

(No Model.)

A. CLOUARD.  
GAZOGENE.

No. 594,460.

Patented Nov. 30, 1897.

Fig. 1

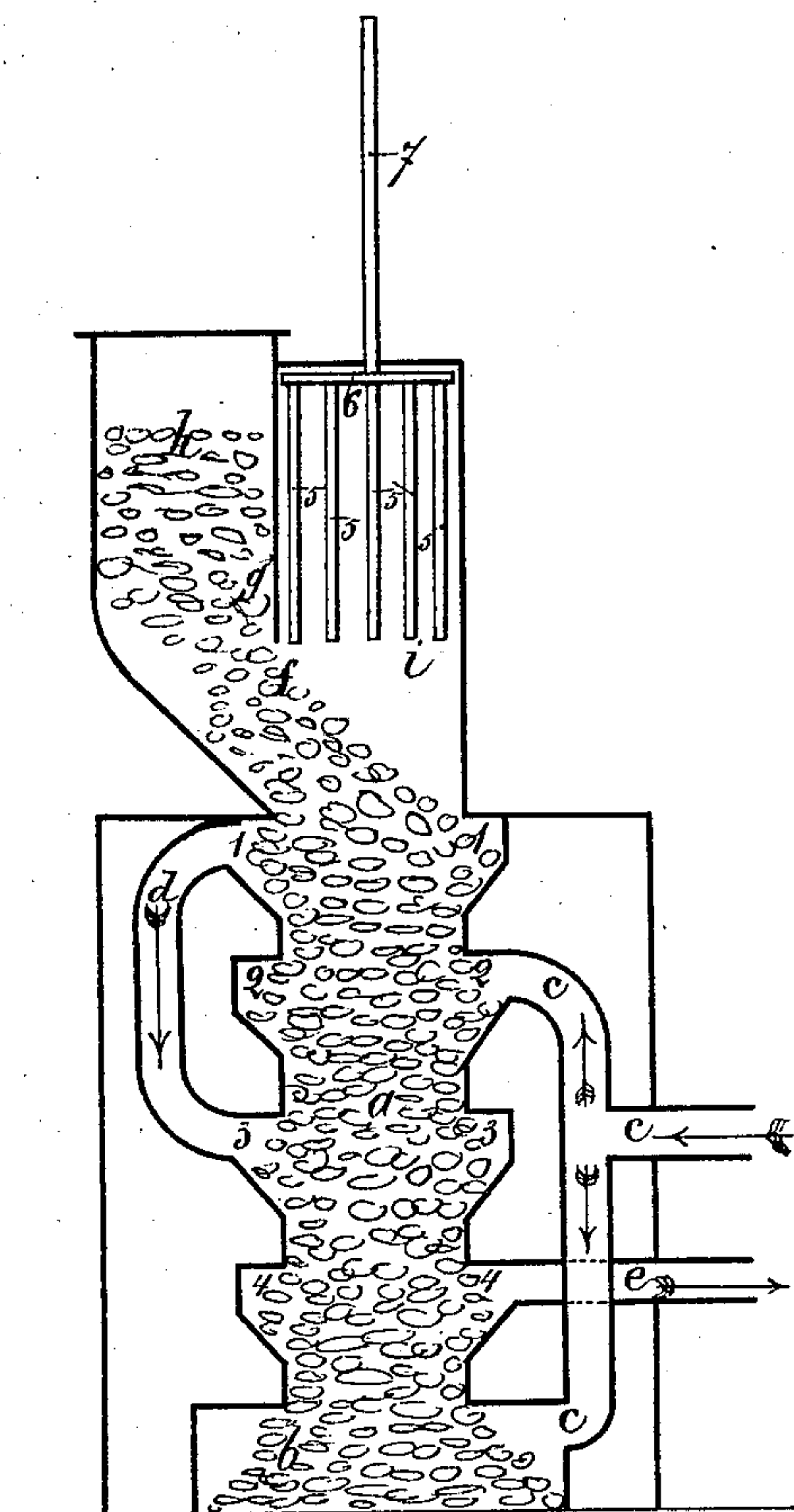
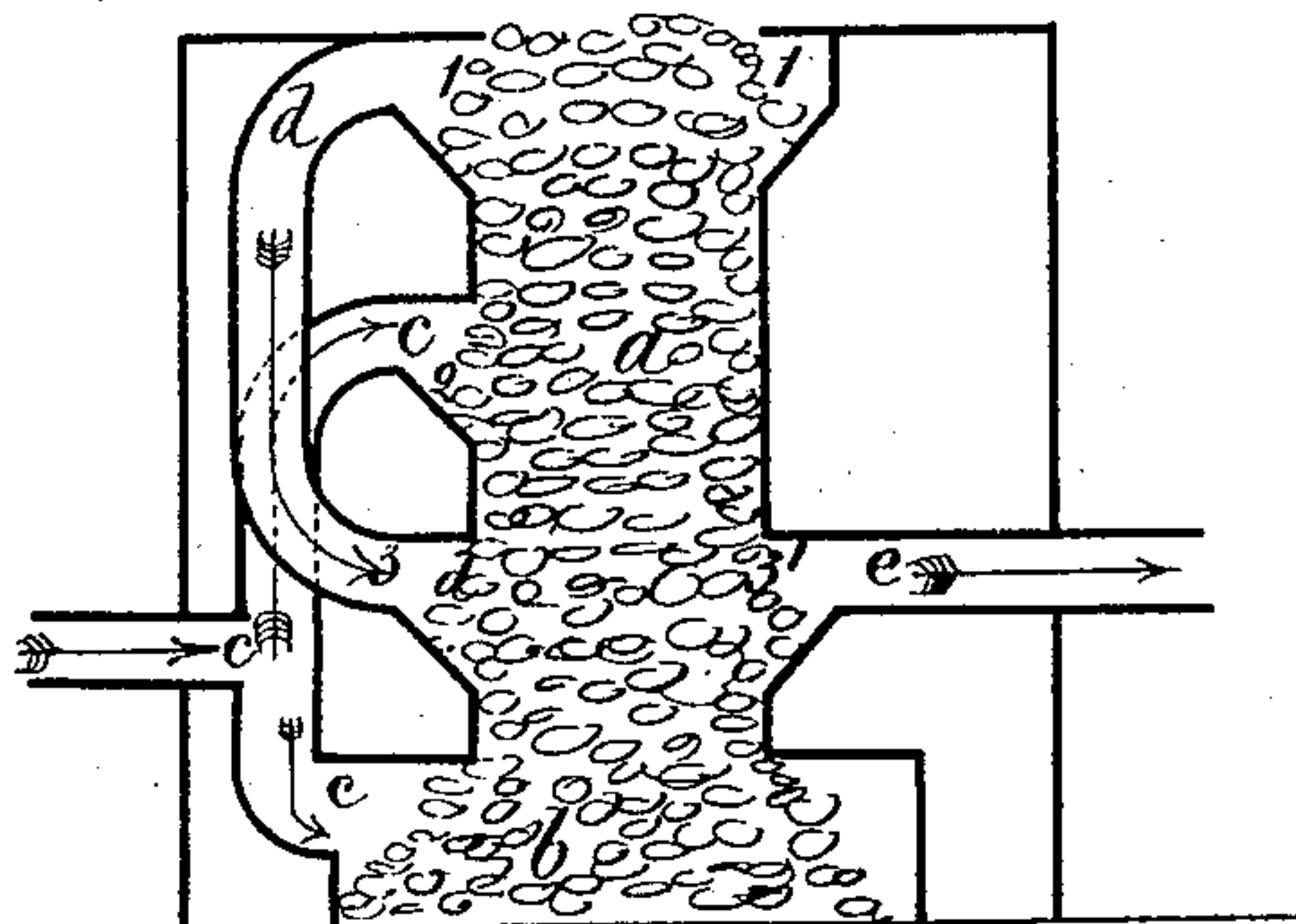


Fig. 2



Witnesses:

J. Chebret.  
O. Block.

Inventor:

André Clouard,  
By H. A. de Vos.  
Attorney.

# UNITED STATES PATENT OFFICE.

ANDRÉ CLOUARD, OF CAEN, FRANCE.

## GAZOGENE.

SPECIFICATION forming part of Letters Patent No. 594,460, dated November 30, 1897.

Application filed November 25, 1895. Serial No. 569,997. (No model.) Patented in France April 24, 1895, No. 246,795.

*To all whom it may concern:*

Be it known that I, ANDRÉ CLOUARD, a citizen of the French Republic, residing at Caen, France, have invented certain new and useful Improvements in Gazogenes, (for which I have obtained Letters Patent in France, No. 246,795, dated April 24, 1895,) of which the following is a specification.

My invention relates to a new gazogene adapted to transform solid combustibles, especially slack and small coal, into combustible gas containing no tarry substances or hydrocarburets that condense under pressure and ordinary temperature and which may be used for heating or for the production of power.

Referring to the drawings which accompany the specification to aid the description, Figure 1 is a vertical section of one form of the gazogene, and Fig. 2 is a vertical section of the lower part of a modified gazogene.

My gazogene is composed of—

First, a vertical furnace *a*, made of refractory material and equipped at its inner parts with recesses or grooves 1, 2, 3, and 4, which afford an easy passage to gases which enter into the fuel contained in the furnace or which pass out of the same. These grooves may be substituted by conduits arranged around the furnace and communicating therewith by means of suitable openings.

Second, the ash-box *b*. The fuel is piled up on the bottom of the ash-box or rests on a grate arranged in the lower part of the furnace.

Third, a pipe *c*, through which the air and steam necessary for the operation of the apparatus are fed, and which communicates with groove 2 and the ash-box *b*.

Fourth, a pipe *d*, connecting the grooves 1 and 3.

Fifth, a pipe *e*, connecting with groove 4 and through which the gases flow off.

On top of the furnace *a* is arranged a chamber *f*, divided in its upper part by a partition *g*. On one compartment *h* a suitable funnel or hopper for feeding may be arranged, and this compartment serves as a receptacle for the fuel, which, passing underneath the partition *g*, gradually enters into the furnace *a*, as required. The compartment *i* contains a

plate 6, to which are connected rods 5 5'. At its upper surface this plate is connected to a rod 7, passing freely through an opening provided in the upper wall of the compartment *i*.

The operation of the apparatus as described with reference to Fig. 1 is as follows: When the furnace *a* is filled with coke and the fire is started, so as to bring the coke to incandescence, the receptacle *h* being filled with fuel, a mixture of air and steam is admitted through the pipe *c*. Part of this mixture goes downward and enters into the furnace through the ash-box *b* and part of it goes upward and will enter the furnace through the groove 2. This mixture of air and steam will be decomposed when coming into contact with the incandescent coke and keep up the combustion. The result is, as in all gazogenes, a mixture of combustible gases formed principally of carbonic oxid, carbonic acid, and of hydrogen and the nitrogen of the air. Part of the gases thus formed near the groove 2 will pass downward into the furnace and flow off through pipe *e* with those gases that are formed in the lower part of the furnace by the combustion of the coke. Another part of the gases formed near the groove 2 goes upward to groove 1 and there strikes the layer of fresh coal fed from the receptacle *h* and passes through the same. This coal is decomposed by the action of the heat of the gases and the radiation of the incandescent coke in several hydrocarburets, some of them in the form of gas, others in the state of vapors or tar, and the balance in the form of coke for the feeding of the furnace. The free hydrocarburets and the gases produced by the combustion of coke flow off together through groove 1 and pass down through pipe *d* into groove 3 and into the coke contained into the furnace. They mix there with the downward-flowing gases, to pass out through pipe *e* and near groove 4 come together with the upward-flowing gases from the lower part of the furnace. In consequence of the heat in this part of the furnace the tar and vapors of hydrocarburets are decomposed into permanent gaseous hydrocarburets and pulverulent carbon, in their state of formation in contact with the carbonic acid of the gases form carbon oxid.



This entire gaseous mixture flows off through pipe *e*.

During the distillation of the coal near the groove 1 it softens and thus pieces and dust  
5 form a crust and a layer of coke which would prevent the fuel in the receptacle *h* to drop downward. This disadvantage is removed by crushing from time to time the layer of coke formed, which is effected by means of  
10 the rods 5, and to this end the rod 7 is moved up and down by any suitable means.

Fig. 2 shows a modification of Fig. 1, which may be used where circumstances require an apparatus of reduced height. This reduced  
15 height is obtained by omitting the part of the furnace between grooves 3 and 4. The groove is only provided at the side where the pipe *c* ends and the grooves 3 and 3' are only provided at two opposite sides of the furnace.  
20 The air and steam are admitted through pipe *c* into groove 2 and into the ash-box *b*. The gases distilled from the coal pass through pipe *d* into the groove 3, from where they pass through the pile of incandescent coke to be  
25 transformed into permanent gaseous hydrocarbons in the same manner as in the apparatus shown in Fig. 1. The gases flow off through pipe *e*.

The gazogene shown in Fig. 2 can be provided with a fuel-receptacle and be equipped with a crusher for the layer of coke similar to that before described; but these parts are not shown in Fig. 2.

Having described my invention and set forth its merits, what I claim is—

1. In a gazogene, the combination with a vertical furnace, of a flue for the admission of air and steam communicating with the furnace at two points, one point being at the  
40 bottom of the furnace and the other point near the upper part of the furnace below the point where the fuel is fed thereto, a gas-flue communicating at its upper end with the furnace above the point where the air and steam  
45 flue communicates therewith at its upper end and at its other end communicating with the furnace between the points of communication of the two ends of the air and steam flue therewith, and an exit-flue leading from the  
50 furnace between the points of communication

of the air and steam flue therewith, substantially as and for the purposes described.

2. In a gazogene, the combination with the vertical furnace, of a flue for the admission of air and steam communicating with the furnace at two points, one point being at the bottom of the furnace and the other point near the upper part of the furnace below the point where the fuel is fed thereto, a gas-exit flue leading from the furnace between the points  
60 of communication of the air and steam flue therewith, and a gas-flue communicating at one end with the furnace above the point where the air and steam flue communicates therewith at its upper end and at its other  
65 end communicating with the furnace between the points where the air and steam flue communicates therewith at both ends and above the point where the gas-exit flue communicates therewith, substantially as and for the  
70 purposes described.

3. In a gazogene, the combination of the vertical furnace, the feed-hopper opening into the same at its upper end and divided centrally by a vertical partition, vertically-  
75 movable rods operating in the hopper to one side of the partition and adapted to crush the cake of coke formed at the upper end of the furnace, a flue for the admission of air and steam communicating at one end with  
80 the upper portion of the furnace and at the other end with the lower portion of the furnace, a gas-flue communicating at its upper end with the furnace above the point where the upper end of the air and steam flue com-  
85 municates therewith and at its other end with the furnace between the points where the two ends of said flue communicate therewith, and a gas-exit flue leading from the furnace between the points of communication of the  
90 air and steam flue therewith, substantially as and for the purposes described.

In testimony that I claim the foregoing I have hereunto set my hand this 25th day of October, 1895.

ANDRÉ CLOUARD.

Witnesses:

VICTOR MATROU,  
FRÉDÉRIC MATROU.