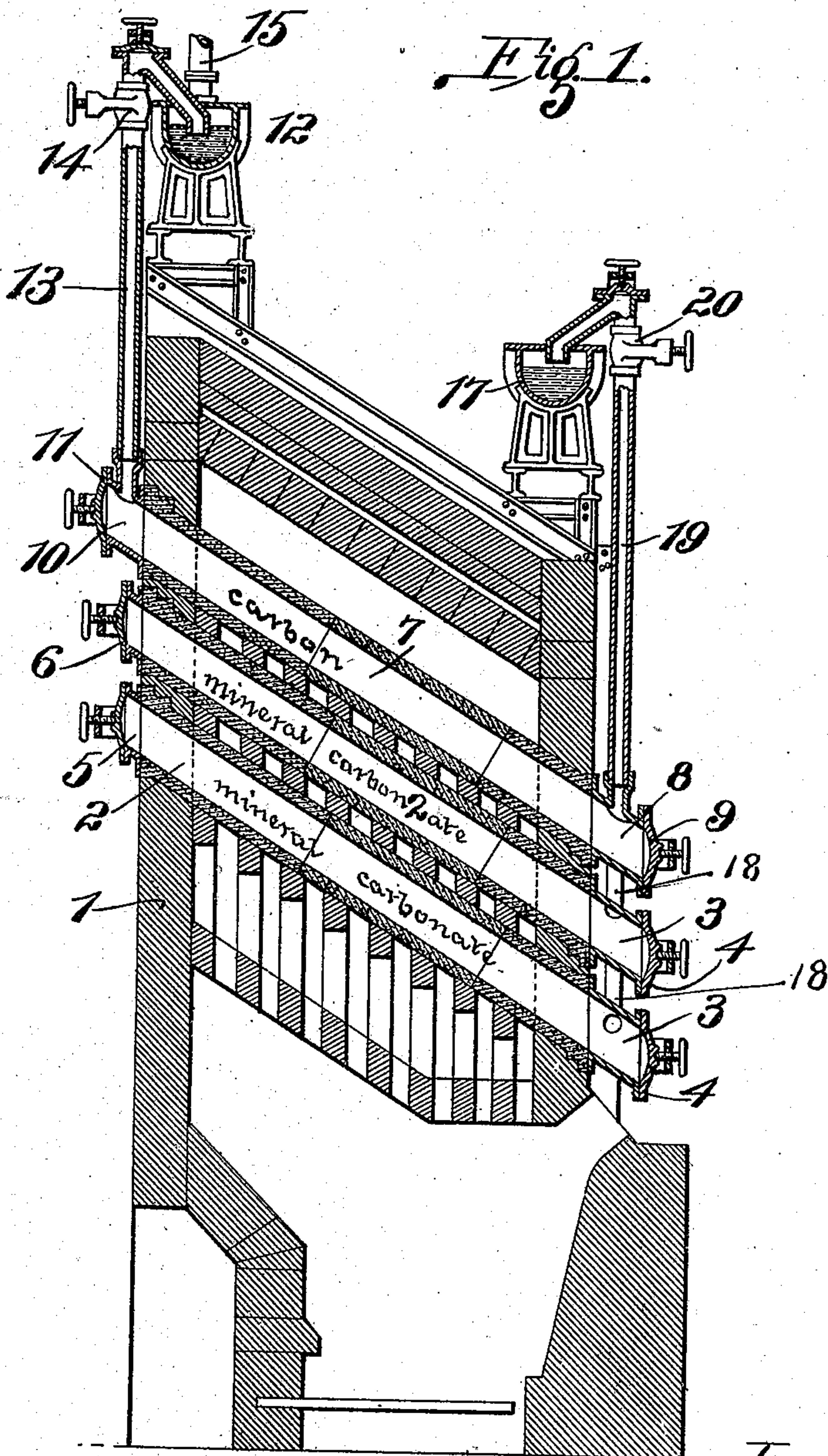


E. RIDER.  
 APPARATUS FOR MANUFACTURING GAS.  
 APPLICATION FILED NOV. 12, 1907.

900,423.

Patented Oct. 6, 1908.

2 SHEETS—SHEET 1.



Attest.  
 Edgar T. Farmer  
 M. Smith

Inventor:-  
 Elmer Rider.  
 By Nigdon Longan.  
 Attys.

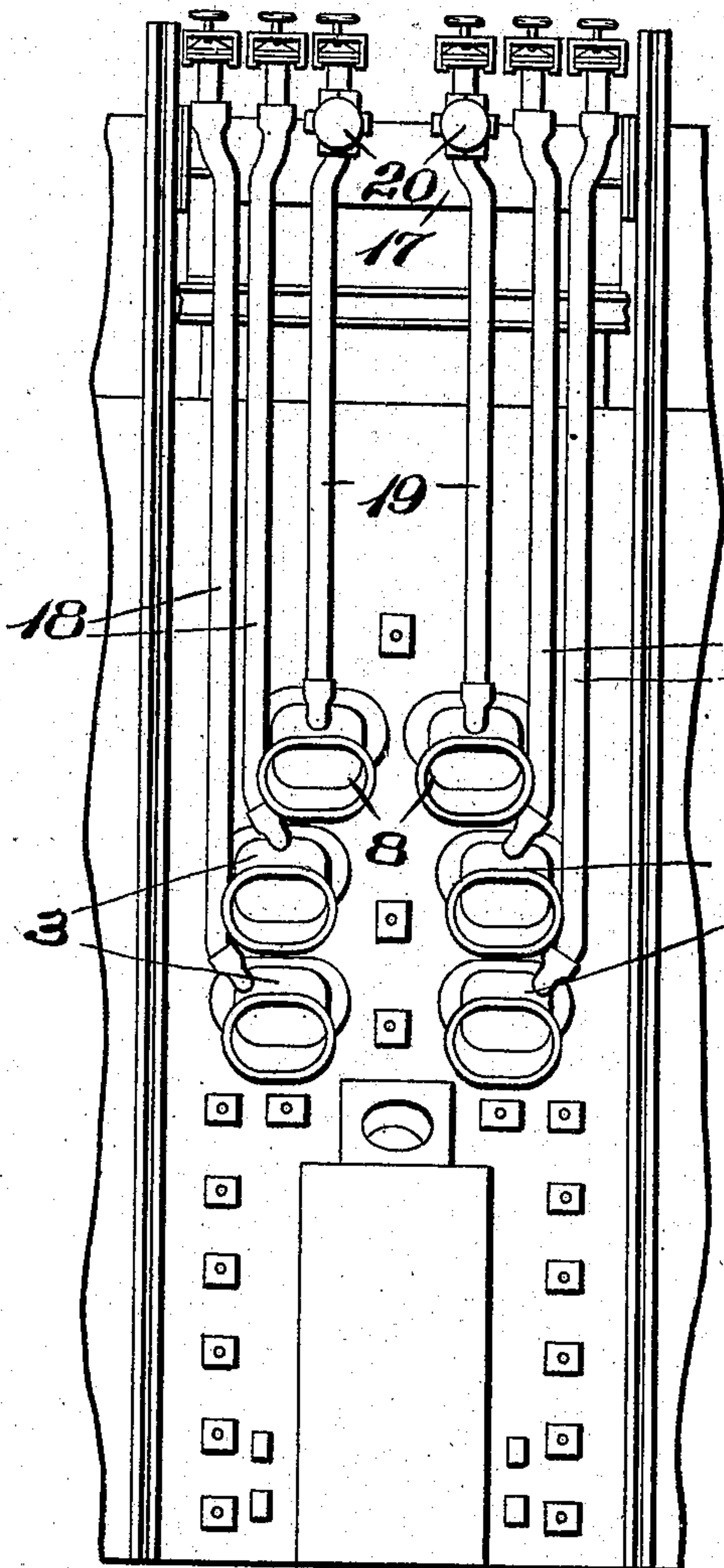
E. RIDER.  
 APPARATUS FOR MANUFACTURING GAS.  
 APPLICATION FILED NOV. 12, 1907.

900,423.

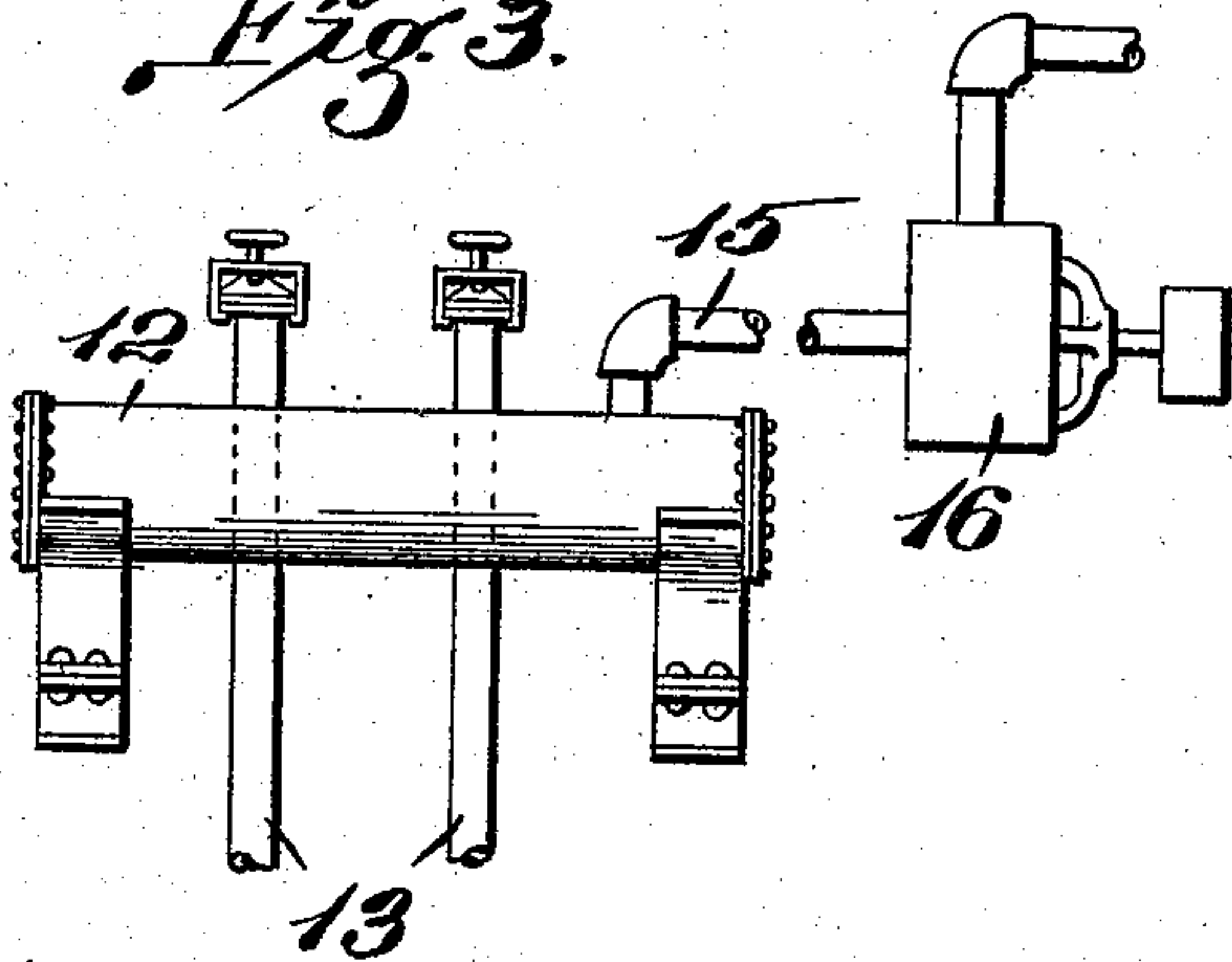
Patented Oct. 6, 1908.

2 SHEETS—SHEET 2.

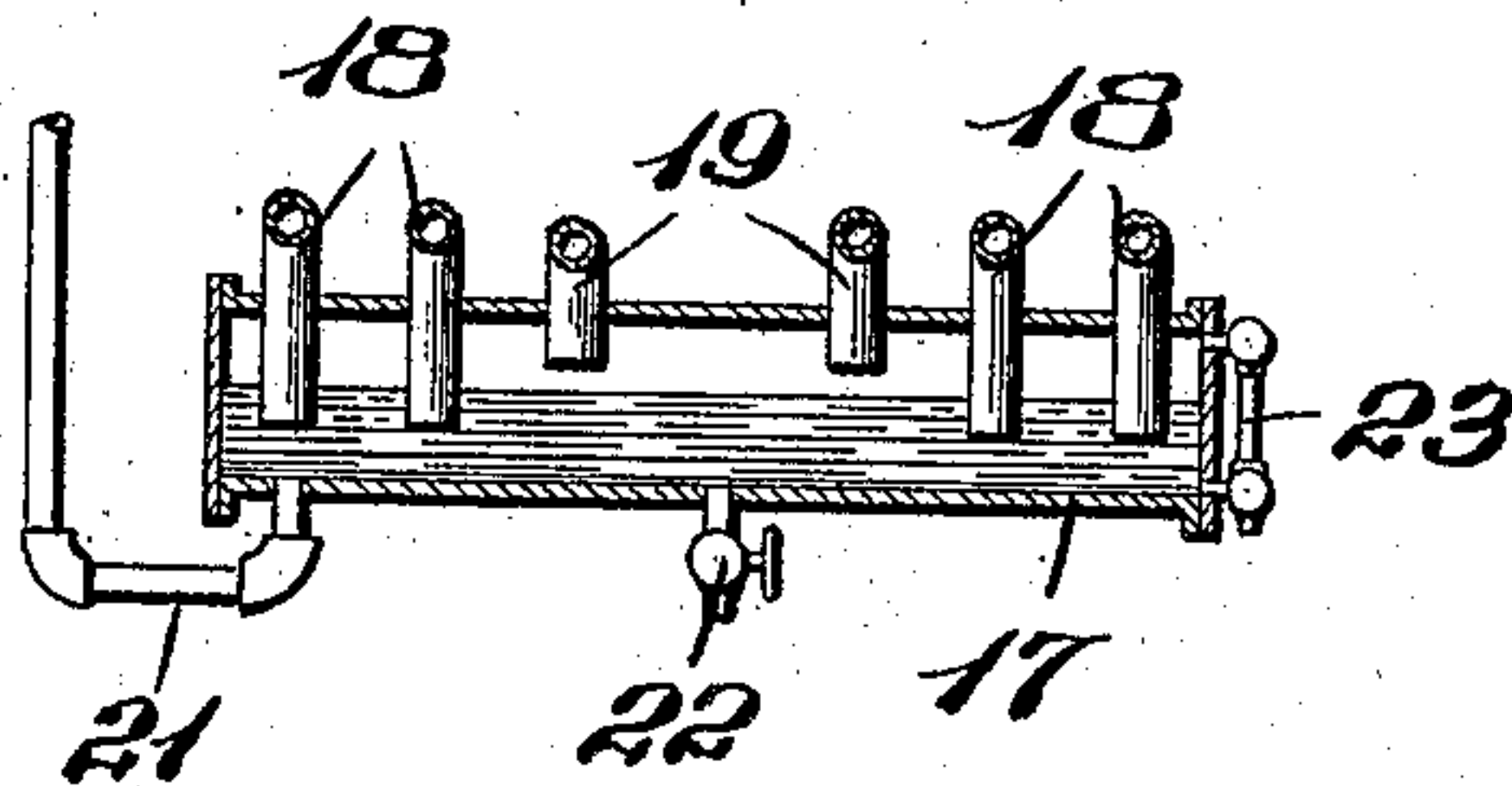
*Fig. 2.*



*Fig. 3.*



*Fig. 4.*



Attest.  
 E. M. Harrington  
 M. P. Smith

Inventor:-  
 Elmer Rider.  
 By Higdon Houghan ATTYS.



# UNITED STATES PATENT OFFICE.

ELMER RIDER, OF ST. LOUIS, MISSOURI.

## APPARATUS FOR MANUFACTURING GAS.

No. 900,423.

Specification of Letters Patent.

Patented Oct. 6, 1908.

Application filed November 12, 1907. Serial No. 401,865.

*To all whom it may concern:*

Be it known that I, ELMER RIDER, a citizen of the United States, and resident of St. Louis, Missouri, have invented certain new and useful Improvements in Apparatus for Manufacturing Fuel-Gas from Mineral Carbonates and Carbonaceous Material, of which the following is a specification containing a full, clear, and exact description, reference being had to the accompanying drawings, forming a part hereof.

My invention relates to an apparatus for manufacturing fuel gas from mineral carbonates and carbonaceous material, my object being to construct a simple apparatus in the form of a furnace, which is provided with retorts in which the carbonates and carbonaceous material is placed and heated in order to be thoroughly decomposed to free the carbon dioxid and other non-ignitable gases, which latter is conducted through a body of heated carbon in order to convert said gases into carbon monoxid, methane, and hydrogen gases, which can be used without further treatment as fuel for gas engines and the like, or for heating purposes.

A further object of my invention is to provide means whereby one of the sets of retorts of each bench may be cut out of service while the contents of said retort are being discharged without affecting the operation of the opposite set.

To the above purposes, my invention consists in certain novel features of construction and arrangement of parts, which will be hereinafter more fully set forth, pointed out in the claims, and illustrated in the accompanying drawings, in which:—

Figure 1 is a vertical section taken through the center of an apparatus of my improved construction; Fig. 2 is a front elevation of a portion of the apparatus, and showing one of the benches of retorts; Fig. 3 is an elevation of the water trap or seal which is located on top of the apparatus and at the rear thereof; Fig. 4 is a vertical section taken through the center of a water seal or trap which is located on top and at the front of the apparatus.

Referring by numerals to the accompanying drawings:—1 designates the furnace, which is of the construction usually employed in gas producers; and arranged in said furnace in the usual manner are the pairs of retorts 2 which receive the mineral carbonates from which the gas is extracted; and ar-

ranged on the forward ends of said retorts are tubular metal fittings 3, the forward ends of which are closed and made air tight by means of plates 4.

The upper rear ends of the retorts 2 are provided with tubular metal fittings 5, which are closed and made air tight by removable plates 6.

Arranged in the usual manner above the upper pair of retorts 2 are the retorts 7, which are adapted to receive carbon, the forward ends of said retorts being provided with tubular fittings 8, the forward ends of which are closed and made air tight by the removable plates 9; and the upper rear ends of said retorts are provided with tubular metal fittings 10, and which are closed and made air tight by means of removable plates 11.

Arranged on top of the furnace and at the rear thereof is a water seal or trap 12; and leading upward from the tubular fittings 10 of the upper pair of retorts 7 into said seal or trap are the pipes 13, in which are located gate valves, such as 14. Leading from the water seal or trap 12 to a gasometer, or like container, is a pipe 15, in which is located an exhaust fan 16, or similar device. Fixed on top of the furnace and at the front thereof is a water seal or trap 17, and leading from the tubular fittings 3 upward and into said trap are pipes 18. Leading upward from the tubular fittings 8 on the upper pair of retorts are the pipes 19, which discharge into the water seal or trap 17, and located in said pipes are ordinary gate valves 20. The water seal or trap 17 is provided with an inlet pipe 21, an outlet valve 22, and a gage glass 23, by means of which the height of the water within the seal or trap may be readily ascertained.

When my improved apparatus is in use, limestone, or other mineral carbonate, or carbonaceous material, after being broken, to the desired size, is placed in the retorts 2 until the same are about three-fourths full. Charcoal, or other carbon, coarsely broken, is placed in the retorts 7 in sufficient amount to approximately fill said retorts. The plates 4, 6, 9, and 11 are now tightly seated on the ends of the tubular fittings so as to make the retorts perfectly air tight, and fire is built in the furnace, using any desirable fuel, and the temperature in the retorts is brought to about 1100° F., which temperature is maintained as near as possible until



all of the volatile matter has been expelled from the carbonates within the retorts 2, which operation requires from three to four hours. During the decarbonization of the mineral carbonates, the exhaust fan 16 is operated continuously so as to remove the gases from the retorts 2 and 7 as fast as generated, as hereinafter described; thereby hastening the operation, and at the same time preventing an excess pressure against the walls of said retorts. The gases thus generated in the retorts 2 are drawn through the tubular connections 18 and discharge from the upper ends thereof into the trap or seal 17, and pass from thence through the pipes 19, the gate valves 20 of which are open, and from thence to and through the retorts 7 containing the charcoal or other carbon; and from thence said gases pass through the pipes 13, the gate valves 14 of which are open, and said gases discharge from said pipe 13 into the trap of seal 12, and from thence through the pipe 15 to the gasometer, or other container, from whence the gas may be drawn off and used as desired. During this operation, the generation of non-ignitable carbon dioxid is almost completely prevented by excluding the air from the retorts during the decarbonization of the carbonates, and whatever carbon dioxid is formed is completely converted into carbon monoxid during its passage through the red hot charcoal, or other carbon contained in the retorts 7, owing to the total absence of air, as shown by the reaction:— $\text{CO}_2 + \text{C} = 2\text{CO}$ . Owing to the moisture and water of crystallization and organic impurities contained in nearly all limestone or other mineral carbonates, there is formed during this treatment of the carbonates a compound gas, composed of carbon monoxid, methane, hydrogen, and a small amount of nitrogen; of an average composition approximately as follows: carbon monoxid, ( $\text{CO}$ ) 88% to 90%; methane, ( $\text{CH}_4$ ) 1% to 3%; hydrogen, ( $\text{H}_2$ ) 3% to 5%; nitrogen, ( $\text{N}_2$ ) 4% to 6%. In generating this gas during the manufacture of Portland or other cement, wherein the process calls for a mixture of calcium carbonate, alluminates, silicates, and coal, as is used in some of the processes for manufacturing Portland cement, the material is placed in the retorts as above described and the heat is raised to the desired degree to form "clinker," the gas being conducted through the apparatus as previously described.

I have found by actual working of the process and by analytical tests that a ton of ordinary limestone produces from 13000 to 15000 cubic feet of gas, showing heating power by analysis to be 320 British thermal units, and a by-product of anhydrous calcium oxid, weighing from 1125 to 1140 pounds.

Owing to the arrangement of connections

between the sets of retorts 2 and 7, all of the gases generated from the carbonates pass through the retorts 8 containing carbon, thereby completely converting carbon dioxid into carbon monoxid.

When it is desired to cut out one of the retorts 7, for the purpose of discharging the carbon therefrom, the gate valves 14 and 20 of the pipes 13 and 19 leading upward from the ends of the retort to be cut out are closed; and following this action, the gases generated in the pair of retorts 2, immediately below the retort 7 which is cut out, pass upward through the corresponding pair of pipes 18 into the trap or seal 17, and from thence through the pipe 19 which remains in service, and from thence to and through the corresponding retort 7, corresponding pipe 13, to and through the trap or seal 12, and from thence to and through the pipe 15 to the gasometer. Thus the retort 7 may be temporarily cut out of service for the purpose of renewing the carbon whenever desired; and all of the gases generated in the corresponding pair of retorts 2 is caused to pass through the body of the carbon in the opposite retort 7 to convert the carbon dioxid into carbon monoxid.

I claim:—

1. An apparatus for manufacturing fuel gas from mineral carbonates and carbonaceous material, comprising a furnace, a series of inclined retorts arranged therein and adapted to receive the mineral carbonates, a water seal arranged above the lower ends of said retorts, tubular connections leading from the forward ends of the retorts to the water seal, a pair of retorts arranged adjacent the first mentioned retorts and adapted to receive carbonaceous material, tubular connections leading from the lower ends of the second mentioned pair of retorts to the water seal, valves located in said last mentioned tubular connections, a water seal arranged above the rear ends of the retorts, tubular connections leading from the second mentioned pair of retorts to the second mentioned water seal, and valves located in the last mentioned pair of tubular connections.

2. An apparatus for manufacturing fuel gas from mineral carbonates and carbonaceous material, comprising a furnace, a plurality of inclined retorts arranged therein and adapted to receive the mineral carbonates, air tight fittings arranged on the ends of said retorts, a water seal arranged above the lower ends of said retorts, tubular connections leading from the air tight fittings on the lower ends of said retorts to the water seal, and the ends of which tubular connections extend below the water line in the water seal, a pair of retorts arranged adjacent the first mentioned retorts and adapted to receive carbonaceous material, air tight fittings on both ends of said pair of retorts, tu-



bular connections leading from the air tight fittings on the lower ends of said pair of retorts to the water seal, valves located in the last mentioned tubular connections, a water  
5 seal arranged above the rear ends of the retorts, tubular connections leading from the air tight fittings on the rear ends of the pair of retorts to the last mentioned water seal, valves located in said tubular connections,  
10 and means whereby suction is created

through the last mentioned water seal and the tubular connections leading thereto.

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

ELMER RIDER.

Witnesses:

M. P. SMITH,  
E. L. WALLACE.