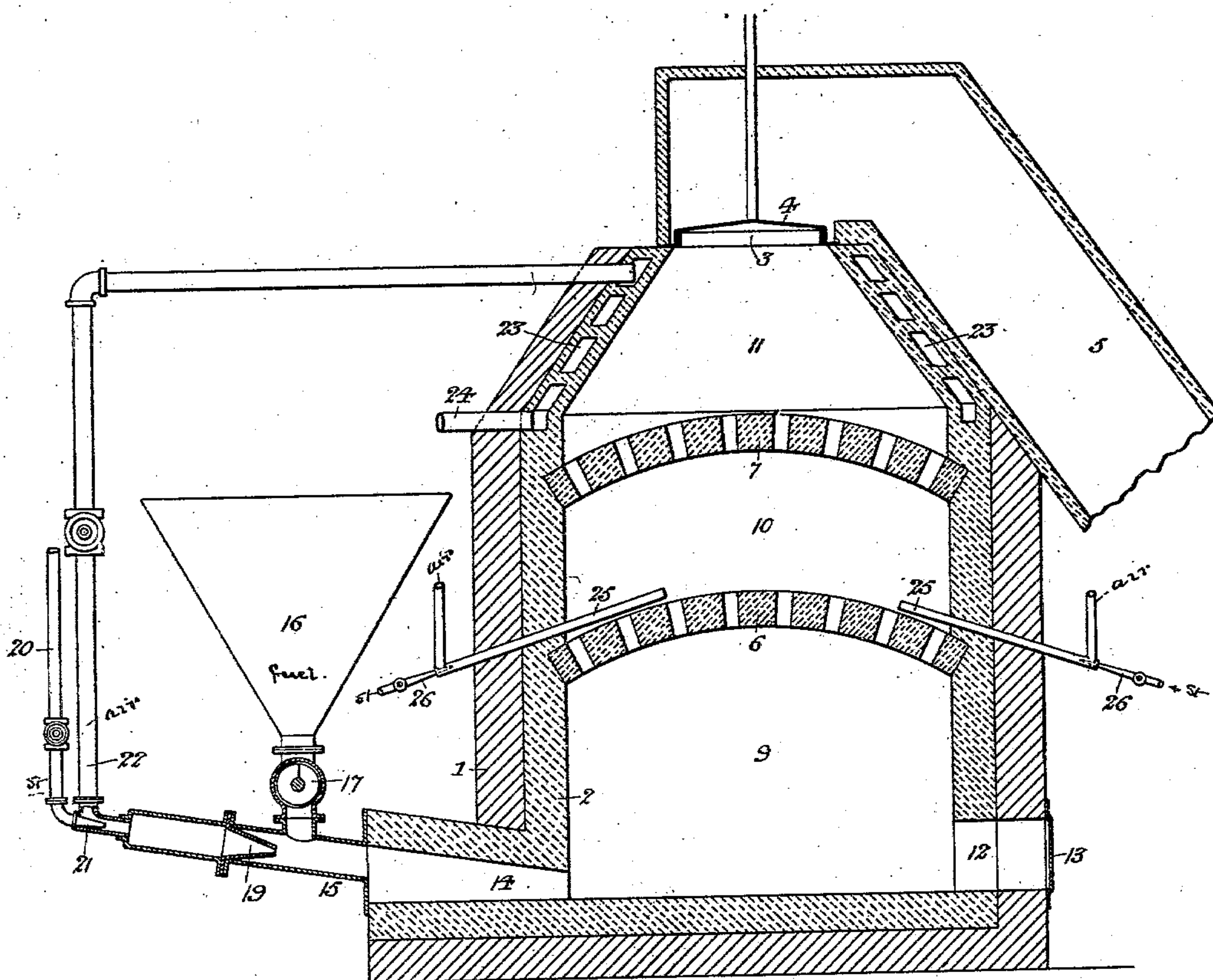


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C. W. LUMMIS.  
METHOD OF MANUFACTURING GAS.  
APPLICATION FILED MAR. 17, 1902.

NO MODEL.



Witnesses:-

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# UNITED STATES PATENT OFFICE.

CHARLES W. LUMMIS, OF CLEVELAND, OHIO.

## METHOD OF MANUFACTURING GAS.

SPECIFICATION forming part of Letters Patent No. 745,635, dated December 1, 1903.

Application filed March 17, 1902. Serial No. 98,525. (No model.)

*To all whom it may concern:*

Be it known that I, CHARLES W. LUMMIS, a citizen of the United States, and a resident of Cleveland, Ohio, have invented certain Improvements in Generating Fuel-Gas, of which the following is a specification.

My invention relates to the production of carbon monoxid, commonly known as "producer-gas."

One object of my invention is to produce a richer and more nearly uniform gas than can be made in an ordinary producer, which gas can be used in gas-engines, as well as for heating purposes.

A further object is to simplify such production and lessen or entirely dispense with the severe and exhausting labor necessary in operating such ordinary producer, the process being also cheapened because of this lessening of labor and because of the lower cost of installation of plant, more perfect conversion of the coal into gas, and fewer repairs.

The figure in the accompanying drawing is a longitudinal section of a gas-producer which may be employed in carrying out my invention.

1 represents a casing of any suitable form and dimensions lined with fire-brick or other refractory material 2 and preferably coned or otherwise contracted at the top, so as to terminate in an outlet 3, to which a valve 4 can be readily applied, this outlet and valve being contained within the upper portion of a downtake 5, whereby the gas is discharged from the producer and is conveyed to an ordinary dust-collector and thence to the furnace or other structure in which it is to be used or to a storage vessel or reservoir.

The interior of the producer structure is divided by two perforated arches 6 and 7, also of refractory material, into lower, intermediate, and upper chambers 9, 10, and 11, respectively. The upper chamber 11 communicates, through the valved outlet 3, with the downtake 5, and the lower chamber has at one side an opening 12, close to the bottom and provided with a suitable door 13, and at the other side a passage 14, which is in communication with a pipe 15, into which powdered coal can be fed in determinate quantity from a hopper 16 by means of an endless conveyer 17 or other available feeding device.

The pipe 15 has at its outer end a nozzle 19, which is supplied with a mixture of heated air and steam under pressure, the steam being derived from a valved pipe 20, terminating in a nozzle 21, which projects into the lower end of a valved air-pipe 22, the upper end of the latter communicating with heating-passages 23, formed in the walls or lining of the upper chamber 11 of the producer and supplied with air in any convenient manner—as, for instance, by means of a pipe 24.

Into the lower portion of the intermediate chamber 10 of the producer project pipes 25, which may communicate with any available supply of air under pressure or may be provided with steam-nozzles 26, whereby a flow of air mixed with steam can be caused to pass through them and into said intermediate chamber 10 of the producer. The air is by preference preheated in order that it may not unduly chill the gas in the chamber 10.

In operation, a wood fire is first kindled in the lower chamber 9 of the producer, and pulverized coal, together with air in sufficient amount to induce complete combustion, are blown into said chamber through the passage 14, the pulverized coal being thereby burned so as to produce an intense heat in the various chambers of the producer, and thereby raise to a very high temperature the refractory lining 2 and arches 6 and 7. When this has been effected, the amount of air introduced with the pulverized coal is diminished, and steam is also introduced into the chamber 9 with the air and coal, it being understood that the supply of air previously introduced with the coal has been caused by pressure imparted thereto independent of the steam-jet. The supply of oxygen now furnished is only sufficient in volume to cause the production of carbon monoxid, or producer-gas, and such production continues as long as the supply of powdered coal is maintained, the gas passing up through the perforated fire-brick arches and being delivered through the downtake 5.

While the gas produced by blowing the fine powdered coal with a limited quantity of air and steam into the highly-heated chamber 9 of the producer is chiefly carbon monoxid, due to the partial burning of the coal, there may also be some carbon dioxid; but as the pro-



portions of air, steam, and coal are regulated with the view of supplying just sufficient oxygen to oxidize the carbon to carbon monoxid such carbon dioxid as is formed will  
 5 be accompanied by some free carbon mingled with the gases in the combustion-chamber, and as in the presence of carbon and heat carbon dioxid is an unstable compound and tends to give up one atom of its oxygen to the  
 10 carbon the result will be the reduction of the carbon dioxid to carbon monoxid and the simultaneous conversion of the carbon into carbon monoxid. It is for this purpose that the perforated fire-brick arches and the air  
 15 and steam supply pipes 25 are used, the gases produced in the lower chamber 9 passing through the perforations in the intensely-heated arches and being thereby changed into carbon monoxid, as indicated above, the  
 20 pipes 25 being employed in order to perfectly regulate the total amount of air and steam introduced, as it may be found best in practice to reduce the amount of steam blown in with the coal and introduce it into the gas  
 25 after the latter passes through the arch 6.

As in regular gas-producer work, steam is used to transfer some of the heat of primary combustion in the producer to the furnace or other structure, the steam absorbing heat  
 30 and being thereby broken up into its elements in the producer and giving out this heat again when the hydrogen which is carried off with the carbon monoxid is burned in the furnace.

It will be evident that a gas-producer of the character shown and described dispenses with these severe and exhausting labor attending the use of an ordinary gas-producer and demanded by the necessity of poking the mass of fuel  
 40 for the purpose of breaking up clinkers and providing for the passage of the air through said mass of fuel, the production of a richer and more uniform gas being insured, owing to the fact that the conditions under which  
 45 the gas is formed are practically constant, whereas in an ordinary gas-producer these conditions are constantly varying, because of the difficulty of getting the blast through the mass of fuel or because of the production of  
 50 holes or channels through said mass, the formation of clinkers therein, or other causes of variation. Owing to the simplicity of construction of my improved gas-producer, moreover, the first cost of installation as compared  
 55 with that of the ordinary producer is much reduced and as the operation of the producer is practically continuous requires but little care and attention and effects practically complete conversion of the coal into gas. The pro-  
 60 duction of such gas is very materially cheapened, there being no shut-downs on account of clinkers, as in ordinary hand-poked gas-producers, or because of derangement of complicated machinery, as in the case of pro-  
 65 ducers having mechanically-operated pokers. Owing to the high heat at which the gas is generated and under which it is subsequently

maintained the gas will be fixed and the distillation of tar-forming vapors from the coal, as in ordinary producers, will be prevented, 70  
 the gas being available for use in engines, as well as for heating purposes.

Although I prefer in carrying out my invention to construct a producer with two or even more of the perforated arches, a single 75  
 arch only may be used in some cases, or the arches may even be dispensed with altogether without departing from the essential feature of my invention, and, as I have already indicated, the steam may be introduced inde- 80  
 pendently of the air, or the production of gas in accordance with my invention may be conducted without the use of steam at all, such use being, however, preferred in all cases for the reasons before given. 85

Having thus described my invention, I claim and desire to secure by Letters Patent—

1. The mode herein described of generating carbon monoxid or producer-gas, said mode 90  
 consisting in introducing into a highly-heated chamber, powdered coal, and combining therewith air and steam in volumes so limited as to provide only sufficient oxygen to effect such conversion of the coal into carbon mo- 95  
 noxid, substantially as specified.

2. The mode herein described of generating carbon monoxid or producer-gas, said mode consisting in introducing into a highly-heated chamber, powdered coal, and combining 100  
 therewith preheated air and steam in volume so limited as to provide only sufficient oxygen to effect such conversion of the coal into carbon monoxid, substantially as specified.

3. The mode herein described of generating 105  
 carbon monoxid, or producer-gas, said mode consisting in introducing into a highly-heated chamber, powdered coal combined with air, maintaining the heat of the gas so produced and introducing thereinto a further 110  
 supply of air, the total volume of air being so limited as to supply only sufficient oxygen to effect the conversion of the coal into carbon monoxid, substantially as specified.

4. The mode herein described of generating 115  
 carbon monoxid or producer-gas, said mode consisting in introducing into a highly-heated chamber, powdered coal combined with preheated air, maintaining the heat of the gas so produced and introducing thereinto a 120  
 further supply of air, the total volume of air being so limited as to supply only sufficient oxygen to effect the conversion of the coal into carbon monoxid, substantially as specified. 125

5. The mode herein described of generating carbon monoxid or producer-gas, said mode consisting in introducing into a highly-heated chamber, powdered coal combined with a mixture of air and steam, maintaining the 130  
 heat of the gas so produced and introducing thereinto a further supply of air, the total volume of steam and air being so limited as to supply only sufficient oxygen to effect the



conversion of the coal into carbon monoxid, substantially as specified.

5 6. The mode herein described of generating carbon monoxid or producer-gas, said mode consisting in introducing into a highly-heated chamber, powdered coal combined with a mixture of preheated air and steam, maintaining the heat of the gas thus produced, and introducing thereinto a further supply  
10 of air, the total volume of steam and air being so limited as to supply only sufficient oxygen to effect the conversion of the coal into carbon monoxid, substantially as specified.

15 7. The mode herein described of generating carbon monoxid or producer-gas, said mode consisting in introducing into a highly-heated chamber, powdered coal combined with air, maintaining the heat of the gas thus produced, and introducing thereinto a supply of  
20 steam, the total volume of steam and air being so limited as to supply only sufficient oxygen to effect the conversion of the coal into carbon monoxid, substantially as specified.

25 8. The mode herein described of generating carbon monoxid or producer-gas, said mode consisting in introducing into a highly-heated chamber, powdered coal combined with preheated air, maintaining the heat of the gas thus produced, and introducing thereinto a  
30 supply of steam, the total volume of steam and air being so limited as to supply only sufficient oxygen to effect the conversion of the coal into carbon monoxid, substantially as specified.

35 9. The mode herein described of generating carbon monoxid or producer-gas, said mode consisting in introducing into a highly-heated chamber powdered coal combined with air, maintaining the heat of the gas thus produced,  
40 and introducing thereinto a further supply of air mixed with steam, the total volume of steam and air being so limited as to supply only sufficient oxygen to effect the conversion

of the coal into carbon monoxid, substantially as specified.

45 10. The mode herein described of generating carbon monoxid or producer-gas, said mode consisting in introducing into a highly-heated chamber, powdered coal combined with preheated air, maintaining the heat of  
50 the gas thus produced, and introducing thereinto a further supply of air mixed with steam, the total volume of steam and air being so limited as to supply only sufficient oxygen to effect the conversion of the coal into carbon  
55 monoxid, substantially as specified.

11. The mode herein described of generating carbon monoxid or producer-gas, said mode consisting in introducing into a highly-heated chamber, powdered coal combined  
60 with a mixture of air and steam, maintaining the heat of the gas thus produced, and introducing thereinto a further mixture of air and steam, the total volume of steam and air being so limited as to supply only sufficient  
65 oxygen to effect the conversion of the coal into carbon monoxid, substantially as specified.

12. The mode herein described of generating carbon monoxid or producer-gas, said mode consisting in introducing into a highly-  
70 heated chamber, powdered coal combined with a mixture of preheated air and steam, maintaining the heat of the gas thus produced, and introducing thereinto a further supply of air and steam, the total volume of  
75 steam and air being so limited as to supply only sufficient oxygen to effect the conversion of the coal into carbon monoxid, substantially as specified.

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

CHARLES W. LUMMIS.

Witnesses:

C. W. COMSTOCK,  
FRED. F. BOWMAN.