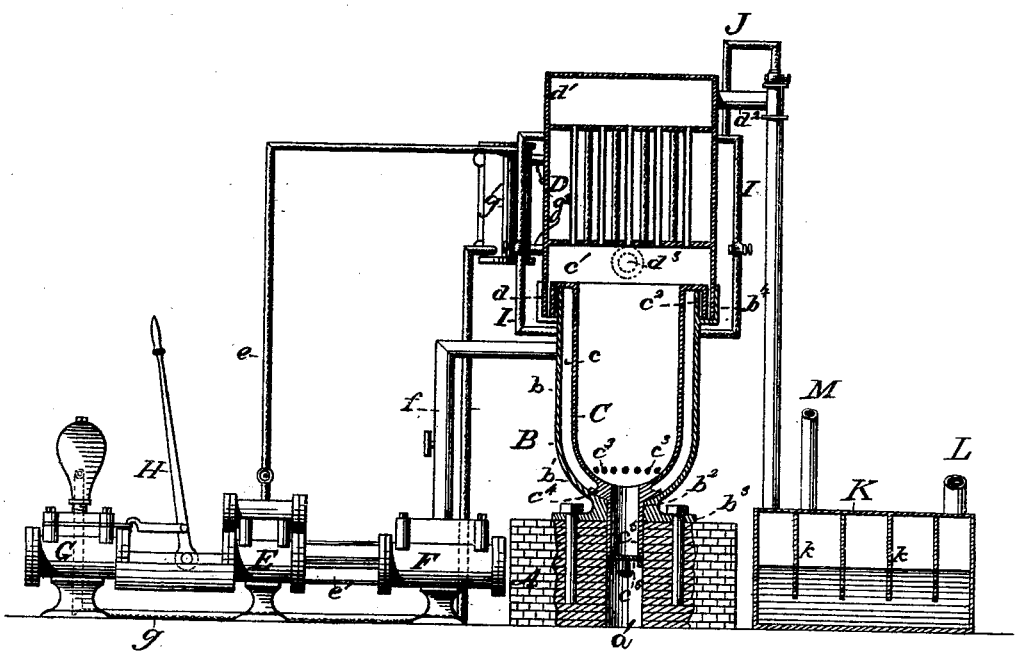
J. RIGBY.

PROCESS AND APPARATUS FOR MANUFACTURING GAS.

No. 189,576. Patented April 17, 1877.



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IMPROVEMENT IN PROCESSES AND APPARATUS FOR MANUFACTURING GAS.

Specification forming part of Letters Patent No. **189,576**, dated April 17, 1877; application filed March 20, 1877.

To all whom it may concern:

Be it known that I, JAMES RIGBY, a citizen of the United States, now residing at Montreal, Quebec, Canada, have invented a new and useful Improvement in Process and Apparatus for Manufacturing Gas; and I do hereby declare that the following is a full, and exact description of the same, reference being had to the accompanying drawings, and to the letters of reference marked thereon.

This invention is a special apparatus for preparing a special gas which is adapted and designed for mixture with hydrocarbon gas, for the purpose of increasing its bulk and diminishing its weight.

Its novelty consists, mainly, in certain details of construction, which will be fully described hereinafter.

In the drawings is represented a front elevation of my improved gas apparatus, partially in section.

To enable others skilled in the art to make and use my invention, I will now proceed to describe fully its construction and manner of operation.

A represents the base of the furnace, constructed generally in any proper manner, but preferably formed of brick or masonry, with a circular outline, and provided with the recess or opening *a*, serving as an ash-pit, as shown.

B represents the outer shell of the furnace, consisting of a hollow cylinder, *b*, with semispherical base b^1, having the central opening b^2, and also the flange b^3, strongly secured to the base A in any proper manner. b^4 represents a seal-cup located on the upper end, as shown.

C represents the inner shell of the retort, corresponding in its general outline with the outer shell, but made smaller in diameter, for the purpose of leaving an intermediate space, *c*, between the two, which is provided above with an annular horizontal flange, c^1, adapted to cover the space *c* between the inner and outer shells, and an annular vertical flange, c^2, adapted to dip into the seal-basin, as shown, and below with an annular series of openings, c^3, a supporting-base, c^4, and a downwardly-extending hollow cylindrical projection, c^5, through which the residuum of the furnace may be discharged into the ash-pit.

c^6 represents a valve or door, located at the end of the projection c^5, by means of which the opening through it may be closed when desired.

D represents a vertical flue-boiler, provided below with an extension, *d*, adapted to rest in the seal-cup b^3, as shown, and above with a gas-chamber, d^1, from which leads a pipe, d^2, as shown.

d^3 represents an opening having a proper door, through which the material for the furnace may be introduced and its interior inspected.

E represents a steam-pump of any proper construction, actuated by steam from the boiler, received through pipe *e*, which is provided with a double-acting piston-rod, *e'*, to one end of which is attached the piston of the air-pump F, of any proper construction, and to the other the piston of the water-pump G, of any proper construction.

f represents a pipe controlled by proper cocks, by means of which air from pump F is delivered to the space between the shells of the retort, as shown.

g represents a pipe controlled by proper cocks, by means of which water from the pump G is delivered to the supply-tank g^1, from which it passes into the boiler through the circulation-pipes g^2 g^2, as shown.

H represents a hand-lever, by means of which the pumps may be actuated, if desired, before steam has been generated.

I I represent steam-pipes controlled by proper cocks, when leading from the boiler-discharge into the chamber *c*, between the shells of the furnace, near its top, as shown.

J represents a steam-pipe controlled by a proper cock, which, leading from the boiler, terminates in an injector discharging into the vertical portion of the pipe d^2, as shown. Through this pipe the gas formed in the furnace, and also the products of combustion, are conveyed away to the washer.

K represents the washer, consisting of a closed box having a series of mid-feathers or partitions, *k k*, extending below the water-line k^3, by means of which the gas is washed in the usual manner.

L represents the discharge-pipe, by means of which the purified gas is led away to any desired point.

M also represents a discharge-pipe, controlled by a proper valve or damper, through which any excess of gas produced may be conveyed away to the furnace of the hydrocarbon apparatus, and through which, also, the products of combustion may be discharged when the fire is first lighted.

The operation is substantially as follows: The furnace is prepared for action, after providing the same with the proper materials for igniting the fuel, by placing therein, in alternate layers of proper thickness, anthracite coal and some form of lime, oyster-shells being preferred, in proportions, say, of ninety per cent. of fuel to ten per cent. of lime.

The fire having been lighted, the pump may be operated by hand to furnish water and air until sufficient heat has been obtained to generate steam.

When the furnace is in active operation, the result will be substantially as follows:

The air, entering the outer shell of the furnace under pressure, will pass downward in the chamber *c*, through the series of openings c^3, into the furnace, and up through the burning fuel to the gas-chamber.

The air, as it enters, comes in contact with the highly-heated inner shell, and consequently passes on to the fire in a highly-heated condition. When the flame is reached, its oxygen, being consumed, serves to give intensity to the fire, while its nitrogen passes on to the gas-chamber to give bulk and weight to the mixed gas resulting from the process.

The steam, entering the outer shell of the furnace, is also decomposed, its hydrogen passing on to the gas-chamber to give heating powers to the mixed gas resulting from the process. In the passage of these various products through the fuel particles of lime are taken up, and the whole compound mixture, including the products of combustion, pass on together through the pipe d^2 to the washer. In this pipe the passing current is subjected to the action of steam by means of the injector described, and consequently the particles of lime are thrown down into the washer, and, forming milk of lime, serve to remove from the gas the sulphur and other objectionable compounds resulting from the coals.

By means of this process a mixed gas is obtained which, consisting mainly of hydrogen and nitrogen, is comparatively light, while having great bulk.

By means of this process a gas is obtained which consists, principally, of nitrogen having a specific gravity of .971, and hydrogen having a specific gravity of .069, and hence the mixture is lighter than atmospheric air, which is usually employed to mix with hydrocarbon gas.

This mixture, also, in addition to its quality of lightness, possesses great bulk, so that it is specially adapted to dilute the heavy hydrocarbon gases rich in carbon.

By properly manipulating the apparatus, the relative proportion of the elements of the mixed gas may be varied according to the necessities of the case, and also the proportions of the mixture resulting from the union of the mixed gas with the hydrocarbon, so that the final product may, by the proper exercise of judgment, most advantageously unite the qualities of specific gravity, bulk, and illuminating power.

I am aware that it is old to make gas by passing steam and air through hot carbonaceous material; also, that lime has been used in a retort in connection with sand for the purpose of preventing the contents from caking or hardening; also, that lime has been employed in a retort in the manufacture of coal-gas.

Having thus fully described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. The furnace described, having the outer shell B, with base b^3, and inner shell C, with base c^4 and projection c^5, as described.

2. In combination with the furnace B C, having the flange c^2 and seal-cup b^4, the tubular boiler having the extension *d*, as described.

3. In combination with the furnace and boiler, the double-acting pump, adapted to supply water and air, substantially as described.

4. The method described of making gas, consisting essentially in causing air and steam to pass through the burning fuel and lime layers, and in subjecting the resulting products to the action of steam, substantially as described.

5. The method described of making gas, consisting essentially in subjecting air and steam to the action of burning fuel and lime, substantially as described.

This specification signed and witnessed this 20th day of March, 1877.

JAMES RIGBY.

Witnesses:
THEODORE L. WEST,
MAMIE E. STALLINGS.