No. 822,486. PATENTED JUNE 5, 1906.

F. SIEMENS.

REGENERATIVE GAS FURNACE.

APPLICATION FILED JAN. 18, 1904.

2 SHEETS—SHEET 1.

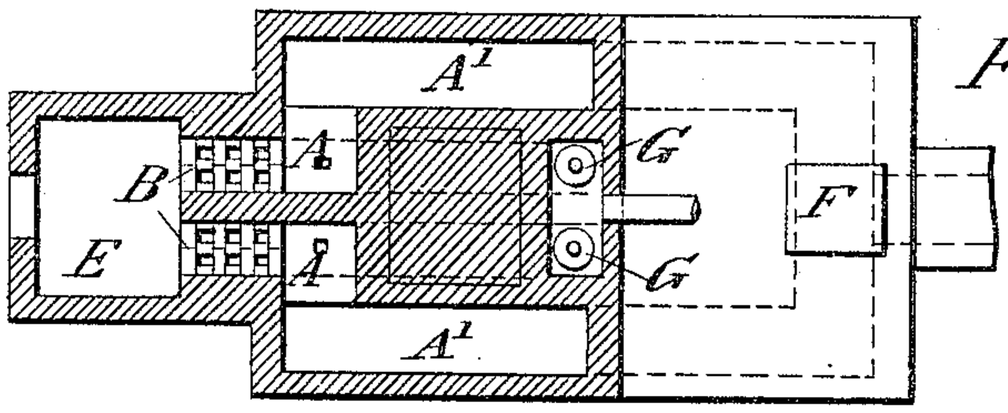


Fig. 1.

Fig. 2.

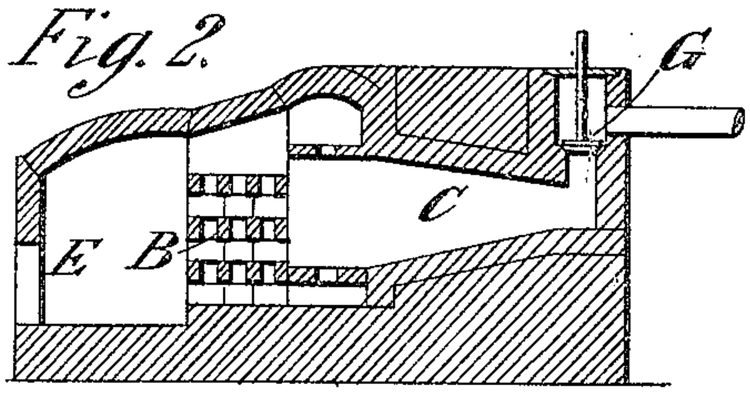


Fig 3.

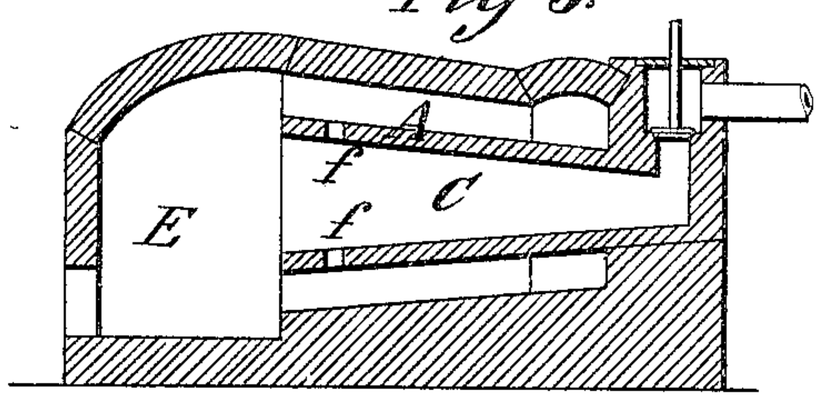
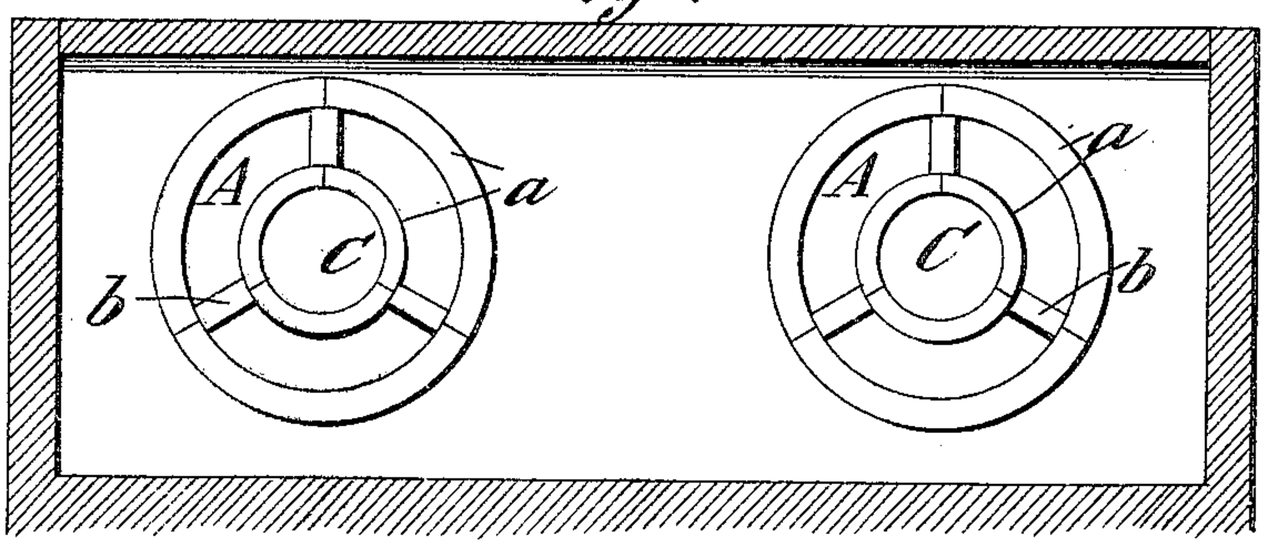


Fig. 4.



Witnesses:
James L. Norris, Jr.
C. D. Kesler.

Inventor:
Frederick Siemens
By James L. Norris
Atty.

No. 822,486. PATENTED JUNE 5, 1906.

F. SIEMENS.

REGENERATIVE GAS FURNACE.

APPLICATION FILED JAN. 18, 1904.

2 SHEETS—SHEET 2.

Fig. 5.

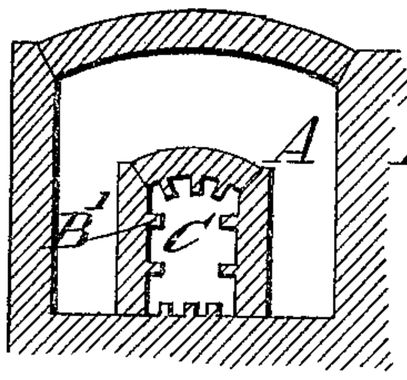


Fig. 6

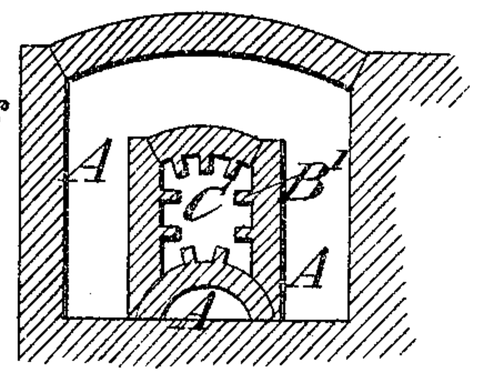


Fig. 7.

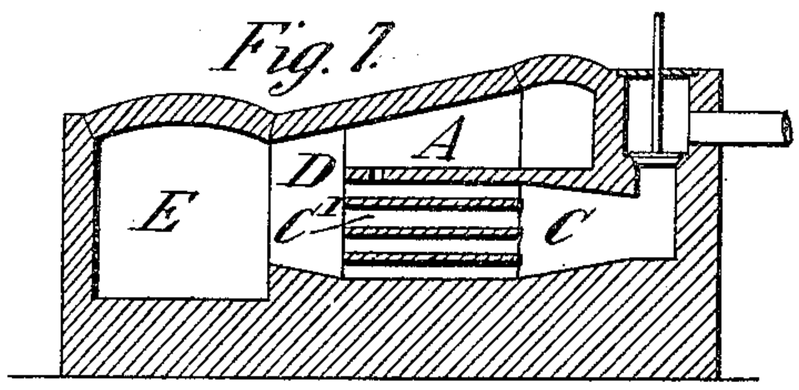


Fig. 8.

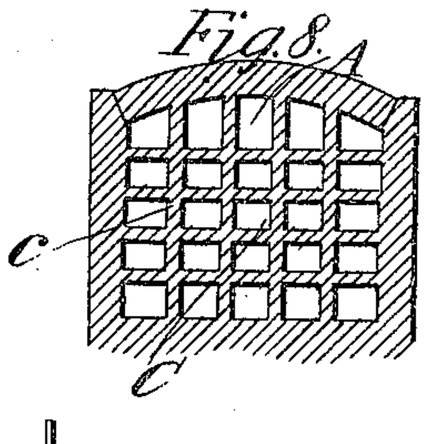


Fig. 9.

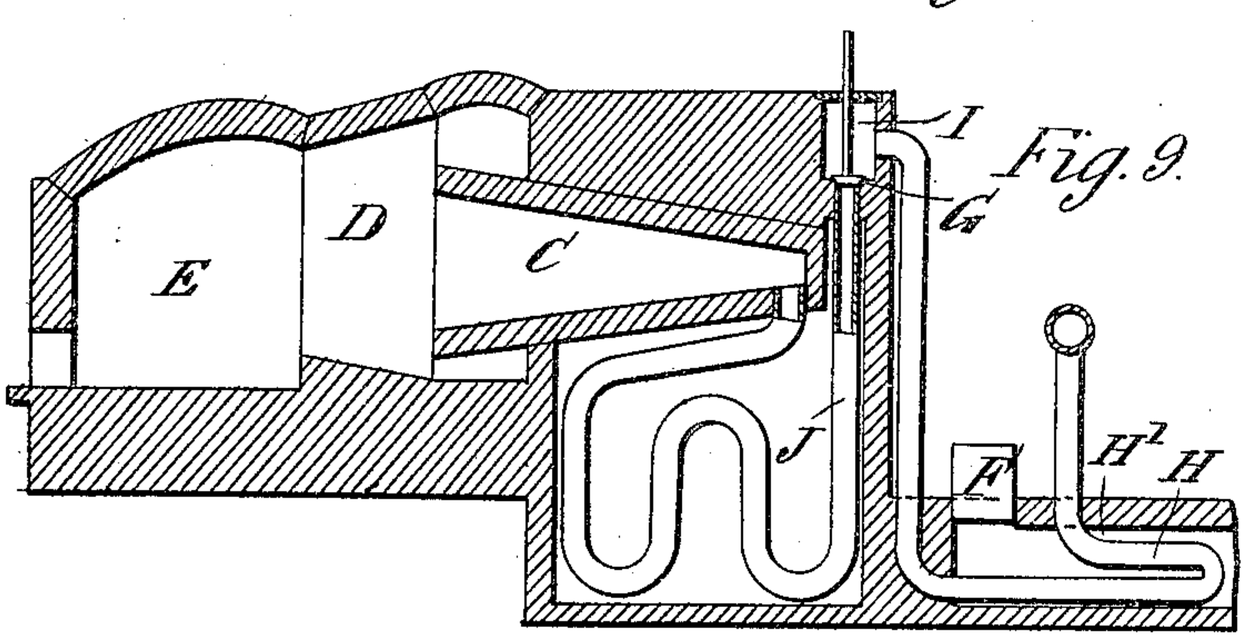
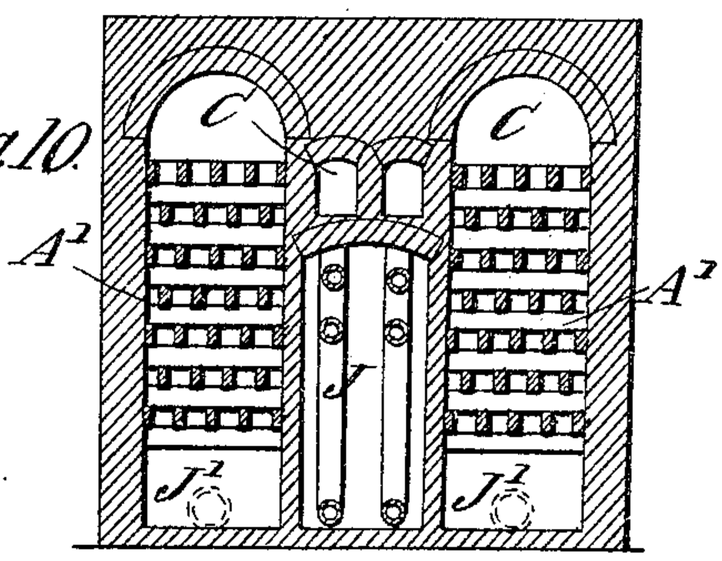


Fig. 10.



Witnesses:
James L. Norris, Jr.
C. D. Kesler.

Inventor
Frederick Siemens
By James L. Norris.
Atty

UNITED STATES PATENT OFFICE.

FREDERICK SIEMENS, OF DRESDEN, GERMANY.

REGENERATIVE GAS-FURNACE.

No. 822,486. Specification of Letters Patent. Patented June 5, 1906.

Application filed January 18, 1904. Serial No. 189,624.

To all whom it may concern:

Be it known that I, FREDERICK SIEMENS, a subject of the King of Saxony, residing at 4 Liebigstrasse, Dresden, in the Kingdom of Saxony, have invented certain new and useful Improvements in Regenerative Gas-Furnaces, of which the following is a specification, (for which I have applied for a patent in Great Britain, dated March 13, 1903, No. 5,866.)

The Siemens regenerative gas-furnaces as at present constructed burn gas in its hot condition either after it has been preheated in gas-regenerators, as in such furnaces of the original type, or as it proceeds directly from the producers, as in such furnaces of the most modern type.

Sometimes producer-gas or blast-furnace gas is put through an elaborate washing process for recovery of ammonia and is thus deprived completely of its sensible heat, of its suspended combustible matter, and to a great extent of its hydrocarbons.

My present invention relates to improvements whereby the most modern type of Siemens regenerative gas-furnace is made suitable for using or burning the gas in question, a type of which is known as "Mond" gas, or for other low-temperature gas without reverting to the use of expensive gas-regenerators connected to a chimney, as used in the wasteful original type of regenerative gas-furnace.

I cause the cool gas to be conducted to the furnace through a flue or flues preferably of considerable length and size to properly expand or reduce the velocity of the gas and so shaped toward the furnace-chamber that they expose a large surface to heat directly radiated therefrom. For example, these flues may be coned outwardly toward the furnace-chamber.

The gas-flues made hot by radiated heat from the furnace-chamber become regenerators and serve alternately to heat the combustible gas. Thus it is possible to eliminate all direct communication between the combustible-gas flues or passages and the chimney, so avoiding loss of gas.

Obviously that part of the regenerative gas-flues exposed to the heat of the furnace-chamber may be provided with any known device for better absorbing the radiated heat, such as checker brickwork. For still further increasing the temperature of the gas in the regenerative gas-flues they may be arranged as described in British Patent No. 770 of 1902 for admitting hot air thereinto before the gas reaches the furnace-chamber.

When desirable, the combustible gas in its cool or cold condition may be passed through pipes contained in the chimney-flue, and the gas may be made to pass around or between the air-regenerators or through pipes situated in the cooler parts thereof.

To improve the combustion, I may arrange to admit the air into the furnace in such manner that it more or less completely surrounds the combustible gas, or a mixing-chamber in which the air and gas mix and begin to burn may be inserted before the furnace-chamber. Such mixing-chamber is best arranged between the regenerative gas-flue and the furnace-chamber and may be coned outwardly from the furnace-chamber.

In the accompanying drawings, Figure 1 represents a diagrammatic sectional plan, and Fig. 2 a corresponding part-sectional elevation, of one form of furnace constructed according to the present invention, in which the gas-flue is made longer than usual and is coned outwardly or expanded toward the furnace-chamber, such gas-flue being heated by heat radiated from the furnace and acting as a gas-regenerator. Fig. 3 is a sectional elevation of another form in which the gas-regenerative flue is surrounded by the air-passage; Fig. 4, a transverse vertical section showing a similar arrangement of gas and air flues. Figs. 5 and 6 are part transverse sections of modified arrangements of flues, showing projecting brickwork from the walls of the regenerative gas-flue; Fig. 7, a longitudinal section of a construction in which a mixing-chamber is interposed between the air and gas flues and the furnace. Fig. 8 is a transverse section showing a convenient arrangement of subdivided gas and air flues in which the partitions constitute equivalents to the projecting brickwork shown in Figs. 5 and 6, or the brickwork checker-work shown in Figs. 1 and 2. Figs. 9 and 10 are longitudinal and transverse sections showing an arrangement of flues by which the heat of the combustion products is utilized on their passage to the chimney to heat the cool incoming gas.

In all these constructions there are preferably two air-regenerators of the form usually provided, which are alternately heated by the products of combustion and alternately heat the air for combustion in the well-known

manner, and no part of the gas flue or passage is connected directly with the chimney, as in older Siemens furnaces, with a resulting loss of gas.

Referring to Figs. 1 and 2, the passages A from the air-regenerators A′ are arranged to surround partially or wholly the inner ends of the gas-regenerative flues C and the brick checker-work B, which are heated by direct radiation from the furnace E, the gas-regenerative flues C being made longer than usual and coned outwardly toward the furnace-chamber E and serving as gas-regenerators. The air-valves F and gas-valves G are reversed simultaneously, so that contiguous air and gas flues are always in working connection with each other.

The expanded gas-flues, which preferably contain brick checker-work, are made hot by direct radiation from the furnace-chamber E and serve alternately as regenerators for the combustible gas. These gas-regenerators are thus not heated at all by passing the gaseous combustion products of the furnace through them, nor have they any direct communication with the chimney, as in furnaces at present constructed for using cold producer-gas.

In Fig. 3 the gas-regenerative flue C is carried forward to the furnace-chamber E and is partially or wholly surrounded through its length by the air-passage A. In this case there is no checker-work in the gas-regenerative flue or between its end and the furnace-chamber, the heat radiated from the latter being directly absorbed by the walls of the gas-regenerative flue, which is made conical or expanding toward the furnace-chamber, so as to expose a large surface at that end to the heat directly radiated from the furnace-chamber E and also to provide for the expansion of the gas as it is heated on its passage through the flue. To assist the heating of the incoming gas, hot air may be admitted in jets through the holes *f*, forming flames through or over which the main body of the gas has to pass, as described in specification to British Patent No. 770 of 1902.

In Fig. 4 the air-flues A and the gas-flues C are shown as consisting of coaxial cones built of segmental tiles *a* with distance-pieces *b* arranged to support the junctions of the tiles.

In Figs. 5 and 6 the gas-flues C are surrounded on three and four sides, respectively, by the air-flues A and have built into their walls rows of bricks or blocks B′, which project into the flues and serve to increase their heat-absorbing and heat-transmitting surface.

In the construction of Fig. 7 the gas-regenerative flues C C′ is at its inner end C′ subdivided horizontally and may also be divided vertically along its length by brickwork *c*, as shown in Fig. 8, and this subdivided gas-regenerative flue may be partially or wholly surrounded by the air-passage A, which may also be similarly subdivided. Both the air and the gas flues open into a chamber D, in which combustion of part of the air and gas and mixing of the remainder takes place, and this mixing is facilitated by the diminution of cross-section of the chamber D toward the furnace shown in Figs. 7 and 9.

Referring to Figs. 9 and 10, the cool gas is subjected to a preliminary heating by being led through a pipe H, inclosed in the chimney-flue H′, which is traversed by the products of combustion from the furnace to the chamber I, whence it passes by the gas-valves G through pipes J, which are suitably coiled in a space between the air-regenerators A′, to the gas-regenerating flues C. The gas may also before reaching the flues C be passed through pipes J′ (shown in dotted lines in Figs. 9 and 10) in the cooler part of the air-regenerators A′.

It will be readily understood that the arrangement of flues by which the hot air and cool gas are conveyed toward the furnace-chamber may be varied in many ways without departing from this invention, which consists, essentially, in the herein-described treatment of poor or cold producer-gas by which it is enabled to be used for the production of high temperatures in regenerative gas-furnaces and in the utilization of the waste heat of the gaseous products of combustion of such furnaces before passing them to the chimney.

Having thus described the nature of this invention and the best means I know of carrying the same into practical effect, I claim—

1. In regenerative gas-furnaces, gas-regenerative flues having no direct communication with the chimney and no communication with the air-flues except near their furnace end, the said gas-flues being flared outwardly toward the furnace and constructed with a brickwork recuperator heated by direct radiation from the furnace, substantially as described.

2. In regenerative gas-furnaces, the combination of gas-regenerative flues which are flared or coned outwardly toward the furnace and have no direct communication with the chimney, and an air passage or passages connecting the furnace and the air-regenerators and contiguous with the said gas-regenerative flues, the said air-passage and gas-flues communicating with each other only toward the furnace end, substantially as described.

3. In regenerative gas-furnaces, the combination of outwardly-flaring gas-regenerative flues having no direct communication with the chimney, an air passage or passages contiguous with said gas-flues and communicating with them near their furnace ends, and a mixing-chamber interposed between the gas and air flues and the furnace-chamber, and narrowing toward the latter, substantially as described.

4. In regenerative gas-furnaces, in combination with gas-regenerative flues such as herein described, pipes or flues placed in the chimney-flue and leading to a chamber communicating by a valve with the gas-regenerative flue, substantially as described.

5. In regenerative gas-furnaces, in combination with gas-regenerative flues such as herein described, pipes or flues in the cooler parts of the air-regenerators and leading to the gas-regenerative flues, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

FREDERICK SIEMENS.

Witnesses:
WERNER F. SIEMENS,
PAUL E. SCHILLING.