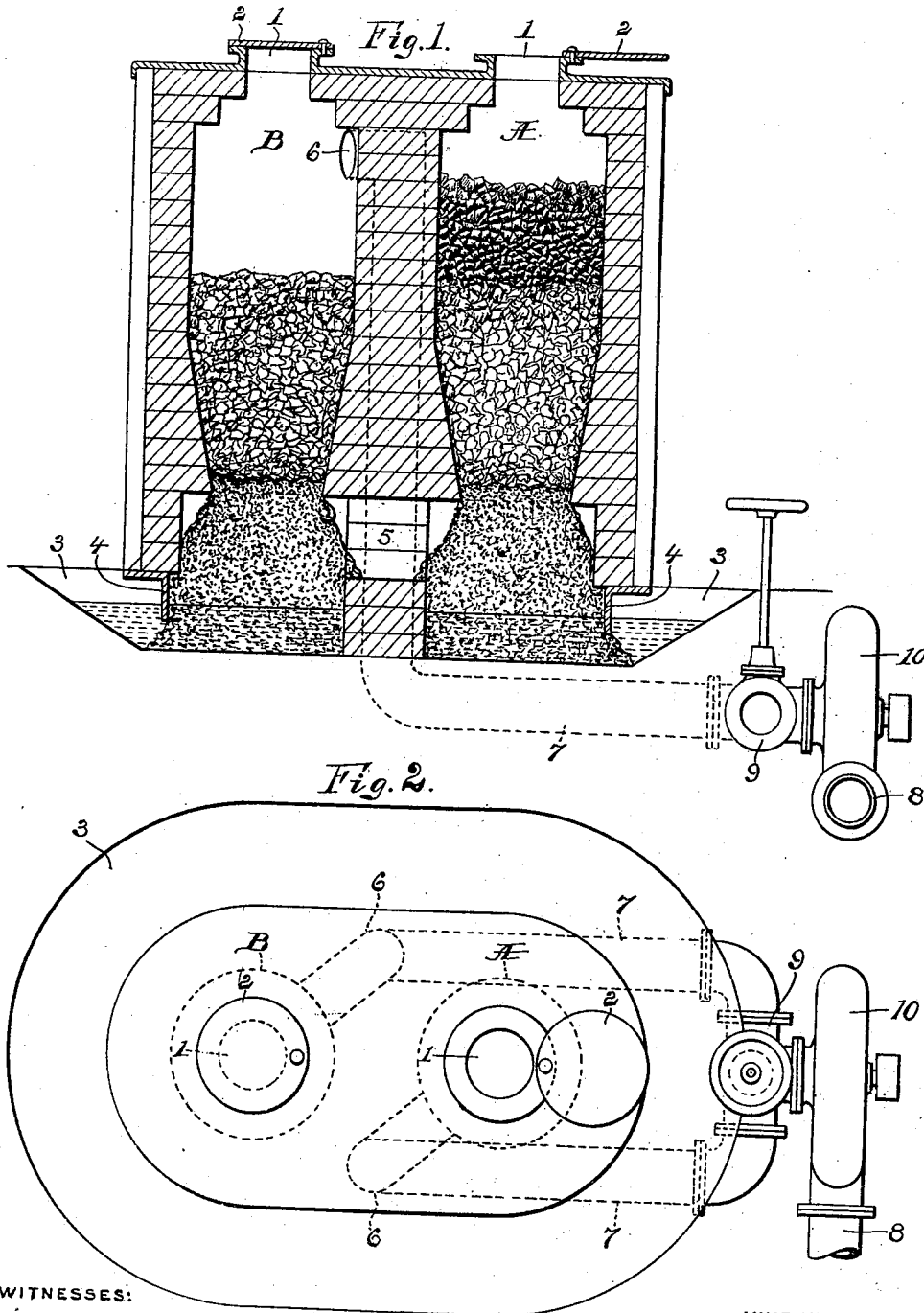


G. P. DAVIS.
GAS PRODUCER.

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980,923.

Patented Jan. 10, 1911.



WITNESSES:

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UNITED STATES PATENT OFFICE.

GEORGE P. DAVIS, OF DETROIT, MICHIGAN.

GAS-PRODUCER.

980,923.

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To all whom it may concern:

Be it known that I, GEORGE P. DAVIS, a citizen of the United States, residing at Detroit, county of Wayne, State of Michigan, have invented a certain new and useful Improvement in Gas-Producers, and declare the following to be a full, clear, and exact description of the same, such as will enable others skilled in the art to which it pertains to make and use the same, reference being had to the accompanying drawings, which form a part of this specification.

This invention relates to improvements in generators for producer-gas and its object is to provide a cheap and efficient construction which is simple in its operation and which will produce at a minimum of cost from bituminous coal a fixed gas, free from condensable constituents and especially adapted for use in internal combustion engines.

In those producers heretofore constructed in which an up-draft is maintained and air is introduced directly into the combustion zone, a very high temperature is produced in that zone causing heavy heat loss and the formation of slag which retards the passage of the blast through the fuel and causes variations in the quality of the gas. If steam or other cooling medium, such as carbon dioxide from an external source, is introduced with the air to keep down the high temperature in the combustion zone and to disintegrate or prevent the clinkers, the temperature in the distillation zone above is correspondingly reduced, producing an increase in the amount of condensable constituents which will pass off with the gas and causing a lack of uniformity in the combustion of the fuel, leading to great fluctuations in temperature in the different zones and extreme variations in the quality of the producer-gas.

The down-draft construction in which air and fuel are introduced directly into the upper open end of the generator has many advantages and is quite efficient in its operation due to the direction of the flow through the fuel bed, but yet there is a heavy loss through the high sensible heat of the gas produced and the gas will contain a certain amount of condensable constituents.

If steam is introduced for the purpose of forming a water gas and cooling the resultant gas, said gas will contain larger quantities of diluents and condensable elements.

The advantages are well known of producing and mixing a water gas with the dis-

tilled gases, provided such gas may be produced without great loss or hindering the distillation process, and provided the heat which would otherwise be lost in the distillation process may be utilized.

To the end of obtaining the objects of this invention, the invention consists in the construction, arrangement, and combination of parts whereby the down-draft dry distillation process is combined with the up-draft water gas process in such a manner as to eliminate the undesirable features heretofore found in these processes, all as hereinafter more fully described and particularly set forth in the claims, reference being had to the accompanying drawing in which—

Figure 1 is a longitudinal section of a device embodying the invention; and Fig. 2 is a plan view of the same.

As shown in the drawing, the generator consists of a structure formed of fire-brick with two generating chambers A and B of the usual form located side by side with a single wall between. Each has an open top 1. closed by any suitable cover 2. and an open lower end closed by a water seal formed by a pit 3. for containing water and a flange 4. secured to the outer bottom edge of the generator and extending downward into the water. This pit also forms an ash pit to receive the ash from the chambers A and B.

In starting the generator ash is heaped up in the pit until the piles reach up into the lower ends of said chambers a short distance and form a bed upon which fuel is placed. The two chambers are connected at their lower ends by a passage 5, and leading from the upper end of each of said chambers is a passage 6. in the brick work of the generator which passage extends downward and connects with a horizontal pipe 7. at its lower end. These pipes 7. are brought together and connected to a common discharge pipe or gas main 8. and at the junction of these pipes with the main, is placed a three-way valve 9. so that the main may be directly connected with either generator chamber through its pipe 7. and the other pipe closed to cut off the direct connection with the other chamber.

Having secured a deep incandescent bed of fuel in each chamber, green fuel is introduced into chamber A through its open top, the top of chamber B being closed by its cover and the valve 9. being turned to close

the pipe 7. leading to chamber A and to connect chamber B with the main, and a down-draft is caused through chamber A and up through chamber B by any suitable suction device 10, connected to the gas main. The air entering on top of the green fuel, passes downward therethrough and combining with the products of distillation in the distillation zone beneath, passes on down into the decomposition zone where it combines with carbon and forms carbon dioxide. This reaction is exothermic, producing high heat which accelerates the velocity of reaction in this zone and also the distillation in the zone above. In the lower or combustion zone, C is added to the CO_2 , and 2CO is produced. This latter is an endothermic reaction owing to the splitting up of the carbon dioxide and the heat of the combustion zone is reduced thereby.

It is well known that the introduction of steam into a producer is advantageous in that it aids in the efficient operation thereof by disintegrating the clinkers and increases the volume and quality of the gas delivered, but it is also known that when introduced directly into the producer fuel bed, steam materially reduces the temperature retarding combustion and causing a heavy heat loss in the producer and the formation of large amounts of diluents. I therefore do not use steam in the main chamber A but carry on therein the dry distillation process described above which will result, at the lower end of said chamber, in a hot gas containing more or less condensable constituents. These hot gases in passing from the lower end of chamber A to the lower end of chamber B, heat the ash and dividing wall, and a certain amount of steam is produced thereby from the water in the water seal pit, depending upon the height of the water therein, which steam passes upward in chamber B with the gas from chamber A through the bed of incandescent fuel therein. As the steam passes through the incandescent carbon, its H_2 is liberated and its O combining with C forms a water gas and the highly heated gas from chamber A in passing through said incandescent bed is subjected to a further reaction which changes all of its condensable constituents into a fixed gas. The resultant gas delivered to the main, is a cool, fixed gas, free from tar or other condensable elements, and may therefore be carried long distances without loss through sensible heat or condensation, and is a very efficient gas for use in internal combustion engines.

When the temperature of the incandescent bed of fuel in chamber B has become reduced to the minimum for efficient operation, the operator will close the cover of chamber A and turn valve 9, to connect said chamber A directly with the main, cutting

off chamber B, and will then remove the cover of chamber B. This changes the direction of travel of the current and reverses the operation, fresh fuel being placed in chamber B upon the incandescent bed therein. Steam from the water seal is now carried up through the fuel in chamber A and any clinkers which may have formed therein during the circulation in the opposite direction, are disintegrated by the steam. This change may be very quickly made as there is but one valve to operate and the production of gas is therefore practically continuous.

In this construction and arrangement, all the advantages of the dry distillation and the water gas processes when used separately, and of the down-draft and up-draft producers, are secured, and by the combination of these and the particular construction and arrangement, many advantages not present in any, are obtained. The dry distillation process with its accelerated reaction and small heat loss, is combined with the water gas process in such a manner as to operate independently thereof and the hot gases therefrom give off their sensible heat to aid the water gas process and to produce steam.

The device is extremely simple in construction and operation, only one valve being necessary, and, owing to the open top, no water jacket, automatic feed, or means for distributing or poking the fuel is required.

Having thus described my invention, what I claim is:—

1. The combination of a pair of generator chambers communicating at their lower ends and each having an open upper end into which fuel may be introduced and air admitted during the operation of the generator, means for conducting gas away from the upper end of each chamber, means for closing the upper end of one of said chambers during the operation of the generator, means for causing a down-draft in the chamber whose upper end is open and an up-draft in the other chamber, and means for changing the direction of the draft.

2. The combination of generator chambers having an inlet and gas outlets at their upper ends and having unobstructed downwardly opening lower ends communicating with each other, means for causing a flow of air and gases downward in one chamber across through their connected lower ends and upward in the other chamber, and a water seal extending across said lower ends to close the same and holding a quantity of ash and residue within said open lower ends to support the fire therein and holding a quantity of water at such a level as to be raised by the capillary attraction of the ash and residue and vaporized by the heat of the gases passing from the lower end of one

chamber to the lower end of the other chamber.

3. A gas producer comprising a pair of generator chambers open at their upper and lower ends and connected at their lower ends by a passage, means for closing the upper end of one chamber during the operation of the generator, a water seal to close the lower ends of said chambers, means for conducting gas from the upper ends of said chambers, means for maintaining a flow downward through the chamber whose upper end is open, through said passage, and upward through the other chamber, and means for changing the direction of flow.

4. A gas producer comprising a pair of generator chambers having open upper ends, ash pits at their lower ends, a water seal,

a passage connecting the lower ends of said chambers above the water in said seal, means for closing the upper end of one of the chambers during the operation of the generator, a passage leading from the upper end of each chamber, a gas main, an exhauster connected to the main, branch pipes connecting the main with said passages, and a three-way valve at the junction of said branches with the main to control the direction of flow through the chambers.

In testimony whereof, I sign this specification in the presence of two witnesses.

GEORGE P. DAVIS.

Witnesses:

LEWIS E. FLANDERS,
N. S. WRIGHT.