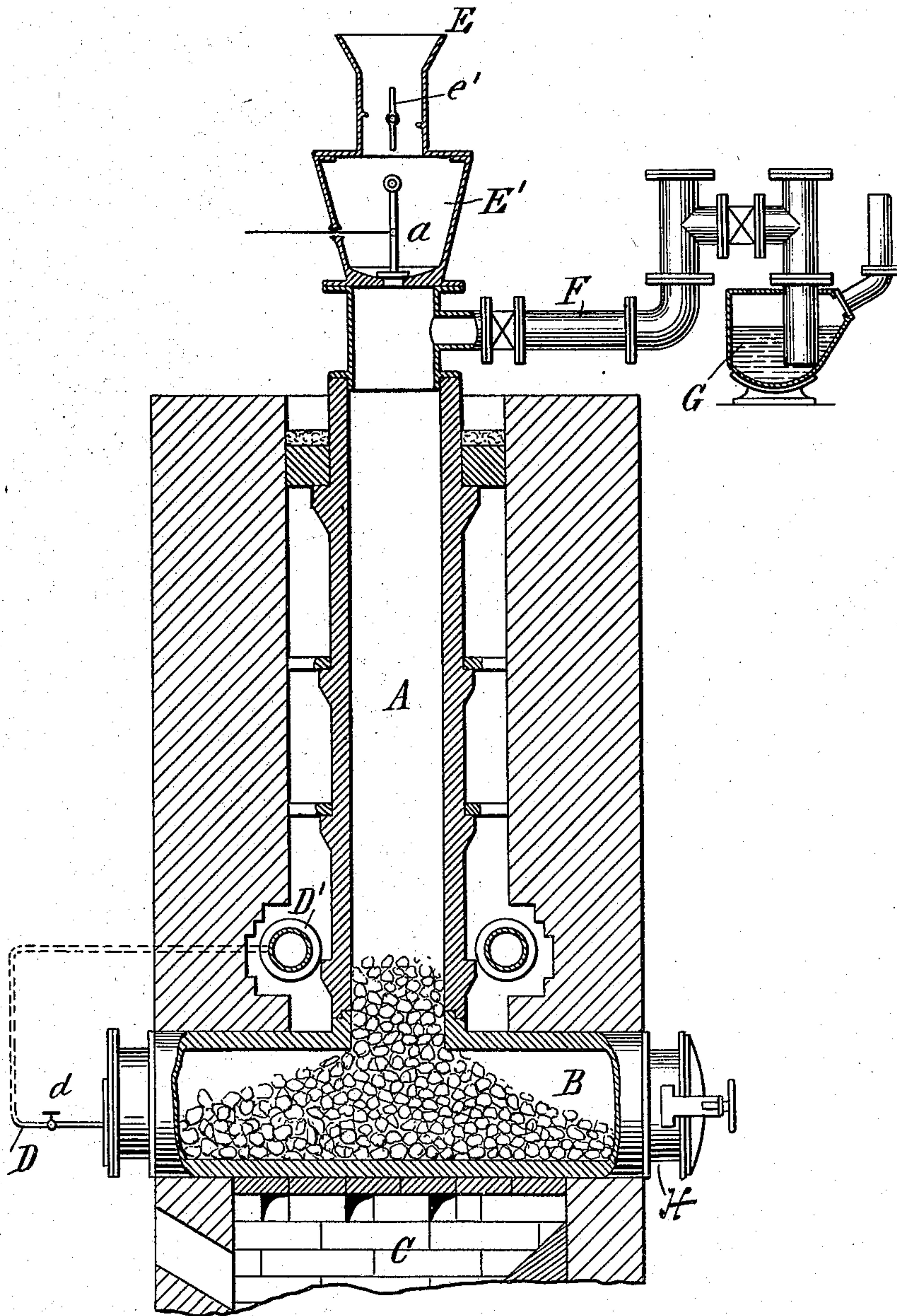


H. W. BENNER.  
 PROCESS OF MANUFACTURING GAS.  
 APPLICATION FILED FEB. 2, 1907.

899,690.

Patented Sept. 29, 1908.



Witnesses:  
*Raphaël Ketter*  
*Robert L. Messimer*

*Henry W. Benner* Inventor  
 By his Attorneys  
*Messmer & Campbell*



# UNITED STATES PATENT OFFICE.

HENRY W. BENNER, OF CHAMBERSBURG, PENNSYLVANIA, ASSIGNOR TO INTERNATIONAL GAS DEVELOPMENT COMPANY, A CORPORATION OF NEW YORK.

## PROCESS OF MANUFACTURING GAS.

No. 899,690.

Specification of Letters Patent.

Patented Sept. 29, 1908.

Application filed February 2, 1907. Serial No. 355,387.

*To all whom it may concern:*

Be it known that I, HENRY W. BENNER, a citizen of the United States, residing at Chambersburg, county of Franklin, and State of Pennsylvania, have invented a certain new and useful Process of Manufacturing Gas, of which the following is a specification.

My invention relates to gas commonly used for illuminating and heating purposes, and has for its object to manufacture the same by a continuous operation at a greatly reduced cost of production.

I manufacture water gas by passing steam, preferably superheated, through a bed of coke heated by an external source of heat, and pass the hot gas up through an externally heated vertical retort. Powdered coal is allowed to fall through this vertical retort with the result that rich coal gas is distilled out of the coal while it is falling and while the rising water gas is in intimate contact with the coal. This rich coal gas and some of the hydrocarbons in the tar vapors serve to carburet both the water gas and the leaner coal gas made by further distillation. The coal, while falling through the vertical retort, becomes partly coked, and falls on the hot coke bed at the bottom of the retort, and there continues to gasify until it is completely coked, after which it may be withdrawn from time to time by any convenient means. The mixture of coal and water gas is continuously drawn off and subjected to the usual cleansing processes, but no fixing by superheating is required. If it is desired, the gas may be enriched by adding oil or oil gas. Many processes for thus enriching the gas are well known and need not be described.

In the accompanying drawings I show in vertical sectional elevation an apparatus which may be used in carrying out my process.

A is a vertical retort opening into a horizontal retort B at its lower end. Both of these retorts are heated by the furnace C, which may be of any desired type, using any suitable kind of fuel.

The steam pipe D leads into the horizontal retort B, and is provided with a valve *d*. The steam may be superheated by passing it through the drum D' within the furnace. At the top of the vertical retort is the double

hopper E, E', separated by the gate *e'*. The lower hopper E is provided with the adjustable valve *a* to control the flow of powdered coal into the retort. The upper hopper is emptied into the lower hopper from time to time to keep a constant supply therein. The gases are withdrawn through the pipe F at the top of the retort and conveyed to the hydraulic main G. The coke may be withdrawn through the mouth piece H.

The operation is as follows. The horizontal retort and the lower part of the vertical retort may be filled with coke and brought to the desired temperature by external heat, or, instead of using an initial charge of coke, coal may be used either by admitting powdered coal from the hopper or by an initial charge of coal. If coal is used it must be partly or completely distilled before the manufacture of water gas is commenced. In either case, however, as soon as a bed of hot coke is secured, superheated steam is admitted to the horizontal retort and powdered coal to the vertical retort. The powdered coal first gives up its richer gases,  $C_2H_4$ , and tar vapors, and as distillation proceeds, to some extent after the powdered coal has fallen on the coke bed, it gives up the leaner gases  $CH_4$ , leaving a mass of incandescent coke. The superheated steam is forced through this bed of incandescent coke and becomes decomposed, forming water gas. This water gas, together with the leaner gases from the coal, both at a high temperature, rises through the vertical retort in intimate contact with the falling powdered coal, thereby assisting in cracking up the falling coal, and also combining with the illuminants in the tar vapors given off by the distilling coal. The amount of carbon taken from the coke will depend upon the amount of steam admitted to the retort, and it is not my intention to rob the coke of more than say twenty per cent. of its carbon, and in some cases as low as five per cent., as the coke is valuable as a by-product. The process is continuous, and after once started and adjusted, the apparatus requires but little attention.

Having described my invention, what I claim is:

1. The process of manufacturing gas con-

sisting of forming water gas, passing the water gas through powdered coal falling through a distilling chamber, and collecting the products.

- 5 2. The process of manufacturing gas consisting of passing steam through a bed of hot coke to form water gas, passing the water gas up through powdered coal falling through a

distilling chamber, and collecting the products.

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In witness whereof, I have hereunto set my hand this 31st day of January, 1907.

HENRY W. BENNER.

Witnesses:

W. S. HALLETT,

O. F. BRUNER.