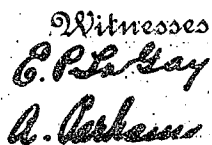


APPLICATION FILED OCT. 21, 1909.

1,015,550.



Inventor
Hans Forsterling
& Co.

UNITED STATES PATENT OFFICE.

HANS FOERSTERLING, OF PERTH AMBOY, NEW JERSEY, ASSIGNOR TO ROESSLER & HASSLACHER CHEMICAL COMPANY, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK.

METHOD OF AND APPARATUS FOR GENERATING GAS, STEAM, AND POWER.

1,015,550.

Specification of Letters Patent.

Patented Jan. 23, 1912.

Application filed October 21, 1909. Serial No. 523,925.

To all whom it may concern:

Be it known that I, HANS FOERSTERLING, a subject of the German Emperor, and a resident of Perth Amboy, county of Middlesex, State of New Jersey, have invented certain new and useful Improvements in Methods of and Apparatus for Generating Gas, Steam, and Power, of which the following is a specification, accompanied by drawings.

This invention relates to a new and improved method of and apparatus for generating gas, steam and power.

The object of the invention is to enable practically all of the available heat units in the original fuel to be used, thus effecting great economy in operation.

The method is described and claimed in this specification and illustrated by a diagrammatic drawing of suitable apparatus for carrying out the method.

Referring to the drawings, the gas is first generated from coal or other fuel in a suitable gas producer A, and the gas is cooled and steam generated thereby in a suitable boiler B provided with a deflecting plate B'. A portion of the steam, together with air is returned beneath the fuel bed of the gas producer A to gasify the fuel and the excess of steam is led away for useful purposes. In starting the producer steam may first be obtained from a separate source through the pipe R and valve R' leading to the producer blast O and from thence beneath the fuel bed. Preheated air is preferably obtained from the air shell H around the producer through the conduit O'. After the producer is started, the valve R' is closed and the steam valve G² is opened in the branch pipe connecting with the steam pipe G at the top of the boiler B, so that the steam is then obtained from the boiler. The excess of steam generated is led off by the steam pipe G' and may be utilized as desired, as for instance, in the steam turbine S' connected to the steam main G'. Preheated water for the boiler B is preferably obtained from the water jacket or hollow cover I on the producer A by means of the pipe Q leading to the hot water well L and pumped from thence to the boiler B by boiler feed pump M and water feed pipe N. After leaving the boiler B, the producer

gas is preferably led through the pipe F to the scrubber C and thence through the gas pipe F to a gas engine D where the gases are exploded for generating power. The hot products of combustion are led through the pipe P to the boiler E provided with a deflecting plate E', and out at the pipe P', thus producing more steam in the boiler E which may be led back by the steam pipe G to the steam main G'. Preheated water for the boiler E is preferably taken from the water jackets K of the gas engine D through pipe Q' to the hot water well L' and thence pumped by boiler feed pump M' through pipe N' to the boiler E.

In accordance with this method I obtain gas, steam and power in the most economical way, because I use practically all of the available heat units contained in the original fuel. The heat of radiation of the producer is used partly for preheating air and partly for water. The sensible heat of the gases is used for the production of steam, and the heat generated by explosion of the gases in the cylinder of the gas engine is used partly for preheating water and partly for producing steam.

In accordance with this method I generate an excess of steam beyond that needed for the gasification of the fuel. In actual practice I have obtained up to 1.6 pounds of steam in boiler B per pound of fuel used. As only 0.3 to 0.4 pound of steam is required per pound of fuel for ordinary practice, I have thus produced more than 1 pound of steam in excess of that needed. During a run of 7½ hours 5378 pounds of anthracite pea coal were gasified in the producer and 8368 pounds of water were evaporated in boiler B. The steam pressure in boiler B was 106 pounds and the air blown into the producer was at the temperature of 81° C. The temperature of the feed water to the boiler was 73° C., the gases leaving the producer at 717° C., and the producer gas leaving the boiler was at the temperature of 188° C. The distance between the top of the fire-bed and the producer-cover was 4½ feet. As only 0.3 to 0.4 pound of steam is necessary to blow the producer, in this case more than 1 pound of steam was generated in excess, or more than 200% of excess steam. These new and useful results

are due principally to the fact that practically all of the available heat units are utilized.

The amount of steam generated in boiler E from the exhaust gases of the gas engine D depends upon the amount of gases which are used for the generation of power. If all the gas generated in the producer A is converted into power, about 3 pounds of steam will be generated in the boiler E per pound of coal gasified in the producer A, so that in a plant using only power and steam per one pound of coal gasified in the producer A, I have found that I can generate 1 H. P. hour and about 4 pounds of steam in addition to the steam required for the gasification of fuel. The 4 pounds of steam would require about 0.5 pound of coal, if produced in an ordinary steam boiler. Therefore the real expenditure for fuel to generate 1 H. P. hour amounts to only 0.5 pound of coal.

If gas is drawn from the gas main F' for other purposes than for the gas engine D, a correspondingly less amount of steam per pound of fuel gasified in producer A will be generated in boiler E.

The apparatus shown is for the purpose of illustration only and it is to be understood that changes may be made in the apparatus without departing from the spirit of the invention. Instead of a pressure producer as shown in the drawing, I may use a suction producer or any other gas generator which produces hot combustible gases. I have furthermore described one method only of producing gas, steam and power in order to better explain my invention, but I do not limit the invention to the specific mode of operation described.

I claim and desire to obtain by Letters Patent the following:

1. The method substantially as herein described for the continuous generation of producer gas, steam and power which consists in generating gas from fuel in a producer, preheating water and air by the hot gas so generated without substantially reducing the temperature of said gas, subsequently passing said gas through a boiler separate from the producer and simultaneously cooling said gas and generating steam in said boiler in excess of the requirements of the producer, supplying the preheated water to the boiler, supplying the preheated air to the producer, returning a portion of the steam generated in the boiler to the producer and leading off the remainder.

2. The method substantially as herein described for the continuous generation of producer gas, steam and power which consists in generating gas from fuel in a producer, preheating water and air by the hot gas so generated without substantially reducing the temperature of said gas, subsequently passing

said gas in a deflected path through a boiler separate from the producer and simultaneously cooling said gas and generating steam in said boiler in excess of the requirements of the producer, supplying the preheated water to the boiler, supplying the preheated air to the producer, returning a portion of the steam generated in the boiler to the producer and leading off the remainder.

3. The method substantially as herein described for the continuous generation of producer gas, steam and power which consists in generating gas from fuel in a producer, preheating water and air by the hot gas so generated without substantially reducing the temperature of said gas, subsequently passing said gas through a boiler separate from the producer and simultaneously cooling said gas and generating steam in said boiler in excess of the requirements of the producer, supplying the preheated water to the boiler, supplying the preheated air to the producer, returning a portion of the steam generated in the boiler to the producer, leading off the remainder of said steam, burning the cooled gas in a gas engine and utilizing the hot products of said combustion for the further production of steam.

4. The method substantially as herein described for the continuous generation of producer gas, steam and power which consists in generating gas from fuel in a producer, preheating water and air by the hot gas so generated without substantially reducing the temperature of said gas, subsequently passing said gas through a boiler separate from the producer and simultaneously cooling said gas and generating steam in said boiler in excess of the requirements of the producer, supplying the preheated water to the boiler, supplying the preheated air to the producer, returning a portion of the steam generated in the boiler to the producer, leading off the remainder of said steam, burning the cooled gas in a gas engine, preheating water by the heat from the hot products of said combustion, supplying said preheated water to a second boiler and passing said hot products of combustion through said second boiler for the further production of steam.

5. The method substantially as herein described for the continuous generation of producer gas, steam and power which consists in generating gas from fuel in a producer, preheating water and air by the hot gas so generated without substantially reducing the temperature of said gas, subsequently passing said gas in a deflected path through a boiler separate from the producer and simultaneously cooling said gas and generating steam in said boiler in excess of the requirements of the producer, supplying the preheated water to the boiler, supplying

the preheated air to the producer, returning a portion of the steam generated in the boiler to the producer, leading off the remainder of said steam, burning the cooled gas in a gas engine, preheating water by the heat from the hot products of said combustion, supplying said preheated water to a second boiler and passing said hot products of combustion through said second boiler in a deflected path for the further production of steam.

6. In an apparatus for the continuous generation of producer gas, steam and power, the combination of a producer, an air-shell surrounding a portion of the producer, a water heater on top of said producer, a boiler adjacent said producer adapted to generate steam in excess of the producer requirements, an uninterrupted passage-way for the hot gases from the fuel bed of said producer to said boiler, means for supplying preheated water from said water heater to said boiler, means for supplying preheated air from said air-shell to said producer, means for returning a portion of the steam from said boiler to the producer and means for leading off the remainder of said steam.

7. In an apparatus for the continuous generation of producer gas, steam and power, the combination of a producer, an air shell surrounding a portion of the producer, a water heater on top of said producer, a boiler adjacent said producer adapted to generate steam in excess of the producer requirements, an uninterrupted passage-way for the hot gases from the fuel bed of said producer to said boiler, a deflection plate in said boiler, means for supplying preheated water from said water heater to said boiler, means for supplying preheated air from said air-shell to said producer, means for returning a portion of the steam from said boiler to the producer, and means for leading off the remainder of said steam.

8. In an apparatus for the continuous generation of producer gas, steam and power, the combination of a producer, an air-shell surrounding a portion of the producer, a water heater on top of said producer, a boiler adjacent said producer adapted to generate steam in excess of the producer requirements, an uninterrupted passageway for the hot gases from the fuel bed of said producer to said boiler, means for supplying preheated water from said water heater to said boiler, means for supplying preheated air from said air-shell to said producer, means for returning a portion of the steam from said boiler to the producer, means for leading off the remainder of said steam, a gas engine, means for burning said

gas in said gas engine and means for the further production of steam by the heat from the hot products of said combustion. 65

9. In an apparatus for the continuous generation of producer gas, steam and power, the combination of a producer, an air-shell surrounding a portion of the producer, a water heater on top of said producer, a boiler adjacent said producer adapted to generate steam in excess of the producer requirements, an uninterrupted passage-way for the hot gases from the fuel bed of said producer to said boiler, means for supplying preheated water from said water heater to said boiler, means for supplying preheated air from said air-shell to said producer, means for returning a portion of the steam from said boiler to the producer, means for leading off the remainder of said steam, a gas engine, means for burning said gas in said gas engine, a water-jacket surrounding said gas engine, a second boiler, means for supplying preheated water from said water-jacket to said second boiler and means for conducting the hot products of combustion from said gas engine to said second boiler for the generation of steam therein. 90

10. In an apparatus for the continuous generation of producer gas, steam and power, the combination of a producer, an air-shell surrounding a portion of the producer, a water heater on top of said producer, a boiler adjacent said producer adapted to generate steam in excess of the producer requirements, an uninterrupted passage-way for the hot gases from the fuel bed from said producer to said boiler, a deflection plate in said boiler, means for supplying preheated water from said water heater to said boiler, means for supplying preheated air from said air-shell to said producer, means for returning a portion of the steam from said boiler to the producer, means for leading off the remainder of said steam, a gas engine, means for burning said gas in said gas engine, a water-jacket surrounding said gas engine, a second boiler, a deflection plate in said boiler, means for supplying preheated water from said water-jacket to said second boiler and means for conducting the hot products of combustion from said gas engine to said second boiler for the generation of steam therein. 115

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

HANS FOERSTERLING.

Witnesses:

FRITZ HOYLER,
HERBERT PHILIPP.