No. 887,989. PATENTED MAY 19, 1908.

G. J. WEBER.

PROCESS OF PRODUCING GAS.

APPLICATION FILED MAR. 29, 1904.

2 SHEETS—SHEET 1.

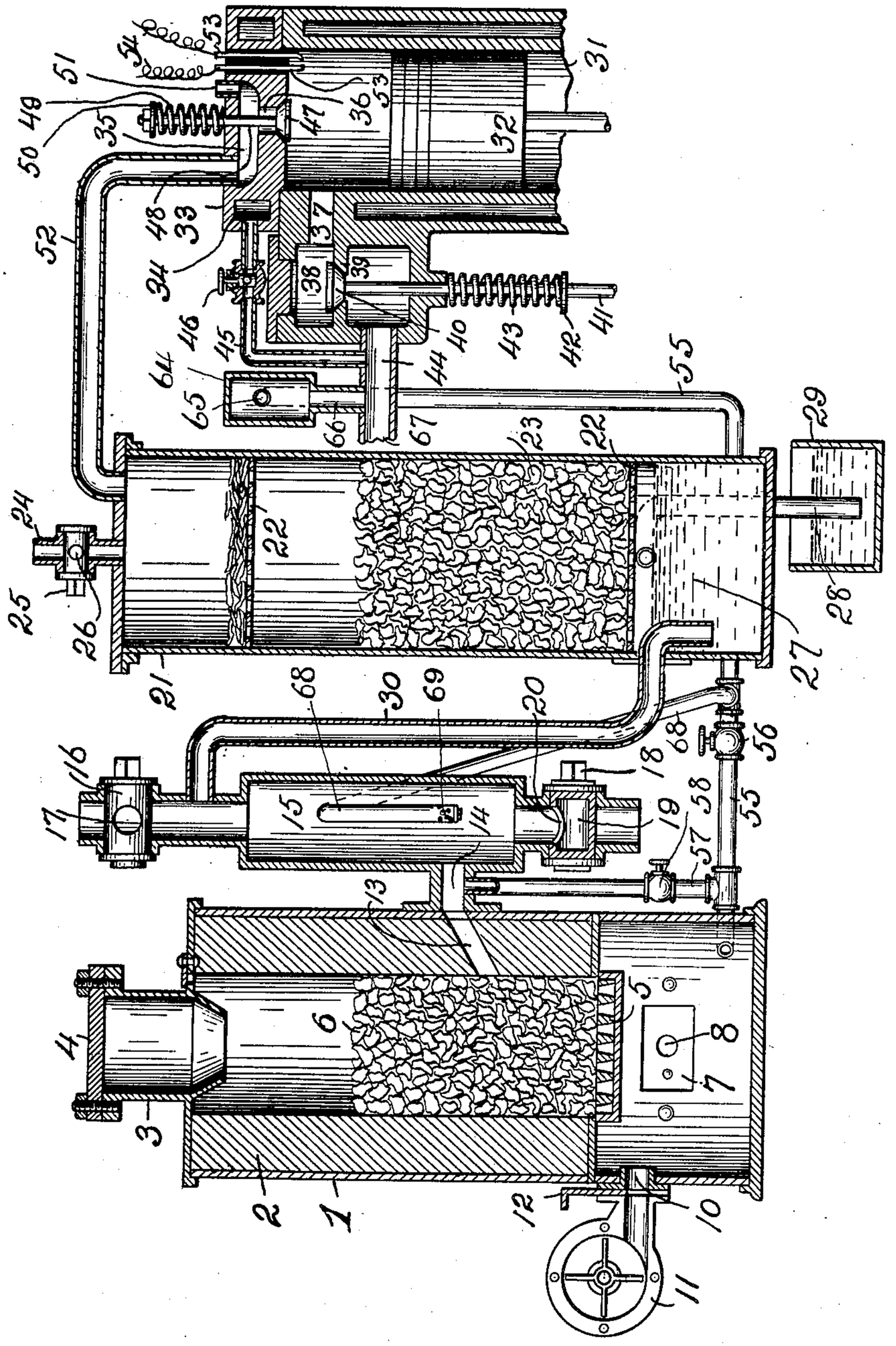


Fig 1

WITNESSES:
R. E. Hamilton.
L. R. Barker.

INVENTOR.
George J. Weber
BY
Warren D. Housel.
His ATTORNEY.

No. 887,989. PATENTED MAY 19, 1908.

G. J. WEBER.

PROCESS OF PRODUCING GAS.

APPLICATION FILED MAR. 29, 1904.

2 SHEETS—SHEET 2.

Fig 2

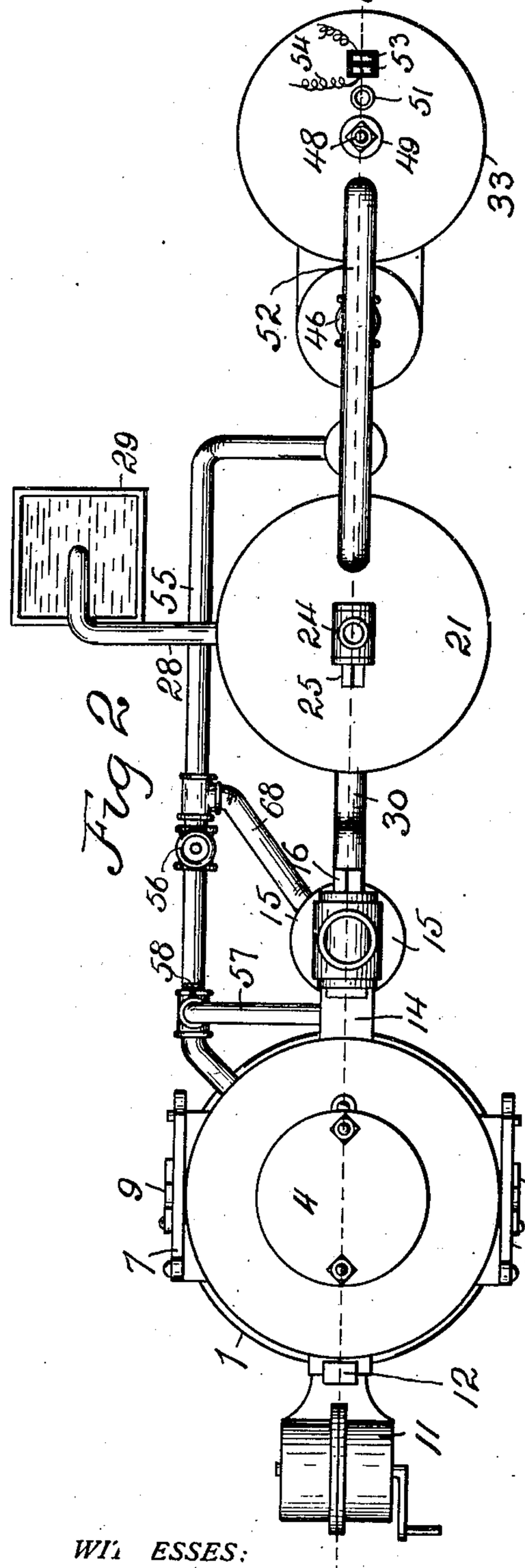


Fig 3

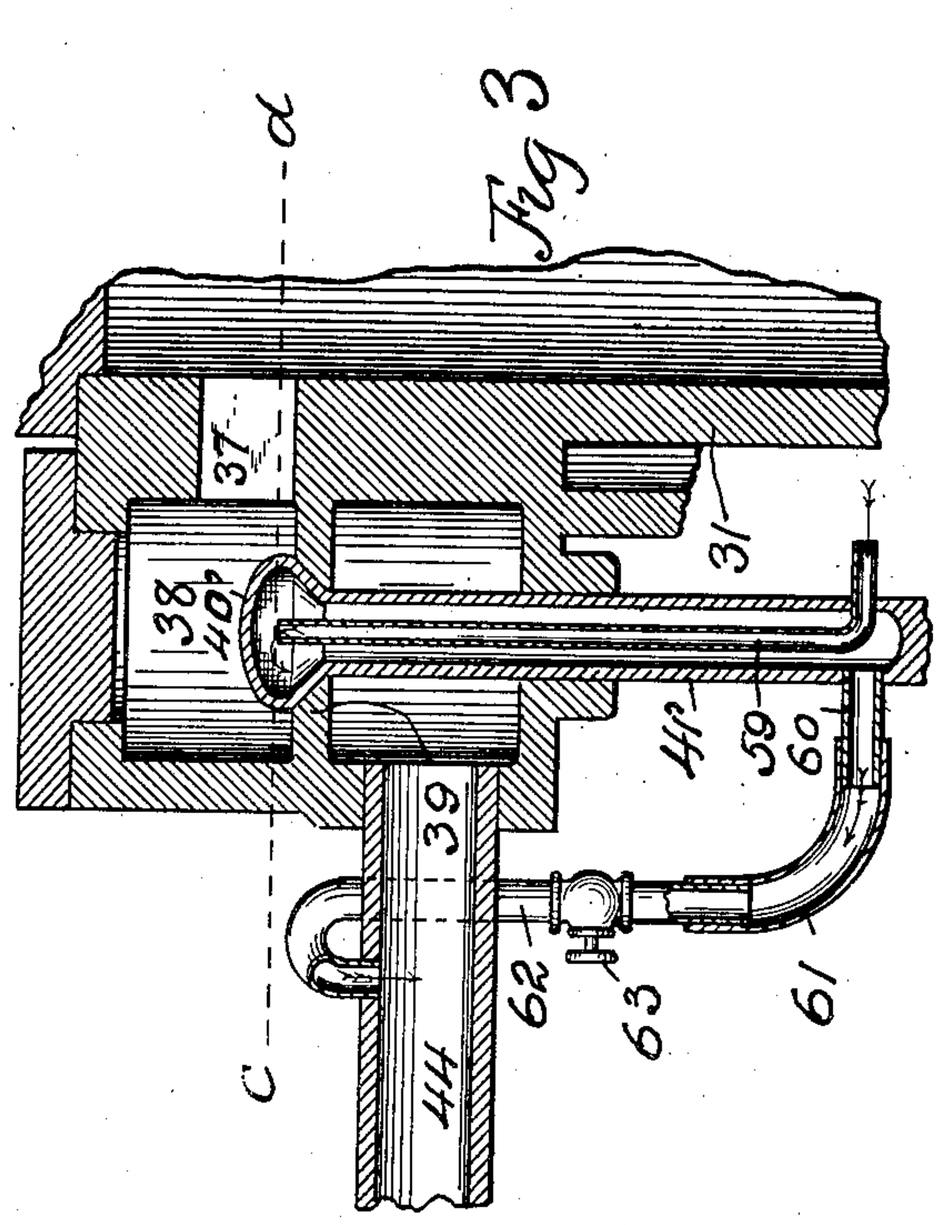
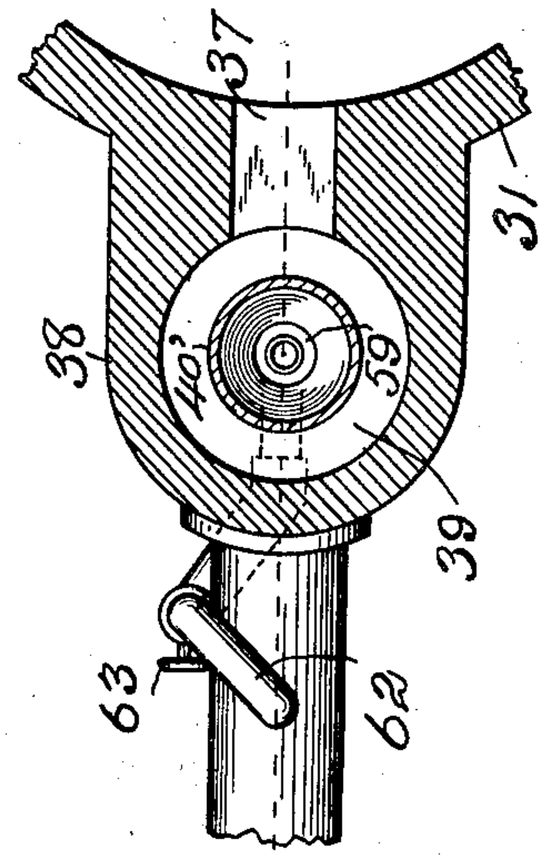


Fig 4



WITNESSES:

R. E. Hamilton.

L. R. Barker.

INVENTOR.

George J. Weber

BY

Warren D. House

His ATTORNEY.

UNITED STATES PATENT OFFICE.

GEORGE J. WEBER, OF KANSAS CITY, MISSOURI.

PROCESS OF PRODUCING GAS.

No. 887,989. Specification of Letters Patent. Patented May 19, 1908.

Application filed March 29, 1904. Serial No. 200,524.

To all whom it may concern:

Be it known that I, GEORGE J. WEBER, a citizen of the United States, residing at Kansas City, in the county of Jackson and State of Missouri, have invented new and useful Improvements in Processes of Producing Gas for the Production of Power, of which the following is a specification.

My invention relates to improvements in process for producing gas for the production of power.

My invention is employed in connection with the running of a gas engine of the explosive type and which is driven by the gaseous products formed from burning fuel in a gas producer. A portion of the combustible ingredients are not consumed when the charge is exploded in the engine cylinder, and the full efficiency of the fuel is therefore not obtained as the engine is ordinarily used.

The object of my invention is to mix steam with the exploded gaseous products taken from the engine cylinder and force the mixed steam and exploded gaseous products through the burning fuel in the producer, the steam being mixed with the exploded products prior to the introduction of the said ingredients into the producer chamber, and prior to access of air to either the steam or burned products. By mixing the steam with the exploded gaseous products immediately after the release of the products from the engine cylinder, and before air has contact therewith, the steam is decomposed by the burned products and forms therewith and with the unburned portions a combustible gas which passing through the producer is further enriched by the carbon therein after which it passes with the fresh gas formed in the producer to the engine cylinder for use in propelling the engine. Such steam as is not combined with the exhaust products combines with the air and enters the producer to form combustible gas in the ordinary manner.

In addition to passing the mixed steam and exhaust gas through the burning fuel, a portion may be combined with the gaseous products after the same comes from the producer. Thus with the employment of my process the unburned portions of an exploded charge are caused to unite with the steam to form combustible gas that may be employed again for producing power. Furthermore, by decomposing the steam by contact with the highly heated exhaust gas, that part of the steam which does not combine with the unburned portions is in the best possible condition for uniting with the products of the burning fuel for forming highly combustible gas. This is furthermore accomplished in my process without cutting down the temperature in the producer chamber, thus permitting the use of a large amount of steam without harmfully affecting, but increasing instead, the combustion in the producer chamber.

My invention provides further the utilizing of the gas engine for forcing air and the mixed steam and exhaust gas through the burning fuel and making the process continuous.

My invention provides further the subjecting water to contact with the highly heated exhaust gas thus forming steam which is permitted to mix with the exhaust gas, the mixture being then forced through burning fuel to form the gas for the production of mechanical energy in the gas engine or otherwise.

My invention provides further the heating of water by absorbing out of contact the heat from the exhaust gas, then subjecting the heated water to direct contact with the exhaust gas thus forming steam which is mixed with the exhaust gas and the mixture forced through burning fuel.

My invention provides further the cooling and compressing the combustible gas prior to exploding the same in the gas engine, and formed by forcing the mixed steam and exhaust gas through the burning fuel.

Other novel features are hereinafter fully described and claimed.

In the accompanying drawings which illustrate my invention, Figure 1 is a vertical sectional view of an apparatus adapted to carry into effect my improved process, the view being taken on the dotted line *a*—*b* of Fig. 2. Fig. 2 is a plan view of the same apparatus. Fig. 3 is a vertical sectional view of a modified form of apparatus employed to heat the water prior to its being subjected to direct contact with the exhaust gas. Fig. 4 is a horizontal section taken on the dotted line *c*—*d* of Fig. 3.

Similar characters of reference indicate similar parts.

The apparatus required to carry into effect my process comprises a gas producer, a cooling and purifying mechanism for receiving the gaseous products delivered from the pro-

ducer, a gas engine connected with the cooling and purifying mechanism, and means for forming the steam, mixing it with the exhaust gas and delivering the mixture to the gas producer.

1 denotes the vertical tubular shell of the gas producer provided with a refractory lining 2 and a feed opening located in the upper end of the producer, and indicated by 3. A removable closure 4 is provided for the opening 3. Near the lower end of the producer chamber is provided a transverse grate 5, on which rests the fuel 6, comprising any suitable carbonaceous fuel, such as coal, bituminous or anthracite, charcoal, coke, wood, etc. In the producer chamber below the grate 5, in the side wall, are one or more doors 7 having each an air inlet opening 8 which can be closed by a closure 9 pivoted to the door. To produce initial combustion in the producer, I provide in the producer wall below the grate 5, an air inlet opening 10, through which air may be forced by a hand operated air pump 11, of any ordinary pattern. The opening 10 may be closed by a vertical slidable door 12 when the air pump is not in use. Through the producer wall and the lining 2, above the grate 5, is provided an outlet opening 13, communicating with an inlet opening 14 provided in the side wall of a vertical tubular dust-collecting chamber 15, disposed outside of but adjacent to the producer 1. In the upper end of the chamber 15 is provided an opening for the escape of the gaseous products during the time the fuel in the producer is being first ignited, but adapted to be closed at other times by means of a transverse cylindrical rotatable valve 16 provided with a transverse hole therethrough, denoted by 17, through which the gaseous products escape when the valve 16 is properly positioned. The lower end of the chamber 15 is provided with an opening for the discharge of ashes, dust, or dirt collecting in the chamber 15. Excepting at such times as it is desired to discharge such materials from the chamber 15, the lower opening is closed by a transverse cylindrical rotatable valve 18, provided with a hollow space 19, and having in its wall a hole 20, through which dust and similar materials may enter the hollow space 19, when the valve 18, is positioned as shown in Fig. 1. When it is desired to empty the dust in the space 19, the valve 18 is rotated to a position diametrically opposite the one shown in the drawing.

Adjacent the chamber 15 is the vertical tubular cooling and purifying chamber 21, the upper and lower ends of which are closed and in the inside of which are provided one or more transverse perforated horizontal partitions 22, upon which are placed coke, charcoal, shavings or similar materials, denoted by 23. In the upper end of the chamber 21 is provided a vertical tubular conductor 24, through which water may be fed into the chamber 21. In the said conductor 24 is provided a horizontal, cylindrical, rotatable valve 25, for closing the said conductor 24, and provided with a transverse hole 26, which, when the valve 25 is properly positioned, registers with the opening in the conductor 24 so that water may be poured therethrough into the chamber 21, for the purpose of moistening the materials 23, and for providing in the chamber 21 a supply of water 27, for washing, cooling and purifying the gas delivered from the producer. An overflow pipe 28, has its upper end extending through the side wall of the chamber 21, below the lower partition 22. The lower end of the pipe 28 is inserted in a vessel 29 which, receiving water passing through the pipe 28, forms thereby a water seal for preventing inlet of air to or escape of gas from the chamber 21. A tubular conductor 30, has its upper end connected to the upper part of the chamber 15 and its lower end extending through the side wall of the chamber 21 and below the surface of the water 27 held in said chamber.

31 denotes the upper portion of a working cylinder of a gas engine of the vertical type.

32 denotes the piston of the gas engine, 33 the head of the cylinder provided with a water space 34, and having a mixing chamber 35 connected by an inlet port 36, with the interior of the cylinder 31. The cylinder 31 is provided near its upper end with an exhaust port 37, communicating with a valve chamber 38 divided by a transverse partition 39, having therethrough a vertical valve opening, in which is seated the exhaust valve 40, provided with a valve stem 41 on which is mounted rigidly, a collar 42 upon the upper side of which rests the lower end of a coil spring 43, the said spring encircling the stem 41 and having its upper end bearing upon the valve chamber 38. The spring 43 normally holds the exhaust valve 40 against its seat.

44 denotes the horizontal exhaust pipe connected to the valve chamber 38 below the partition 39.

A water conductor 45 has one end connected with the water space 34 and its lower end connected to the exhaust pipe 44. In the conductor 45 is inserted a valve 46, of any suitable form, for controlling the flow of water through the said conductor. In the lower end of the inlet 36, is mounted the inlet valve 47, provided with a vertical stem 48, extending through and vertically movable in the head 33. The valve 47 is held normally seated by means of a spring 49 which encircles the stem 48, and has its lower end resting upon the upper side of the head 33, and its upper end bearing upon a collar 50, rigidly held in any suitable manner upon the stem 48. The chamber 35 is pro-

vided with an air inlet 51 and has also connected to it one end of a conductor 52, the other end of which, with the interior of the chamber 21, above the upper partition 22. The charge is exploded in any suitable manner in the cylinder 31, as for instance by means of an electric spark passing between two insulated contacts or electrodes 53 mounted in the head 33 and connected to any suitable electric generator by suitable wires 54 respectively.

To supply mixed steam and exhaust gas to the producer chamber 1, a tubular conductor 55 is connected at one end to the exhaust pipe 44 and at its other end to the producer chamber below the grate 5. In the conductor 55 is provided a valve 56 for controlling the flow therethrough. A tubular conductor 57 has one end connected to the conductor 55 and its other end to the inlet 14. A valve 58 is provided in the conductor 57 to control the flow of gas therethrough.

In carrying into effect my process, the fuel is placed in the producer chamber 1, the closure 4 applied to the feed opening 3, and the fuel ignited. The valve 16 and door 12 are opened and the air pump or fan 11 operated by hand, thus supplying to the fuel the necessary air for combustion, the doors 7 and closures 9 being closed at this time. When the fuel is well ignited, the valve 16 is closed and engine started by withdrawing the piston 32 from the head 33, thus drawing in a charge of gas taken through the outlet 13, inlet 14, chamber 15, pipe 30, chamber 21, pipe 52, mixing chamber 35 and inlet port 36. At the same time the air for mixing with the gas is taken in through the air inlet 51. The piston is then reversed in movement compressing the mixed charge of air and gas, after which the compressed charge is ignited. The exploding gas forces outward the piston 32 thus producing mechanical energy, and imparting motion to the parts connected with the piston. When the gas is exhausted after exploding, the valve 40 is raised in any ordinary manner by timing mechanism provided for the purpose and not shown here. The valve 46 is then opened and the water heated by the exploding charges passes through conductor 45 into the exhaust pipe 44 where it is in direct contact with the highly heated exhaust gas which instantly converts the water into steam a portion of which is decomposed and combines with burned and unburned portions of the exploded charge to form a gas which passing through the conductor 55 enters the producer chamber and passes through the fuel 6 by which it is enriched. At this time the fan or pump 11 is then stopped and the closures 9 are opened and air is drawn into the producer and passes through the fuel. The resultant gaseous products pass from the producer to the mixing chamber 35 as already described, the gas engine being utilized to cause the flow of gas through the apparatus. The valve 58 may be opened and a part of the mixed steam and exhaust gas will pass through the conductor 57 into the inlet 14 where this part of the mixture mixes with the gaseous products coming from the outlet 13 of the producer.

By regulating the valve 58 the proper proportion of gas combining with the gaseous products without passing through the burning fuel may be obtained.

By heating the water prior to its admission to the exhaust pipe 44, the temperature of the gas in the pipe 44 is not materially lowered, at least not sufficiently to prevent decomposition of a portion of the steam.

In Figs. 3 and 4 I have illustrated another means for heating the water that is to be made into steam to form gas with the unburned exhaust products. In this form the exhaust valve denoted by 40′ is provided with a hollow stem 41′ in which is disposed a vertical tube 59 the lower end of which extends through the wall of the stem and in which water may be passed from any convenient source. To the stem 41′ outside the exhaust chamber 38 is secured a horizontal pipe 60 to the outer end of which is secured a flexible tube 61 connected to a conductor 62 the upper end of which is connected to and discharges into the exhaust pipe 44. A valve 63 is provided in the conductor 62 to control the flow of water therethrough. In this form, the water is heated by the exhaust gas having contact with the valve 40′. At the same time the valve 41′ is cooled.

It will be noted by reference to Fig. 1 that all of the exhaust gas and steam entering the exhaust pipe 44 does not pass through the conductor 55, but a portion passes out into the atmosphere. The conductor 55 is provided at a point above the pipe 44 with a steam dome 64, the inlet end of which is below the outlet thereof, the outlet being denoted by 65 and the inlet by 66. The function of the steam dome is to arrest such steam as becomes condensed into water on the walls of the dome, and prevents such water passing through the conductor 55 into the producer chamber 1. Such water returns into the pipe 44 through the inlet 66, and is then discharged from the discharge end 67 of the exhaust pipe. Only dry steam and gas thus enters the producer or the conductor 57. A further function of the dome 64 is to arrest such carbonaceous particles as are not combined with the decomposed steam. These uncombined particles fall back through the inlet 66 into the pipe 44 and are discharged therefrom through the outlet end 67. The gaseous products coming from the producer must be reduced in temperature before being used in the engine. This is done in the chamber 21. Some of the heat

of the gaseous products may be employed to heat the combined steam and gas coming through the conductor 55 by carrying the mixture through a pipe 68 one end of which is connected with the conductor between the dome 64 and the valve 56, the other end of the pipe 68 being extended through the side wall of the upper part of the chamber 15, and having its upper end turned downward in the chamber 15. The lower end of this downwardly extending portion of the pipe 68 is preferably plugged and a series of peripheral holes 69 provided above the plug to permit the mixed steam and exploded gas to be delivered from the pipe 68 in a spray.

If desired, the valve 56 may be entirely closed and all the mixed steam and exhaust gas be caused to pass through the pipe 68 into the chamber 15. While passing through that portion of the pipe 68 within the chamber 15 the mixture is heated by the gaseous products coming through the inlet 14. It then passes out of the pipe 68 through the openings 69 and is enriched by the gaseous products with which it mixes in the chamber 15 The valves 56 and 58 may be regulated so that a portion of the mixture may pass into the producer and a portion through the conductor 57 as well as through the pipe 68.

Modifications of my invention may be resorted to without departing from its spirit.

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

1. The process consisting in first mixing the exhaust gases from a gas engine with steam, then forcing the resulting product and air into burning fuel, and then mixing with the resulting gaseous products a mixture of the exhaust gases and steam.

2. The process consisting in first mixing the exhaust gases from a gas engine with steam, then forcing a portion of the resulting product and air into burning fuel, then mixing with the resulting gaseous products another portion of mixed steam and the gaseous products.

3. The process consisting in first mixing the exhaust gases from a gas engine with steam, then forcing one portion of the resulting product and air into burning fuel, then mixing with the resulting gaseous products another portion of the mixed exhaust gases and steam, and finally exploding the last resulting gaseous products in the gas engine to form fresh exhaust gases for continuing the process.

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

GEORGE J. WEBER.

Witnesses:
WARREN D. HOUSE,
HENRY F. ROSE.