

R. L. MIDDLETON.  
APPARATUS FOR ENRICHING GAS.

(Application filed Dec. 14, 1900.)

(No Model.)

2 Sheets—Sheet 1.

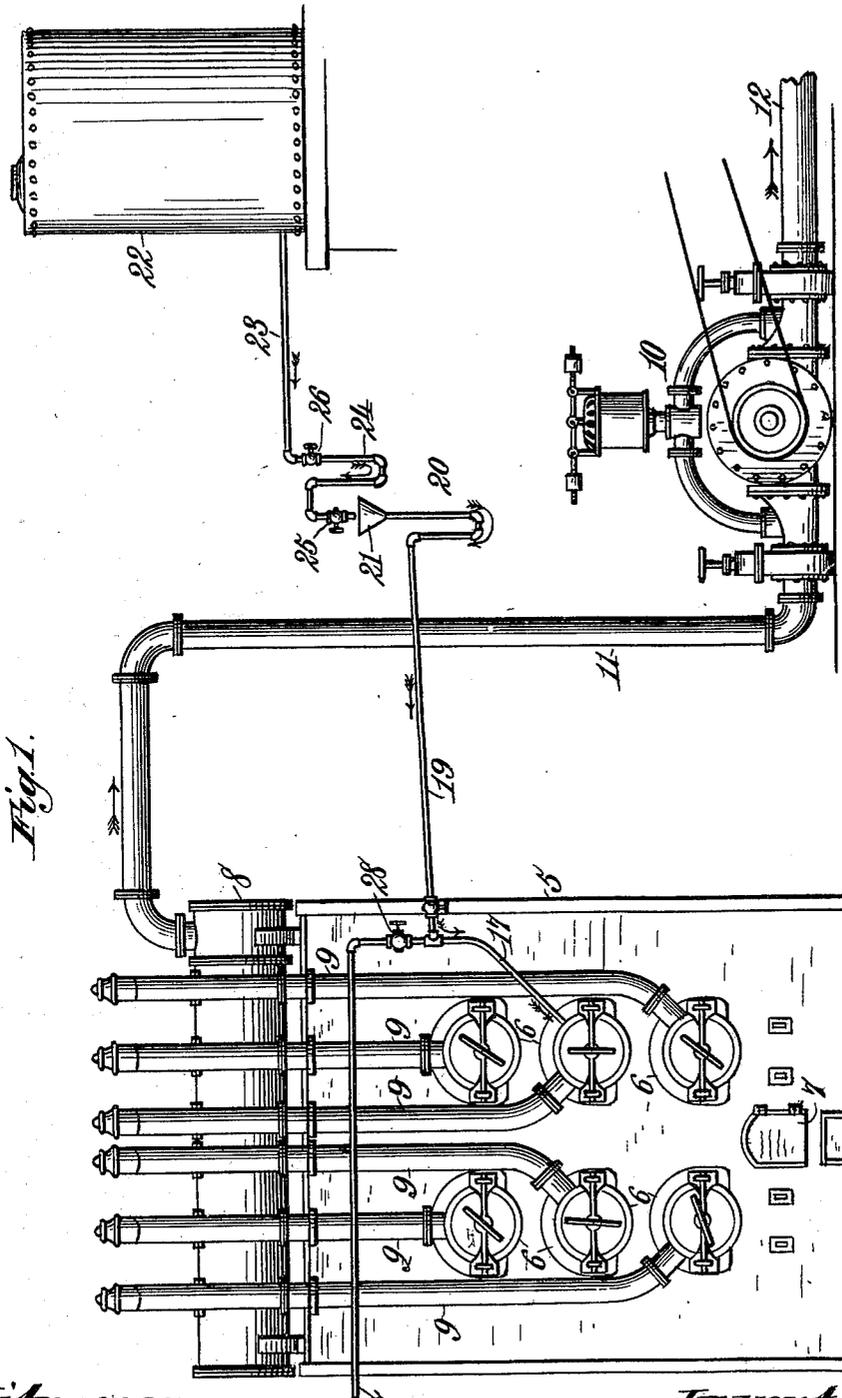


Fig. 1.

Witnesses.  
*Robert Smith,*  
*Prue S. Elliott.*

Inventor.  
*Robert L. Middleton.*  
 By *James L. Norris,*  
 Atty.

No. 669,651.

Patented Mar. 12, 1901.

R. L. MIDDLETON.  
APPARATUS FOR ENRICHING GAS.

(Application filed Dec. 14, 1900.)

(No Model.)

2 Sheets—Sheet 2.

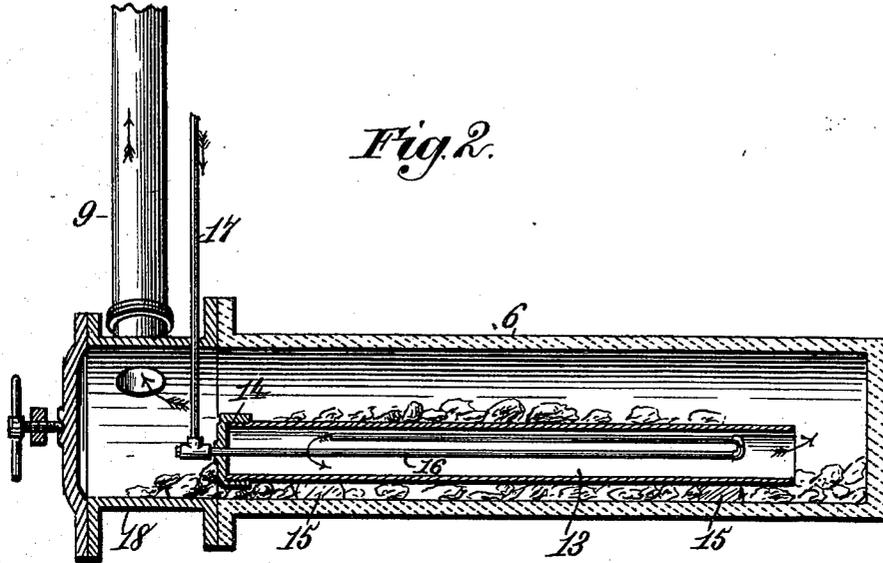


Fig. 2.

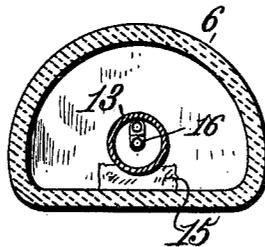


Fig. 3.

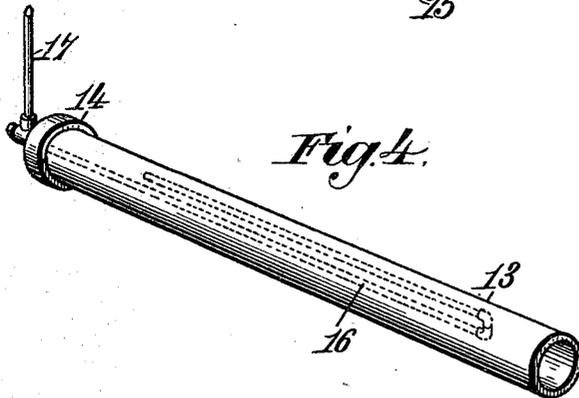


Fig. 4.

Witnesses.  
Robert Emmet,  
Ames J. Elliott.

Inventor:  
Robert L. Middleton.  
By James L. Norris  
Atty.

# UNITED STATES PATENT OFFICE.

ROBERT LEVI MIDDLETON, OF WASHINGTON, DISTRICT OF COLUMBIA,  
ASSIGNOR, BY MESNE ASSIGNMENTS, TO JOHN R. MCLEAN, OF CIN-  
CINNATI, OHIO.

## APPARATUS FOR ENRICHING GAS.

SPECIFICATION forming part of Letters Patent No. 669,651, dated March 12, 1901.

Application filed December 14, 1900. Serial No. 39,857. (No model.)

*To all whom it may concern:*

Be it known that I, ROBERT LEVI MIDDLETON, a citizen of the United States, residing at Washington, in the District of Columbia, have invented new and useful Improvements in Apparatus for Enriching Coal-Gas with Oil, of which the following is a specification.

My invention relates to certain new and useful improvements in apparatus for enriching coal-gas with oil, and has for its general object to provide an improved apparatus designed to be supported within the ordinary retort in general use in the manufacture of coal-gas, which apparatus in operation will insure that oil supplied thereto in its passage through the same will be thoroughly and completely vaporized by the heat of the retort and changed into a fixed gas, so that on passing into the retort it will combine with the coal-gas therein and greatly enrich the latter.

Other objects of the invention relate to certain details of construction of the apparatus and to combinations and arrangements of parts, all of which will be described herein and particularly pointed out in the claims.

In order that my invention may be clearly understood, I have illustrated the same in the accompanying drawings, in which—

Figure 1 is a view in elevation showing my invention applied to one of a series of retorts constituting a bench. Fig. 2 is a longitudinal sectional view through a retort and a portion of my apparatus. Fig. 3 is a transverse sectional view of the retort; and Fig. 4 is a detail perspective view of my improvement, the inner pipe being shown in dotted lines.

Referring now to the drawings, the numeral 5 indicates a bench consisting of six retorts supported above a furnace 7, each of which retorts communicates with a hydraulic main 8 by means of a stand-pipe 9.

The numeral 10 indicates an exhaustor for drawing the gas from the hydraulic main 8 through a pipe 11 and forcing it through a pipe 12, leading to the purifying apparatus. (Not shown.)

The above is a brief description of sufficient of an ordinary gas-making apparatus to illustrate the application of my invention and need not be described more in detail.

The numeral 13, Fig. 2, indicates a wrought-iron casing or cylinder closed at one end by means of a cap 14, screwed on such end. The cylinder 13 is supported within one of the retorts 6 by means of one or more pieces of fire-brick 15, placed under the same or in any preferred manner, and with its closed end located toward the front of the retort, as shown. The cap 14 is centrally apertured, and extending through this aperture is a relatively small pipe 16, which extends into the cylinder 13 to near the rear or open end thereof, and is then given a return-bend and its open end brought back to a point more or less removed from the cap 14. The end of pipe 16 projecting through the cap 14 is connected to a pipe 17, which leads through the head 18 of the retort. The pipe 17 in turn is connected to a pipe 19, which at its outer end is provided with a gooseneck or seal 20 and a drip or funnel 21.

The numeral 22 indicates an oil-tank supported in an elevated position, preferably in a place removed from the bench 5 for purposes of safety. Leading from the tank 22 is a pipe 23, having a seal 24, and its outer end being located immediately above the funnel 21 and provided with a regulating-cock 25. The pipe 23 is also preferably provided with a second cock 26 for shutting off the supply of oil. The tank 22 will be filled with a hydrocarbon oil, preferably benzine.

The operation is as follows: The retorts 6, including the retort containing my improvement, being charged with coal, the cocks 25 and 26 are opened to permit the flow of oil from the tank 22 through pipe 23 into the funnel 21, whence it passes through the pipes 19 and 17 into the pipe 16 within the cylinder 13. Before it can pass from the pipe 16 the oil must first travel to near the rear of the cylinder 13 and thence back to near the front thereof. Escaping into the cylinder 13, near the front end thereof, it must again pass to the rear or open end of the cylinder, and passing into the retort 6, at the rear end thereof, the oil or vapor must travel again to the front of the retort before passing up the stand-pipe 9 to the hydraulic main 8. In other words, from the time the oil enters the pipe 16 it must

traverse the greater portion of the length of the retort four times before it can pass therefrom. To merely insure a traverse of the oil back and forth in the retort as described and as might be done by providing a pipe 16 with two or more return-bends and dispensing with the cylinders 13 would not of itself induce that high degree of vaporization necessary to thoroughly carbonize the oil and change it into a fixed gas. I therefore insure such traverse of the oil through the retort under conditions favorable to its complete vaporization. It will be seen that by reason of the construction employed three separate expansions of the oil will occur, each one of which is greater than the preceding. Thus in its passage through the pipe 16 the oil will be partially vaporized and will slightly expand, but owing to the relatively small size of the pipe 16 it will be held in a more or less condensed state. On passing from the pipe 16 the partially-vaporized oil expands into the larger area of the cylinder 13, and here a partial separation will occur of the more completely-vaporized oil from the heavy hydrocarbon vapors and liquid hydrocarbon, the former rising and the latter sinking, and thus the unvaporized oil can not only be more readily affected by the pervading heat of the retort, but by contact with the heated side of the cylinder it will be highly heated and vaporized, and finally from the cylinder 13 the now completely-vaporized oil expands into the larger area of the retort 6, where it will combine with the gas therein, and, as stated, must traverse the entire length of the retort before it can escape therefrom.

By providing for the expansion of the oil as vaporized and at the same time causing a back-and-forth circulation thereof through the retort it will be obvious that I utilize all conditions favorable to the transition of the oil from a liquid to a gaseous state, as the free expansion of the vaporized oil prevents any tendency to condensation and the circulation of the oil described under the influence of the intense heat of the retort insures the complete vaporization of the oil. By combining the vaporized oil or oil-gas with the coal-gas in the retort under the influence of the great heat thereof I further insure the permanency of its quality as a fixed gas. It will be understood, of course, that the oil-gas produced in the retort containing my improvement will be mixed not only with the coal-gas in that retort, but also in the hydraulic main with the coal-gas produced in the other retorts of the bench. In practice I find that oil supplied by means of my improved device to one retort of a bench containing six retorts will be sufficient to enrich the gas produced in all of the retorts. I also find that two gallons of oil as a maximum amount will be sufficient to enrich one thousand feet of gas. It will also be understood that the mixing of the oil-gas and coal-gas will be continued throughout the various manipulations to which the

gas is subjected before it is discharged into the holder as commercial gas.

In order to provide for cleaning out the pipe 16 from time to time, I connect to the pipe 17 above its point of connection with the pipe 19 a steam-pipe 27, having a cock 28. By opening this cock steam may be forced through the pipe 16 to clear it of any obstructions.

In case of back-firing the seals 20 and 24 would operate as a barrier to prevent the passage of the flame to the tank 22.

While I have shown and described the casing 13 as being in the form of a cylinder, it is obvious that said casing could be of any other form in cross-section without departing from the spirit of the invention. Neither do I wish to be limited herein to any special shape, form, or configuration of parts, nor to details of construction, except in so far as the same may be specifically indicated in the claims.

The process of enriching gas according to the method of procedure above described forms the subject-matter of a separate application for patent, Serial No. 39,856, filed December 14, 1900.

Having thus fully described my invention, what I claim as new is—

1. A device for use in enriching gas with oil, comprising a casing having a closed and an open end, and a pipe leading through said closed end and extending longitudinally of the casing to near the opposite end thereof, and having a return-bend with an outlet located adjacent to said closed end.

2. A device for use in enriching gas with oil, comprising a casing having an open and a closed end, and a pipe leading into said casing and bent upon itself to extend back and forth therein and having an outlet directed toward said closed end.

3. In combination with a gas-retort having a discharge end, a casing supported therein having an open end and a closed end located toward the discharge end of the retort, and an oil-supply pipe leading into said casing and bent upon itself to extend longitudinally back and forth therein and having an outlet end located adjacent to and directed toward said closed end.

4. In combination with a gas-retort having a discharge end, a cylinder supported therein having an open end and a closed end located toward the discharge end of the retort, and an oil-supply pipe leading into said cylinder through said closed end and bent upon itself to extend longitudinally back and forth therein and having an outlet end located adjacent to and directed toward said closed end.

In testimony whereof I have hereunto set my hand in presence of two subscribing witnesses.

ROBERT LEVI MIDDLETON.

Witnesses:

JAMES L. NORRIS,  
BRUCE S. ELLIOTT.