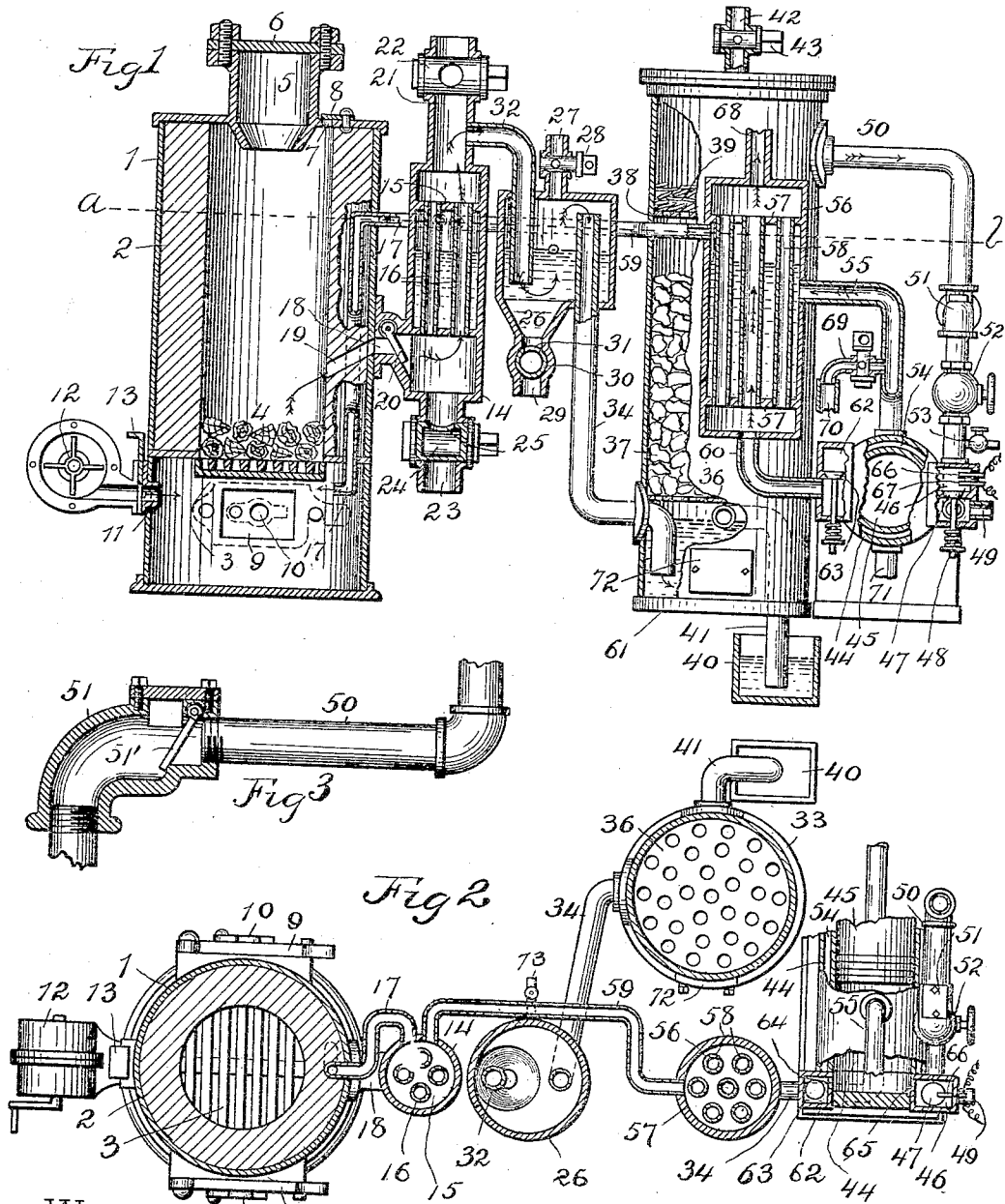


No. 890,476.

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G. J. WEBER.
 APPARATUS FOR GENERATING GAS.
 APPLICATION FILED APR. 28, 1903. RENEWED OCT. 28, 1907.



WITNESSES:

R. Hamilton.
 C. M. R. Chase.

INVENTOR

George J. Weber,
 By Warren & House,
 His Attorney

UNITED STATES PATENT OFFICE.

GEORGE J. WEBER, OF KANSAS CITY, MISSOURI.

APPARATUS FOR GENERATING GAS.

No. 890,476.

Specification of Letters Patent.

Patented June 9, 1908.

Application filed April 28, 1903, Serial No. 154,642. Renewed October 28, 1907. Serial No. 399,397.

To all whom it may concern:

Be it known that I, GEORGE J. WEBER, a citizen of the United States of America, residing in Kansas City, in the county of Jackson and State of Missouri, have invented a new and useful Improvement in Apparatus for Generating Gas, of which the following is a specification, reference being had therein to the accompanying drawings, forming a part thereof.

My invention relates to an improved apparatus for making and utilizing combustible gas.

My invention provides an apparatus for producing combustible gas from charcoal.

My invention provides further an apparatus comprising a gas generating chamber in which the fuel is burned in contact with steam, a gas engine having its cylinder connected with the gas generating chamber, whereby the gas produced in the gas generating chamber is used to propel the engine, the engine in running controlling the gas production, a steam boiler discharging into the gas generating chamber and means by which the exhausted gas from the engine cylinder is used to generate steam in the boiler.

My invention provides further means by which the hot water in the water jacket of the gas engine is used to heat the water in the boiler.

My invention provides further means by which the production of gas in the apparatus is obtained initially by manual exertion, until a sufficient quantity of gas of the proper richness has been produced with which the gas engine may be run.

Other novel features are hereinafter fully described and claimed.

In the accompanying drawings which illustrate my invention, Figure 1 is a view, partly in elevation and partly in vertical section, of an apparatus by means of which my invention may be practiced. Fig. 2 is a horizontal sectional view taken on the dotted line *a—b* of Fig. 1. Fig. 3 is a longitudinal vertical sectional view of the check valve and parts connected therewith, between the engine and the scrubbing chamber.

Similar characters of reference indicate similar parts.

The gas generating chamber 1 is a vertical chamber provided with a transverse grate 3 and a fire brick lining 2.

4 indicates the fuel resting upon the grate 3. 55

5 is a feed opening in the top of the chamber and having a removable closure 6. A peep opening 7 is provided in the top of the chamber through which the fire may be observed. A pivoted closure 8 is mounted on the chamber and adapted to close the peep opening. Below the grate 3 in the side of the chamber 1 are provided two doors 9 through which ashes may be removed. In each door is provided an air inlet having a closure 10. An air inlet 11 is also provided in the wall of the chamber below the grate for the admission of air driven in by a blower 12 operated manually. A sliding door 13 is mounted on the outside of the chamber 1 and is adapted to close the inlet 11. Adjacent to the chamber 1 is a boiler 14 provided with two transverse partitions 15 which form between them a steam space through which and the partitions 15 extend one or more tubes 16 for conveying gaseous products of combustion adjacent to the water held in the steam space.

The upper end of a pipe 17 connects with boiler 14 between the partitions 15 and above the water surface, the pipe extending from the boiler 14 into the gas generating chamber and thence downward to a point below the grate 3, where the steam is discharged. The boiler 14 below the lower partition 15 is provided with a gas inlet 18 connected with a gas outlet 19 which extends through the lining 2 and the wall of the chamber 1 above the grate 3. In inlet 18 is pivotally mounted an inwardly swinging valve 20 which prevents back firing into the gas generating chamber from the engine, and which prevents back flow of gas passing through the inlet 18. The valve 20 serves also as a baffle plate to deflect downward to the bottom of the boiler 14 sediment or brands which enter the boiler. An outlet for the escape of gas, indicated by 21, is provided in the boiler 14 above the upper partition 15. This outlet controlled by a rotary valve 22 is used in starting the apparatus and when it is desired to stop the engine. In boiler 14 below the valve 20 is a sediment outlet 23 normally closed by a hollow rotary valve 24 provided on one side with a hole adapted to register with the outlet, and adapted when in the position shown in Fig. 1 to receive sediment from the boiler 14. By

rotating the valve half around, the sediment collected therein may be dropped out without allowing escape of gas from the boiler.

26 is a washing and cooling chamber adapted to contain water, the same being admitted through an opening 27 in the top of the chamber. A rotary valve 28 normally closes said opening. In the lower end of chamber 26 is an outlet 29 in which is mounted a rotary valve 30 similar in construction and operation to valve 24 and provided with a side opening 31 adapted to register with opening 29 so as to receive sediment there-through. If the valve is rotated half around the sediment collected therein may be dropped out without permitting the escape of water from the chamber 26. A pipe 32 is connected at its upper end to the boiler 14 above the upper partition 15, the lower end of the pipe extending into the chamber 26 below the level of the water therein. The scrubbing chamber 33 provided with means for holding water therein is located adjacent to chamber 26. A pipe 34 has its lower end extending through the wall of chamber 33 and into the water therein. The upper end of the said pipe extends into the chamber 26 above the level of the water therein.

Above the water in the chamber 33 is a transverse perforated partition 36 upon which carbonaceous particles, preferably coke, are placed. Above the coke in chamber 33 is another perforated transverse partition 38 on which rests a quantity of shavings 39. A vessel 40 lower than and outside of the chamber 33 and provided with an open upper end is adapted to contain water into which extends the lower end of a pipe 41 the upper end of which connects interiorly with chamber 33 below the partition 36 and above the lower end of pipe 34. This pipe serves to keep the water in the chamber 33 at a given height and serves with the water in the vessel 40 as a water seal to prevent gas escaping from chamber 33. Water for spraying the shavings and coke is admitted into chamber 33 through an inlet 42 in the top of the chamber, the inlet being normally closed by a rotary valve 43. In the cylinder 44 of an ordinary gas engine is mounted the piston 45. At one end of the cylinder is the explosion chamber 46. A valve 47 normally closes the opening connecting the explosion chamber 46 with the mixing chamber 48 provided with an air inlet 49. A conductor 50 connects the mixing chamber with the upper end of the scrubbing chamber 33.

A check valve, comprising a casing 51 in which is pivotally mounted a flap valve 51' as shown in vertical section in Fig. 3, is inserted in the conductor 50, the flap valve 51' opening toward the mixing chamber. This valve prevents back firing from the engine to the scrubbing chamber. A throttle valve 52, of ordinary construction, is also inserted

in conductor 50 between the mixing chamber and the scrubbing chamber. In the conductor 50 between the throttle valve and the mixing chamber is a try cock 53, of ordinary construction, the function of which is to enable the operator to determine when combustible gas is passing through the conductor 50. An ordinary water jacket provided with a water space 54 encircles the engine cylinder. A pipe 55 is connected at its lower end to the said space and at its upper end with the water and steam space in a vertical boiler 56, the steam space being formed by providing two transverse horizontal partitions 57 in the boiler. The function of the pipe 55 is to supply hot water to the boiler 56 from the water jacket. Through the partitions 57 extend one or more vertical tubes 58 which convey the exhaust gas from the engine into close proximity to the water in the boiler 56. The steam spaces of boilers 14 and 56 are connected at points above the water level of each boiler by a horizontal pipe 59 which serves to convey steam from boiler 56 to gas generating chamber 1 through boiler 14 and pipe 17. To the boiler 56 below the lower partition 57 is connected the upper end of a pipe 60 the lower end of which connects with a chamber 61, which is connected with the exhaust chamber 62 of the engine by an opening in which is mounted the ordinary exhaust valve 63. 64 and 65 denote the ports connecting the cylinder 44 with the exhaust chamber 62 and the explosion chamber 46 respectively. Ignition of the charge in the explosion chamber may be obtained in any of the well known ways. 66 and 67 denote two electrodes mounted in the explosion chamber 46 and between which an electric spark may be caused to pass for igniting the charge. Proper timing of the valves 47 and 63, and the passing of the spark between the electrodes 66 and 67 may be controlled by the running of the engine in the ordinary manner. The boiler 56 is provided above the upper partition 57 with an outlet 68 for the gas passing through the tubes 58. 69 indicates a cock which connects the pipe 55 to a pipe 70 which connects with a water supply tank, not shown, by which the boiler 56 is supplied with water. 71 indicates another pipe connecting the lower side of the water jacket with the said water supply tank.

72 denotes a removable closure for an opening in the lower end of the chamber 33, for the removal of dirt. Between the horizontal planes in which are located respectively the ends of pipes 32 and 34, the side wall of the chamber 26 is provided with a try cock 73 by means of which it may be determined when the water in the chamber is at the proper level.

In operating my invention, water is first supplied to the boilers 14 and 56 and chambers 26 and 33, after which the valve 22 and

door 13 are opened, the other valves and doors being closed excepting closure 6 which is removed for the insertion of fuel into the chamber 1. When starting, water is conveyed to boiler 14 by pipe 59. After the charcoal has been inserted and ignited, the closure 6 is replaced and the blower 12 started manually. The air passing through the charcoal continues the combustion thereof, the gaseous products of combustion passing into boiler 14 through outlet 19, inlet 18 and past the flap valve 20, thence through tubes 16 and out through the outlet 21 past the valve 22. When the gas generating chamber has become sufficiently heated and steam formed in boiler 14 the valve 22 is closed. The steam generated in boiler 14 passes by pipe 17 into the gas generating chamber where it mixes with the air and assists in forming the gaseous products of combustion from the charcoal. The gaseous products pass from the gas generating chamber 1 through boiler 14 and into the pipe 32 from which they pass into the water in chamber 26 by which they are cooled and washed. The cooled gases then pass by pipe 34 into and through the water in the lower end of the scrubbing chamber 33, where they are further washed and cooled, passing thence through partitions 36 and 38, coke 37, and shavings 39, and are thus thoroughly scrubbed and purified. The coke and shavings are kept moistened by water admitted through inlet 42. The throttle valve 52 is then opened, and the gas will pass from the chamber 33 into conductor 50 and thence through valve casing 51, past flap valve 51', through throttle valve 52 and into mixing chamber 48. By opening the try cock 53 and applying a flame thereto, it can be determined when combustible gas is passing through conductor 50. When the gas will ignite, it is ready to use in running the engine. The engine is then caused manually to draw in a charge of mixed gas and air from the mixing chamber 48 through the opening controlled by valve 47 into the explosion chamber where the charge is compressed in the usual manner by retraction of the piston 45 in the opposite direction. The gas is then caused to be ignited by a spark passing between electrodes 66 and 67, the exploded charge passing by port 65 into the cylinder 44 where the force of the charge is caused to reciprocate the piston 45, thus converting the gaseous products into mechanical energy. The piston in moving in one direction causes a partial vacuum to be formed in cylinder 44, explosion chamber 46, mixing chamber 48, conductor 50, chambers 33 and 26, and boiler 14 and connecting pipes, thus causing air to be drawn into gas generating chamber through air inlet 10, which is now opened and the door 13 closed. The blower 12 may now be stopped and the

engine in running will cause the combustion to continue and the gaseous products therefrom to be converted into mechanical energy a portion of which is used to continue the process. The exhaust gases passing from the cylinder 44, port 64, exhaust chambers 61 and 62, pipe 60, and tubes 58 heats the water in the water and steam space of boiler 56, and the steam generated by the heat passes by pipe 59 into the gas generating chamber through boiler 14 and pipe 17. At the same time, the water in the water jacket of the engine becomes heated and passes by pipe 55 into the water and steam space in boiler 56, thus continuing the supply of hot water therein and assisting the exhaust gas in generation of the steam used in combustion of the charcoal.

In using charcoal as a fuel for the production of combustible gas no difficulty is experienced by the formation in the gas generating chamber of cinders and clinkers. Bridging over of the chamber by running together of the fuel, thus affecting the draft and supply of gaseous products, a trouble commonly experienced when coke or coal is used, is perfectly eliminated. Gummy or tarry substances in the gas produced from mineral substances, such as coke, coal, or mineral oils, are avoided by the use of charcoal as the fuel, and the gas produced from the charcoal is free from grit. Undue wear of the valves, piston and other parts of the engine which come into contact with the gas, is thus avoided. Charcoal being produced from wood, which is generally plentiful, can be readily made by unskilled labor. Combustible gas and power derived therefrom may be very economically produced in an apparatus constructed in accordance with the principles of my invention. Charcoal being very light can be readily and cheaply transported over mountainous or other countries, and thus becomes a very desirable source of power. As charcoal is free from sulfur and some other objectionable substances which are contained in coal and coke it can be more cheaply converted into gas and power than coal or coke.

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

1. In an apparatus for producing power, the combination with a gas generating chamber provided with an air inlet, of a steam boiler connected with and discharging into the gas generating chamber, means for washing and cooling the gas generated in the gas generating chamber, an engine adapted to be propelled by the said gaseous products, means by which the engine causes steam to be generated in said boiler, means for conveying the gas from the gas generating chamber to the engine, and means by which the

engine in running causes the gas to be conveyed from the gas generating chamber to the engine.

2. In an apparatus for producing power, the combination with a gas generating chamber provided with an air inlet, of a steam boiler connected with and discharging into the gas generating chamber, means for washing and cooling the gas generated in the gas generating chamber, a supplemental boiler also discharging into the gas generating chamber, an engine adapted to be propelled by the said gas, means by which the engine causes steam to be formed in the supplemental boiler, means for conveying the gas from the gas generating chamber to the engine, and means by which the engine causes the gas to be conveyed from the gas generating chamber to the engine.

3. In an apparatus for producing power, the combination with a gas generating chamber provided with an air inlet, of a steam boiler connected with and discharging into the gas generating chamber, means for washing, cooling and scrubbing the gas, a supplemental boiler connected with and discharging into the gas generating chamber, an engine adapted to be propelled by the said gas, means by which the engine causes steam to be generated in the supplemental boiler, means by which the gas causes steam to be generated in the first named boiler, means for conveying the gas from the gas generating chamber to the engine, and means by which the engine in running causes the said gas to be conveyed from the gas generating chamber to the engine.

4. In an apparatus for producing power, the combination with a gas generating chamber provided with an air inlet, of a blower for forcing air into the said chamber, a steam boiler provided with a steam space and a passage adjacent to the steam space for the gas a conductor connecting the said passage with the gas generating chamber, an outwardly opening valve controlling said conductor, a conductor for steam leading from the steam space to and discharging into the gas generating chamber, two discharge openings in the steam boiler connected with the passage therethrough, and a valve controlling one of the said discharge openings.

5. In an apparatus for the production of power, the combination with the gas generating chamber, of the engine cylinder connected with the gas generating chamber, a water jacket on the engine cylinder, a steam boiler discharging into the gas generating chamber, means by which hot water is conveyed from the water jacket to the boiler, and means by which the exhaust gases from the cylinder are brought into contact with the boiler.

6. In a gas producer, the combination with the gas generating chamber provided with an

air inlet and a gas outlet, of a steam boiler provided with a steam space connected with and discharging into the gas generating chamber, and provided with gas passage adjacent to the steam space and connected with the outlet of the gas generating chamber, and a check valve controlling said passage for preventing back flow of the gas into the gas generating chamber.

7. In a gas producer, the combination with the gas generating chamber provided with an air inlet and a gas outlet, of a steam boiler provided with a steam space discharging into the gas generating chamber and having a gas passage adjacent to the steam space and connected with the outlet of the gas generating chamber, a valve controlling said passage for preventing back flow into the generating chamber, a cooling chamber adapted to contain water and provided with an outlet above the water level, and a conductor connecting with the gas passage of the boiler and discharging into the cooling chamber below the water level.

8. In a gas producer, the combination with the gas generating chamber provided with an air inlet and a gas outlet, of a steam boiler having a steam space discharging into the gas generating chamber and provided with a gas passage extending through the boiler adjacent to the steam space and connected at one end with the gas outlet of the gas generating chamber, and a check valve freely admitting gas from the gas generating chamber through said outlet into the said passage, but preventing the backward flow of the gas from the said passage into the gas generating chamber.

9. In a gas producer, the combination with the gas generating chamber provided with an air inlet and a gas outlet, of a boiler for generating steam provided with means for discharging steam into the gas generating chamber, and provided with a gas passage connecting with said gas outlet, and a pivotally mounted inwardly swinging valve controlling said passage.

10. In an apparatus for producing mechanical energy, the combination with a gas generating chamber provided with an air inlet and a gas outlet, of the cylinder for an engine adapted to be run by the gas formed in the gas generating chamber, a gas conductor connecting the cylinder with the gas outlet of the gas generating chamber, and a check valve in the said conductor opening toward the cylinder.

11. The combination with the gas generating chamber having an air inlet, of a steam boiler, means for conveying steam formed in the boiler into the said gas generating chamber, a gas engine provided with means for being propelled by the gas formed in said gas generating chamber, means for conveying the gas formed in the gas generating chamber

to the gas engine and adjacent to the water held in said boiler, means for preventing backfiring from said engine through said conducting means, and means by which the exhaust from the engine is utilized to form steam in said boiler.

In testimony whereof I have signed my

name to this specification in presence of two subscribing witnesses.

GEORGE J. WEBER.

Witnesses:

WARREN D. HOUSE,
HENRY F. ROSE.