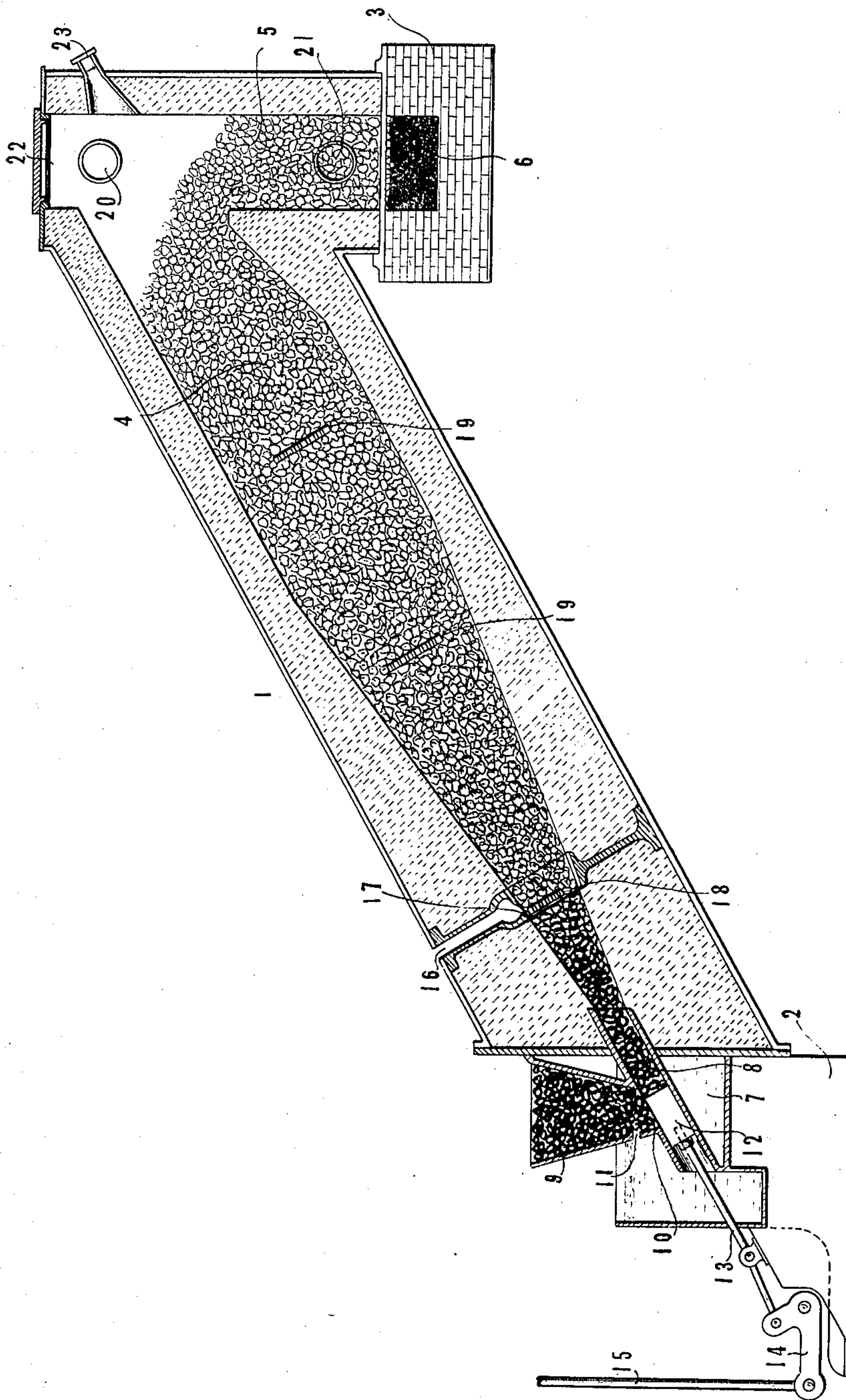


No. 871,202.

PATENTED NOV. 19, 1907.

G. W. BULLEY.
PROCESS OF GENERATING GAS.
APPLICATION FILED DEC. 12, 1906.



WITNESSES

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GEORGE W. BULLEY, OF NEW YORK, N. Y.

PROCESS OF GENERATING GAS.

No. 871,202.

Specification of Letters Patent.

Patented Nov. 19, 1907.

Application filed December 12, 1906. Serial No. 347,451.

To all whom it may concern:

Be it known that I, GEORGE W. BULLEY, residing at New York, in the county of Kings and State of New York, have invented certain new and useful Improvements in Processes of Generating Gas, of which the following is a full, clear, and exact description, such as will enable others skilled in the art to which it appertains to make and use the same.

10 This invention relates broadly to the production of combustible gases, but more especially to a process for producing the same from carbonaceous substances.

One of the objects of my invention is to provide a new and improved process for producing gases of the above character by the incomplete combustion and dry distillation of coal, wood, peat or other solid organic substances.

20 Another object is to provide a process of the character indicated whereby a greater quantity of permanent gas will be produced from a given amount of material and at less expense than has obtained in the processes hitherto employed.

Another object is to provide a process of the above character which while substantially continuous may be carried out with a minimum amount of care and attendance.

30 Other objects will be in part obvious and in part pointed out hereinafter.

The invention accordingly consists in the several steps and the relation and order of one or more of such steps with relation to each of the others thereof which will be exemplified in the process hereinafter described, and the scope of the application of which will be indicated in the following claims.

40 In order that the nature of my invention and the objects and advantages to be obtained thereby may be made more intelligible, I have appended a drawing to this specification, the same forming a part thereof, which shows diagrammatically a preferred manner of carrying out the same, and while in the future many different forms of apparatus may be devised for carrying out the several steps of my process, that shown in the drawing is such as I prefer to employ at the present time.

55 In the accompanying drawing, wherein my invention is illustrated schematically, 1 represents a furnace constructed of fire clay or other highly refractile material which is preferably set in an upwardly inclined position

upon suitable bases 2 and 3 respectively. The generating chamber 4 of the furnace is shown as constricted at its lower end and increasing in diameter from the lower constricted portion toward the upper end, and at the upper end said chamber leads into a vertical chamber 5. Vertical chamber 5 in the present instance is provided with an ash receptacle 6 designed to contain water which acts both as a water seal and as a medium for quenching the spent material or ash, which passes as shown downwardly through chamber 5. A water receptacle 7 is provided at the lower end of the furnace and adjacent thereto, and a conduit 8 leads from said receptacle to the lower end of the generating chamber. A hopper 9 is provided above conduit 8, and has a mouth 10 leading thereinto, said hopper being in open communication, as at 11, with the water contained in receptacle 7.

Mounted to reciprocate within conduit 8 below the mouth of hopper 9 is a feed piston 12 which is reciprocated by means of a piston rod 13 actuated through a link connection with a bell crank lever 14 and a link 15 which extends to and is operated from any suitable source of power.

The walls of furnace 1 are recessed as at 16 for the purpose of admitting an air blast to the generating chamber, the ingoing air passing downwardly through recess 16 and into said chamber through a plurality of twyer openings 17 provided in the lower portion of the recess. The size of the twyer openings may be regulated by a suitable controlling device or damper 18. It will be noted that the form of recess 16 and the disposition of twyer openings 17 are such that the entering air blast will be deflected in a downward direction, the purpose of which will be apparent hereinafter. Furnace 1 is provided between recess 17 and the upper end thereof with air inlet openings adapted to be controlled by dampers 19.

Leading from the upper portion of chamber 4 is a gas exit opening 20, from which may extend a suitable conducting conduit, and a second gas exit opening 21 is also provided in the lower portion of the vertical chamber 5. Access to the generating chamber and to the furnace may be had through a manhole 22, and a poke or sight hole may also be provided as at 23.

Having thus described the construction of a preferred form of apparatus for carry-

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ing out the several steps constituting my process, the manner of carrying out the said process is substantially as follows: the carbonaceous material, which in the present instance is coal, is first introduced into the hopper 9 and falls through mouth 10 thereof into the conduit 8, when the piston 12 is in a retracted position, and when said piston is projected upwardly through the conduit the coal is forced upwardly therethrough into the lower portion of the generating chamber. It will be understood that upon each reciprocation of piston 12 a fresh charge of coal falls into conduit 8, and is projected upwardly therein and into the generating chamber. The level of water in the receptacle is kept above the lower end of conduit 8 and opening 11 of hopper 9 so as to effect a tight seal and thus prevent the escape of any gas through the lower portion from the lower end of the apparatus. When the coal passing upwardly through chamber 4 reaches the twyer openings 17 the same is ignited, which operation may be effected by igniting kindlings introduced into recess 16. The air blast is then turned on, and owing to the disposition of the twyer openings the blast will be deflected in a downward direction, the combustion being substantially confined thereby between the point of introduction of the carbonaceous fuel and said twyer openings. At this point it may be noted that the air blast is regulated to admit only enough air into the combustion chamber to sustain an incomplete combustion of the carbonaceous material. This fuel, as it is fed upward through the generating chamber past the seat of combustion, is converted into coke by the distillation of its hydrocarbon constituents, and these hydrocarbon constituents in the presence of the air issuing through the twyer openings are decomposed to form carbon dioxid. The coked material is forced upward from the seat of combustion through the combustion chamber in a highly heated or incandescent condition, and the carbon dioxid infiltrating through this incandescent body is converted into carbon monoxid before reaching the upper portion of the combustion chamber. The carbon monoxid generated at the seat of combustion also passes through the incandescent mass and is unchanged thereby. It may also be noted that the coal when introduced into the generating chamber is in a saturated condition, and the hydrogen which results from the decomposition of the steam into which this water is formed passes up through the incandescent carbonized material in an unchanged condition. The coke formed at the seat of combustion, when it reaches the upper portion of generating chamber 4, tumbles into vertical chamber 5, the spent material or ash indicated at 24 falling into receptacle 6, from which it may be removed

by any suitable means. The gas produced in the generating chamber, from which a large portion of the incombustible impurities have been removed and which is suitable to be used as a producer gas, may be taken from the generating chamber through conduit 20, or if desired the permanent gases may be taken from the generating chamber through the exit opening provided in the lower portion of vertical chamber 5. This latter gas will be cracked or converted into a fixed or permanent gas by its infiltration through the incandescent mass located within said vertical chamber. It is of course understood that, if desired, gas taken from either of conduits 20 and 21 respectively may be led through suitable washing or purifying apparatus, or that the same may be led directly to the apparatus in which the same is to be utilized. If desired, air may be admitted into the generating chamber through the openings provided in the upper portion of the furnace by manipulating dampers 19.

It will thus be seen that I have provided a process through the carrying out of which the volatile constituents of coal, wood, coke or other preferably solid carbonaceous substances may be converted into valuable, permanent, inflammable gases with practically no loss of the volatile constituents of said carbonaceous substances. The hydrocarbons present in the fuel are oxidized and are converted into hydrogen and carbonic oxid gases, and any water present in the fuel is decomposed and the hydrogen constituents thereof liberated by passing through the incandescent body of carbonized material. Moreover, since the distillation of the hydrocarbons present in the coal takes place in a zone wherein free oxygen is present, some of them are decomposed and converted into carbon dioxid, which in its passage through the incandescent mass is converted into carbon monoxid before it reaches the exit opening.

One of the advantages accruing by reason of the carrying out of my process as above described resides in the fact that more pure carbon monoxid and hydrogen gases free from moisture and volatilized liquid hydrocarbons are produced and stable gases generated than in processes hitherto provided, thus largely obviating the necessity of the employment of purifying apparatus or operations to wash or otherwise separate the non-stable and decomposed constituents from the gas before the same may be economically utilized. In this manner the difficulties arising from the instability of producer gas as hitherto generated are eliminated and gas suitable for general heating purposes is produced within the generating chamber. The gas formed within the generating chamber is substantially free from water, tar and other unstable constituents, and the por-

tion of the hydrocarbon content of the fuel converted into carbon dioxide by the incomplete combustion taking place within the generating chamber is in turn converted into carbon monoxide by contact with or infiltration through the incandescent material present in the generating chamber above the seat of combustion.

Another important advantage obtained by reason of my process as described lies in the fact that the fuel, being introduced under the incandescent coke, is gradually heated before arriving at the seat of combustion and therefore does not affect the continuity of generation of gas. The advantage of the continuous and uniform feed of the fuel past the seat of combustion and the expense saved as regards the matter of care and attendance is obvious. Moreover, the inclined position of the combustion chamber furnishes a natural course for the gas passing through the body of incandescent coke therein.

Still another important advantage inherent in my process resides in the fact that I am enabled to draw from the generator two qualities of gas, one suitable for use in blast furnaces or for analogous purposes being withdrawn from the upper conduit of the generator, while the permanent or fixed gases suitable for gas engine work may be withdrawn from the lower conduit. This latter gas, being withdrawn from the generator in proximity to the water in the ash receptacle, will lose a large portion of its heat and will leave the generator in a comparatively cool condition.

As the process above described could be carried on by the use of radically different apparatus, and as many variations from the details of the process herein set forth could be incorporated without deviation from the broad principles of my invention, I desire that all matter herein set forth or shown in the accompanying drawing shall be interpreted as illustrative and not in a limiting sense.

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

1. The process of generating a gas from a carbonaceous mass comprising green fuel, a coked portion and an intermediate partly coked portion, which consists in confining said mass within a closed retort, progressively moving said mass through said retort, applying an air blast to said mass at said partly coked portion, and then causing the resultant gas to pass directly through the coked portion of said mass.

2. The process of generating a gas from a carbonaceous mass which consists in confin-

ing said mass within a retort, progressively moving said mass through said retort past a seat of combustion provided intermediate the ends thereof, subjecting said mass to an air blast above said seat of combustion, and then causing the gas generated at the seat of combustion to infiltrate through the highly heated partly coked portion of said carbonaceous mass produced at said seat of combustion.

3. The process of generating gases of different characteristics from carbonaceous material which consists in progressively feeding carbonaceous material in a closed retort, forming a seat of incomplete combustion for the carbonaceous material intermediate the ends of the retort, causing the resultant gas to infiltrate directly through coke in a highly heated condition formed at the seat of incomplete combustion, withdrawing the gas from one portion of said retort, causing the remaining gas to further infiltrate through said highly heated coke, and withdrawing the resultant gas from another portion of said retort.

4. The process of generating gases of different characteristics from carbonaceous material, which consists in confining said material within a closed retort, progressively feeding fresh carbonaceous material into said retort, forming a seat of incomplete combustion for said material intermediate the ends of the retort, subjecting said material to an air blast at said intermediate portion, causing the resultant gas to infiltrate through coke in a highly heated condition formed at the seat of incomplete combustion, withdrawing a portion of the gas from the upper portion of the retort, causing the remaining gas to infiltrate through another bed of coke in a highly heated state, and withdrawing the resultant gas from the retort at a location below the point of withdrawal of the first mentioned gas.

5. The process of generating a gas which consists in confining a carbonaceous mass in a closed retort, conducting a green fuel through a water seal and progressively feeding the same into said retort, forming a seat of incomplete combustion intermediate the ends of said retort, forcing air therein above said seat of incomplete combustion and then causing the gas generated at the seat of incomplete combustion to infiltrate directly through coke in a highly heated state produced at said seat of combustion.

In testimony whereof I affix my signature, in the presence of two witnesses.

GEORGE W. BULLEY.

Witnesses:

C. H. WILSON,
H. M. SEAMANS.