B. BRAZELLE.

PROCESS OF MANUFACTURING GAS.

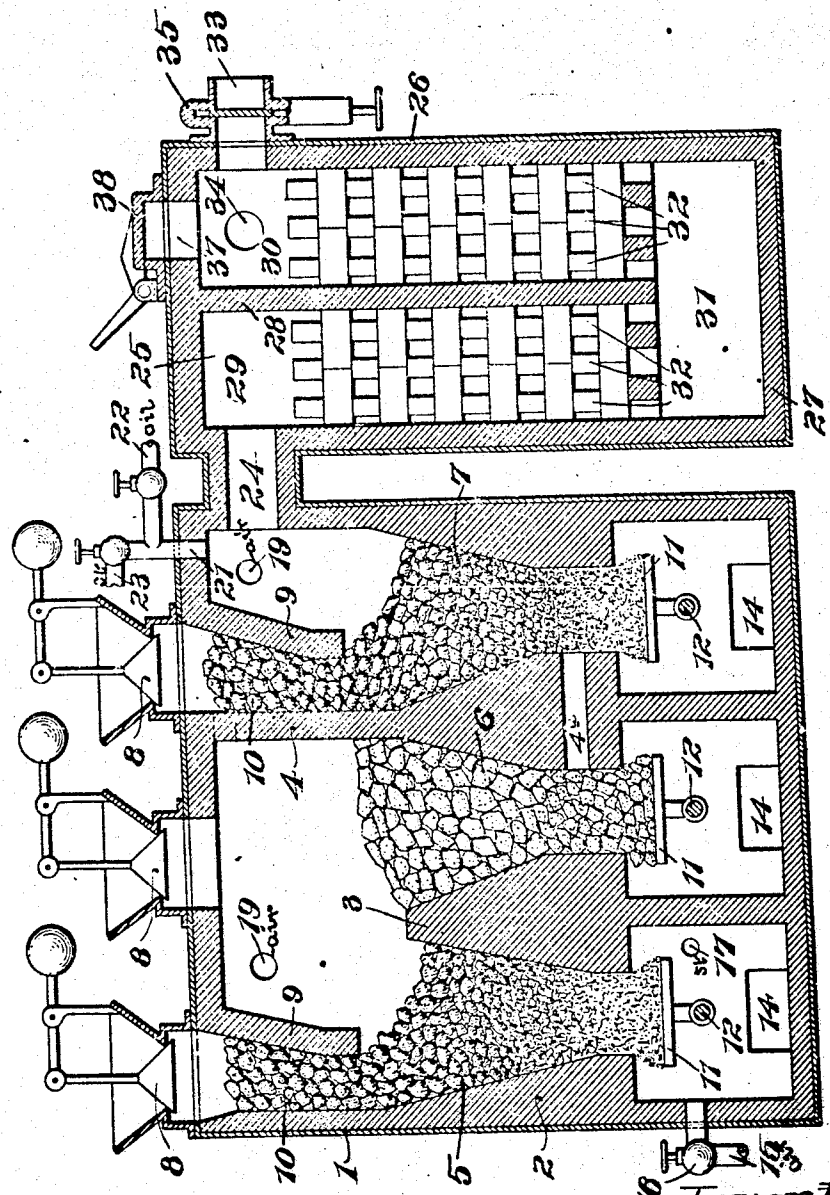
APPLICATION FILED AUG. 3, 1908.

928,103.

Patented July 13, 1909.

2 SHEETS—SHEET 1.

Fig 1.



Witnesses:

Edgar T. Farmer.

G. A. Pennington.

Inventor.

Benjamin Brazelle

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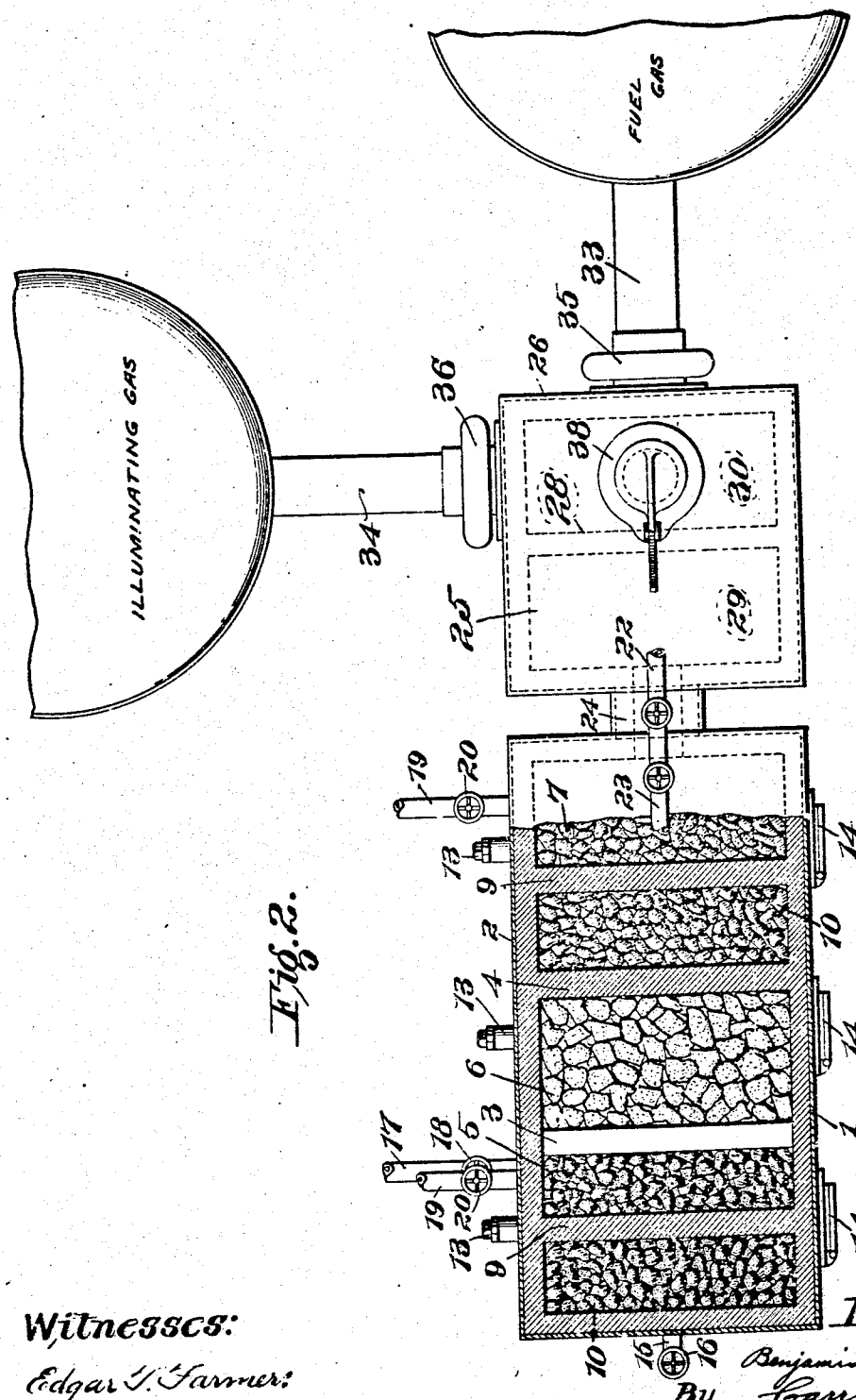

Fig. 2.

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UNITED STATES PATENT OFFICE.

BENJAMIN BRAZELLE, OF KIRKWOOD, MISSOURI, ASSIGNOR OF ONE-HALF TO HENRY LESCHEN, OF ST. LOUIS, MISSOURI.

PROCESS OF MANUFACTURING GAS.

No. 928,103. Specification of Letters Patent. Patented July 13, 1909.

Application filed August 3, 1908. Serial No. 446,637.

To all whom it may concern:

Be it known that I, BENJAMIN BRAZELLE, a citizen of the United States, and a resident of the city of Kirkwood, county of St. Louis, and State of Missouri, have invented a new and useful Process of Manufacturing Gas, of which the following is a specification.

My invention relates to the manufacture of gas and has for its principal objects to utilize cheap material such as limestone and to render the process rapid, economical and substantially continuous.

It consists principally in passing the gases from hot or burning carbonaceous matter through a mass of mineral carbonates for the purpose of evolving carbonic acid therefrom and thence passing such gases through a hot mass of carbonaceous material.

It also consists in various modifications and supplementary steps hereinafter more fully described and claimed.

In the accompanying drawing, which forms part of this specification, and wherein like symbols refer to like parts wherever they occur, Figure 1 is a longitudinal vertical section of an apparatus adapted to carry out my process; and, Fig. 2 is a plan view of said apparatus partly in section.

Said apparatus comprises a steel shell or generator 1 lined with firebrick 2 and divided by vertical walls 3, 4, into three main compartments 5, 6, 7. The shell has an opening in its top above each compartment through which the respective compartments are charged. Each of these openings is closed with a suitable counterweighted hopper bell 8. A hanging wall 9 extends downwardly from a point adjacent to the charging opening of the first and last of the compartments and divides the upper portion of the compartment into a magazine 10 for the fuel and a chamber constituting a part of the flue system. The side walls of each compartment taper or incline inwardly toward the bottom to give support to the weight of the charge. At a suitable distance below the hearth opening of each compartment is a grate 11 which is mounted on a rocking shaft 12, which projects through the casing and is provided with a hand lever 13 for turning it. In the side wall are openings which communicate with the chambers below the respective grates. These openings are normally closed by doors 14 and are used for removing the ashes or other products that are dumped into the respective pits by the periodical turning of the grates.

The wall 3 which divides the first main compartment 5 from the second 6 extends from the bottom nearly but not quite to the top of the casing; and the wall 4 which separates the second compartment from the third 7 has a large opening 4^a located above the grates of said compartment so as to make direct communication between their pits.

Opening into the pit of the first compartment is an air pipe 15 which communicates with an air blower of suitable type and is controlled by a valve 16. Also opening into the pit or lower portion of the first compartment is a pipe 17 which communicates with a boiler or steam generator and is controlled by a suitable valve 18. Near the top of the first and third compartments are pipes 19 which communicate with an air blower and are controlled by valves 20. Also at the top of this third compartment is a pipe 21 which communicates, by valved branch pipes 22, 23, with an oil feeding device and with a steam generator, respectively.

The upper portion of the third compartment communicates through a flue 24 with a fixing chamber 25 consisting of a steel shell 26 lined with firebrick 27. This fixing chamber is divided by a vertical partition 28 into two compartments 29, 30, which communicate with each other through an opening 31 in the bottom of the partition or division wall. Each of these compartments is filled with firebrick 32 set edgewise and far enough apart to form tortuous passages therethrough and constituting a so-called "checker-work". At the top of the second compartment of the fixing chamber are two pipes 33, 34, which communicate, respectively, with gas holders and are controlled by suitable valves 35, 36. In the top of said second compartment of the fixing chamber is a draft opening 37 which is normally closed by a suitable door or covering 38.

In the operation of my invention, the first and third compartments of the generator are charged with coal or other suitable carbonaceous material and the second compartment is charged with limestone or other suitable mineral carbonate. Initially, all of the valves and doors are closed with the exception of the valve 16 which controls the air pipe 15 leading into the pit of the first compartment of the generator and the door 38 at

the top of the second compartment of the fixing chamber. Under these conditions, the coal in the first compartment of the generator is ignited and the hot products of combustion therefrom circulate through the limestone in the second compartment and the carbonaceous material in the third compartment of the generator, thence through the two compartments of the fixing chamber and out into the atmosphere through the draft opening in the top of the second compartment. This operation continues until the limestone in the second and coal in the third compartment and the firebrick in the fixing chamber have become thoroughly hot. If it is desired to hasten the heating of the firebrick in the fixing chamber, the combustible gases generated in the third chamber are ignited and burned by the admission of an air blast into the upper part of the third chamber through the pipe 19. When all parts of the system have been thoroughly heated, the apparatus may be used for the manufacture of fuel gas containing a considerable percentage of nitrogen or for the manufacture of illuminating gas containing an inconsiderable portion of nitrogen.

My invention contemplates the manufacture of both fuel gas and illuminating gas, alternately. In order to manufacture fuel gas, the door 38 of the draft flue of the fixing chamber is closed and the valve of the pipe 33 leading to the fuel gas holder is opened. Under these circumstances, the carbon dioxid resulting from the combustion of the fuel in the first compartment together with the carbon dioxid evolved from the limestone in the second compartment of the generator passes upwardly through the hot mass of coal in the third compartment, wherein the carbon dioxid is converted into carbon monoxid which passes off through the fixing chamber into gas holder. As a modification of this process, the valve 18 controlling the steam pipe 17 leading into the lower portion of the first compartment may be opened to inject steam into said compartment, in which case, occur the reactions well known in the manufacture of water gas. So long as there is combustion in the first compartment, the resulting gas contains a considerable proportion of nitrogen which enters as the main constituent of the air; and, consequently, the resulting gas, whether the steam blast is used or not, is properly classified as a fuel gas.

During the manufacture of fuel gas, all parts of the system are being heated. When all parts of the system are thoroughly hot, the air blast is cut off from the pit of the first compartment, and the valves are adjusted to cut off communication from the fixing chamber to the fuel gas holder and open communication to the illuminating gas holder. Under these conditions, the gases developed in the first compartment as well as those generated in the third compartment are distillation products. The mixture of the gases in the upper portion of this third compartment of the generator contains unstable ingredients which become fixed or converted into more stable gases in passing through the fixing chamber at a high temperature. The gas delivered into the illuminating gas holder is substantially free from nitrogen and contains a lower percentage of carbon monoxid and a larger percentage of hydrocarbon than fuel gas resulting from the previous operations. When it is desired to enrich this illuminating gas, the valves which control the steam pipe 23 and the oil pipe 22 leading into the third compartment are opened, whereby the steam sprays the hydrocarbon oil into the third compartment. The gases resulting from this operation are likewise fixed in passing through the fixing chamber. As a modification of this step, it is sometimes desirable to inject steam into the mass of hot coal in the first compartment, whereby the volume of the resulting gas is considerably increased.

During the manufacture of illuminating gas, the temperature in different parts of the system becomes lower, and as the fixing of the gases requires a high temperature, it is necessary to reheat the fixing chamber periodically as well as to maintain a high temperature in the three compartments of the generator.

When it is required to raise the temperature of the limestone, air may be forced into the upper portion of the first compartment of the generator for the purpose of igniting the gases that distill from the coal therein. In fact, it may sometimes be desirable to burn tar in the upper portion of the first compartment for the purpose of heating the lime rock. By thus converting the upper portion of the first compartment into a combustion chamber, it becomes practicable to use coal that has a large proportion of tarry matter and which would otherwise require special treatment of the gas for the purpose of removing the tarry constituents therefrom.

After the manufacture of illuminating gas has continued for a time, it becomes necessary to reheat the system. This is accomplished either by restoring the system to the original condition in which the products of combustion pass off into the atmosphere, or by directly changing the parts to the conditions required for the manufacture of fuel gas. By thus varying the conditions so as to manufacture illuminating gas and fuel gas alternately, the process becomes continuously productive of one kind of gas or the other. The heat incidental to the manufacture of fuel gas is utilized in the manufacture of illuminating gas, and the lime resulting from the decomposition of the limestone is a val-

uable byproduct, especially as such lime is entirely free from ash. The lime thus formed is periodically dumped, by the rocking of the grate of the second compartment, into the pit where it is readily accessible for removal. In like manner, the ashes or waste of the carbonaceous material is dumped into the pits of the first and third compartments whence it may be readily removed. As all of the compartments of the generator are accessible for charging at the top and for removal at the bottom, the process may be kept in operation indefinitely.

In some cases it is desirable to use more limestone in proportion to the coal. In such a case coal and limestone may be mixed together and charged into the first chamber 5. The resulting limestone byproduct from this chamber is of considerable value and is known as commercial lime as distinguished from the chemically pure lime from the second chamber 6.

When fuel gas is being made and it is desired to maintain the refractory material in the fixing chamber at a high temperature continuously, air may be admitted into the upper part of the third compartment or chamber of the generator in sufficient quantity to burn a minor part of the gases before they enter said fixing chamber.

What I claim is:

1. The process of manufacturing both fuel gas and illuminating gas which consists in alternately admitting and cutting off a supply of air to a bed of hot coal, passing the products of combustion of such coal through a separate mass of mineral carbonates and thence through a second mass of coal, and thence through a mass of refractory material, and collecting the fuel gas thus produced, and in passing the gas, which distils from the hot coal while the air supply is cut off, through said mass of mineral carbonates and the second mass of coal, and then injecting volatile hydrocarbon into it and separately collecting the illuminating gas thus produced.

2. The process of manufacturing both fuel gas and illuminating gas which consists in alternately admitting and cutting off a supply of air to a bed of hot coal, passing the products of combustion of such coal through a mass of mineral carbonates and thence through a second mass of coal, and thence through a mass of refractory material and collecting the fuel gas thus produced, and in passing the gas, which distils from the hot coal while the air supply is cut off, through said mass of mineral carbonates and the second mass of coal, and then injecting volatile hydrocarbon and steam into it and separately collecting the illuminating gas thus produced.

3. The process of manufacturing gas which consists in burning carbonaceous material in the presence of steam, passing the hot products of reaction through a separate mass of mineral carbonate, and then passing all of the gases through a second mass of carbonaceous material.

4. The process of manufacturing gas which consists in burning carbonaceous material in the presence of steam, passing the hot gaseous products of reaction through a separate mass of mineral carbonate to generate carbonic acid therefrom, and then passing all the gaseous products through a second heated mass of carbonaceous material.

5. The process of manufacturing gas which consists in decomposing steam by passing it through a body of hot carbonaceous material, passing the hot products of reaction through a separate mass of mineral carbonate, and then passing all of the gases through a mass of carbonaceous material.

6. The process of manufacturing gas which consists in forcing air and steam through burning carbonaceous fuel, passing the products of combustion through a separate mass of mineral carbonate and thence through a second mass of carbonaceous material, and thence through a heated mass of refractory material.

7. The process of manufacturing gas which consists in evolving carbonic acid by passing through a mass of mineral carbonates the gases distilled from a bed of incandescent coal, then passing such gases mingled with the carbonic acid through a second mass of carbonaceous material and enriching the resulting gas with volatile hydrocarbon, and then fixing the gas with heat.

8. The process of manufacturing gas which consists in commingling all of the gases distilled from a mass of highly heated coal with carbonic acid resulting from the calcination of a mass of mineral carbonate and passing such commingled gases through a mass of hot carbonaceous material, then injecting hydrocarbon oil and steam, and then fixing the resulting gas by passing it through a mass of hot refractory material.

9. The process of manufacturing both fuel gas and illuminating gas which consists in passing the gases arising from a mass of hot coal through a separate mass of mineral carbonate and thence through a second mass of coal, and thence through a mass of refractory material, air being alternately admitted to effect the combustion of a sufficient quantity of coal to heat the mass beyond the point of gas distillation and cut off therefrom for a limited period to permit such distillation of the first mentioned coal, the gas produced during the period of air supply being collected for use as a fuel gas and the gas produced during the period when the air supply is cut off being carbureted and collected separately for use as an illuminating gas.

10. The process of manufacturing gas

which consists in distilling gas from coal, injecting air into such gas to consume a minor portion thereof, passing the gaseous products through a separate mass of mineral carbonate to generate carbon dioxid therefrom and thence through a second mass of carbonaceous fuel and thence through a heated mass of refractory material.

11. The process of manufacturing fuel gas which consists in evolving gases in a generator, burning a minor part of said gases with air to maintain the mass of refractory material in a fixing chamber at a high temperature and passing all of the gases through said heated mass of refractory material in said fixing chamber.

12. The process of manufacturing fuel gas which consists in evolving gases in a generator, passing the gases through a fixing chamber containing a heated mass of refractory material, and maintaining the temperature of said refractory material by burning a minor part of the gases with air in said generator before they enter said fixing chamber.

13. The process of manufacturing fuel gas which consists in evolving gases in a generator, passing the gases through a fixing chamber containing a heated mass of refractory material, and maintaining the temperature of said refractory material continuously by burning a portion of the gases with air in said generator before they enter said fixing chamber.

In testimony whereof I have hereunto signed my name in the presence of two subscribing witnesses at St. Louis, Missouri, this 24th day of July 1908.

BENJAMIN BRAZELLE

Witnesses:
G. A. PENNINGTON,
EDGAR T. FARMER