instead of so doing, the supply to the furnace may be alternated by means of suitable valves U U′, located in the passages K and K′. Thus by shutting off the jets or blast-pipes H′ and closing the valves U′ in the passages K′ the producers may be supplied entirely or mostly with heated air from the regenerators B, so as to produce vivid incandescence of the contents of the producers, or by shutting off the jets or blast-pipes H and closing the valves U in the passages K the producers may be supplied wholly or mostly with the products of combustion carried from the combustion-chamber until their contents become so far cooled that a renewed supply of air is required to reproduce the heat, and so on, alternately; or the gas-producers may be supplied with a portion of the products of combustion, as described, and a portion of air at the ordinary atmospheric temperature through the instrumentality of the jets or blast-pipes J.

In practice I have found that in some cases it is of advantage to supply the furnace with air under moderate pressure above that of the atmosphere, and this I accomplish through means of pumps, blowers, or fans P, which communicate through suitable pipes with the reversing-valves W. The air passes through the reversing-valves and through the heated regenerators to meet the produced gas and form flame with it at the ports of the furnace-chamber. This gas and the portion of heated air from the regenerators B which is let into the producers through the action of the jets or blast-pipes H maintains the heat therein, and also maintains the pressure of the produced gas equal to that of the supplied air. In this case if a portion of the products of combustion are supplied to the producers they must be forced into it under equivalent pressure by means of the injectors or blast-pipes H′.

It will be understood that as the gas-producer and pair of regenerators at each end of the combustion-chamber are provided with reversing-valves when the producer and regenerators at either end of the furnace are reversed those which previously admitted gas and air into the combustion-chamber now serve to convey away the outgoing products of combustion. The regenerators and the sides of the producer therefore reverse their functions.

It will be evident that in a furnace constructed as shown in the drawings, where the producers are entirely independent of each other, that one producer may be so operated as to utilize a portion of heated air and a portion of the products of combustion, while the opposite producer is only using a portion of the products of combustion or heated air, or cold air, or any combination thereof, and vice versa.

My improved method of operation is not limited to a furnace with producers at each end, but may be utilized in a furnace with one or more producers.

I claim as my invention—

1. The herein-described method of operating a regenerative gas-furnace, which consists in extracting the heat from one portion of the products of combustion, thereby heating the air used in combustion and in the gas-pro-

ducer, transmitting the remaining portion of the products of combustion and a portion of the air so heated through a mass of fuel in the producer, 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.

2. The herein-described method of operating a regenerative gas-furnace, which consists in extracting the heat from one portion of the products of combustion, thereby heating the air used in combustion and in the gas-producer, transmitting the remaining portion of the products of combustion, a portion of the air so heated, and a portion of cold air through a mass of fuel in the producer, 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.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, this 23d day of December, A. D. 1890.

FREDERICK SIEMENS.

Witnesses:

C. MAX HERRMANN,

CARL HERMANN SCHROTTE,

Both of Dresden, Saxony.