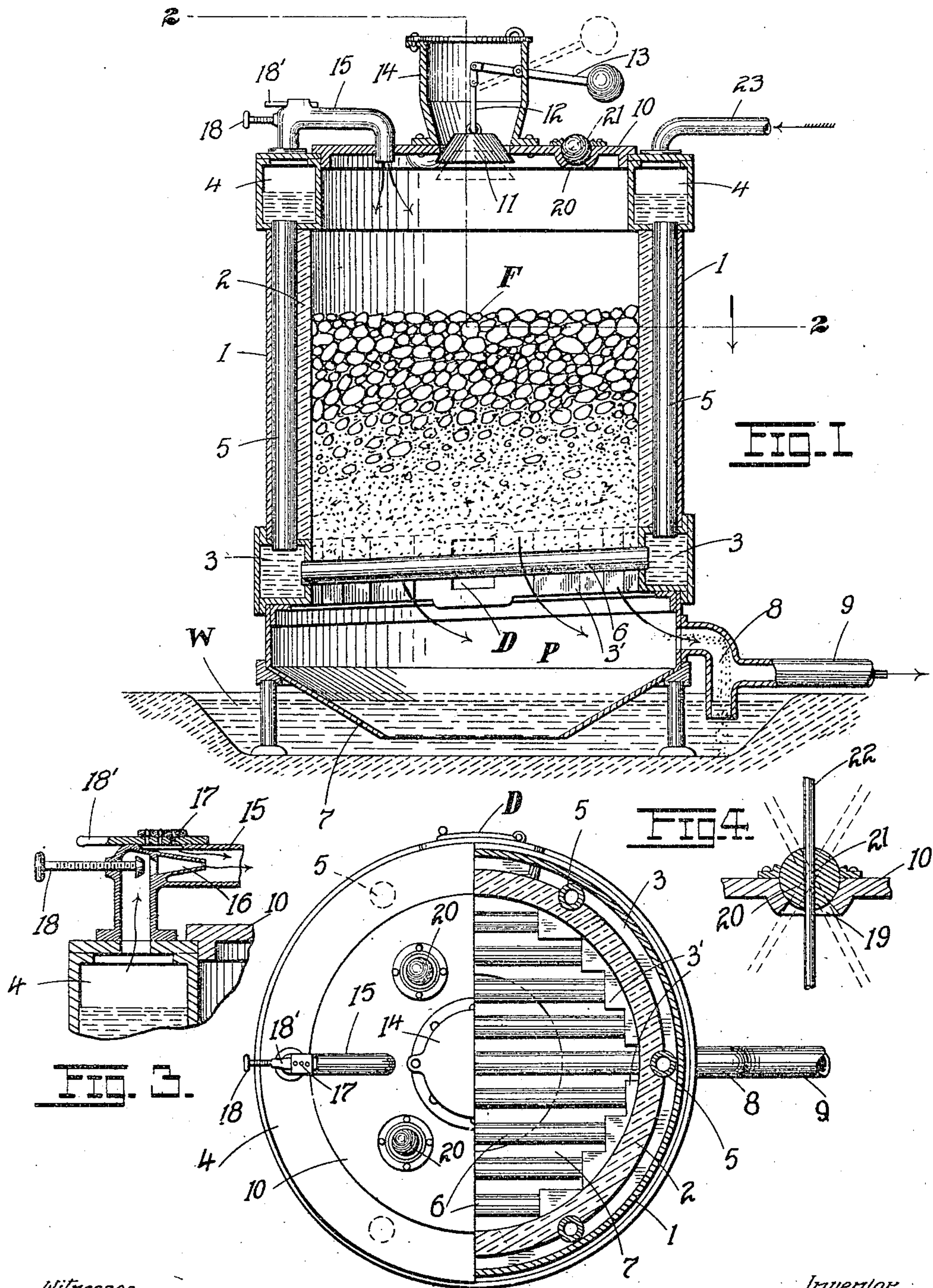


No. 837,026.

PATENTED NOV. 27, 1906.

C. L. ARMSTRONG:  
GAS PRODUCER.

APPLICATION FILED DEC. 16, 1905.



Witnesses  
*P. J. Nawn*  
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**FIG. 2.**

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# UNITED STATES PATENT OFFICE.

CHARLES L. ARMSTRONG, OF ST. LOUIS, MISSOURI.

## GAS-PRODUCER.

No. 837,026.

Specification of Letters Patent.

Patented Nov. 27, 1906.

Application filed December 16, 1905. Serial No. 292,002.

*To all whom it may concern:*

Be it known that I, CHARLES L. ARMSTRONG, a citizen of the United States, residing at St. Louis, State of Missouri, have invented certain new and useful Improvements in Gas-Producers, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming a part hereof.

My invention has relation to improvements in gas-producers; and it consists in the novel construction and arrangement of parts more fully set forth in the specification and pointed out in the claims.

In the drawings, Figure 1 is a middle vertical section taken through the producer. Fig. 2 is a combined plan and section on the broken line 2 2 of Fig. 1. Fig. 3 is a vertical sectional detail of the steam and air injector; and Fig. 4 is a sectional detail of the poke-hole valve, showing the application thereto of the poker or stirring-bar.

The object of my invention is to construct a gas-producer in which a mixture of preferably saturated steam and air is forced downward at stated intervals through the fuel charge, the downward current being in a measure supplemented by the suction on the bottom of the fuel, resulting from the abstraction of the producer-gas by the engine to which the same is supplied.

A special feature of the device is a pressure in the upper part of the generator produced by the introduction of said steam mixed with air in a suitable proportion. One effect of this pressure is to produce a downward current or flow of the intermixed steam and air, and thus to facilitate the expulsion of gas through and from the lower portion of the generator. A more important effect is to condense the material designed for conversion into gas (especially when this material is of light texture or character like peat, lignite, coal-slack, &c.) and maintain continuity and homogeneity in the bed within which partial combustion and the accompanying gasification take place. A still more important effect is to promote union of carbon and oxygen molecules by condensation, and thus to increase the formation of CO and the keeping of CO<sub>2</sub> down to a minimum. Incidentally the pressure tends also to raise the temperature of the intermixed air and water-

vapor, thereby facilitating combustion and reducing the ratio of fuel consumed to that converted into gas. The downward passage of the gas and steam-and-air mixture through the mass of incandescent carbon results, too, in a complete elimination from the charge of all tar products, their disappearance resulting from the destructive distillation and incomplete combustion to which they are subjected in such passage, the products of such distillation combining with the gases of the solid portions of the charge and conjointly escaping from the bottom of the producer.

A further object is to construct a producer which shall serve as a furnace for its own boiler, the latter being provided with a water-tube grate for the direct support of the fuel.

A further object is to produce a gas which will not require a tar extractor or scrubber and from which all solid particles and impurities are eliminated as it leaves the producer, such impurities being deposited in a water seal, which at the same time receives the ashes, all as will hereinafter more fully appear from a detailed description of the invention, which is as follows:

Referring to the drawings, 1 represents the outer metal shell of the producer or generator, and 2 the inner fire-brick lining thereof. The cross-section of the producer is preferably circular, though it may be any shape desired. The generator rests on a lower annular header 3 and is surmounted by a similar header 4, the two being connected by the circulating-tubes 5, of which there may be any number. The space encompassed by the header 3 is spanned by a series of water-tubes 6, which open into the header 3, their opposite ends being supported in the offsets or step-like formations 3' on the inner wall of the header to insure better support for said ends, the header, as well as the tubes, being disposed at an incline, as shown, the tubes 6 serving as a water-tube grate for the support of the charge or bed of fuel F. Formed in the header 3 and extending a suitable distance above and below the grate is a clinker-door D. The walls of the shell 1 are extended a suitable distance below the water-tube grate, forming an ash-pit P, at the bottom of which is disposed a conical hopper 7, which directs the ashes into a basin of water W, the



water making a seal with the walls of the hopper 7 and preventing the escape of gases and at the same time cooling the ashes. Depending from the walls of the pit P and extending a suitable distance below the surface of the water is a vertical dust-intercepting tube 8, from the peripheral wall of which leads a pipe 9, which conducts the gas to any suitable point of consumption or engine. (Not shown.)

The header 4 is provided with a cover plate or lid 10, having a central feed-opening normally closed by a bell 11, the latter being suspended from a link 12 at the end of the short arm of a lever 13, by which the bell is lowered or raised. The lever 13 is mounted in the wall of a feed-hopper 14, into which the fuel is first introduced, the bell being afterward lowered sufficiently to allow the charge to run down its inclined sides and become deposited in a ring within the combustion-chamber of the generator. Leading from the top of the header 4 is a curved steam-pipe 15, which discharges into the combustion-chamber above the charge, the pipe being provided with a valve-controlled nozzle 16, which directs a jet of steam through the pipe into the furnace. The walls of the pipe around the nozzle are provided with valve-controlled perforations 17 for the influx of atmospheric air, which mingles with the steam, the pressure of the combined currents driving the gases which have accumulated within the body of and above the fuel through the latter and toward the grate. By the time the gases have reached the ash-pit the current in the pipe 9 draws the gases toward the point of consumption, any solid particles mechanically carried over with the gases impinging against the vertical walls of the depending tube 8, the sudden arrest of such particles causing them to drop through the tube into the water trap or basin. When the gases have been expelled from the mass, the steam may be shut off by seating the steam-valve 18, and the air may be shut off by closing the sliding air-valve 18', as is obvious. The lid is provided with a series of poke-holes 19, closed by spherical valves 20, each valve being provided with a passage 21 for the insertion of a poke-bar 22, by which the fuel may be stirred, if necessary. The bar is then withdrawn and the valve or ball 20 given a sufficient turn to bring the passage-way 21 thereof out of register with the opening 19, when escape of the gases is cut off. The valve 20 serves as a rotatable bearing or ball-and-socket joint for the poker-bar during the stirring of the charge. The water-feed pipe for the boiler is represented at 23 and may lead to any source of water-supply. (Not shown.)

The operation can be readily understood from the drawings. When the charge is first

ignited, of course the temperature of the water in the boiler is insufficient to furnish steam to expel the gas, and for this purpose steam may be injected from any extraneous source, if desirable; but there will seldom arise an occasion, for this since the steam generates fast enough to attain the objects here sought. The injection of steam and air at a suitable pressure will expel the tarry constituents, as already described, the process converting a maximum portion of the volatile constituents of the fuel into gas freed of impurities and tarry matters and the suction-current below eliminating all solid and mechanically-suspended impurities from the gas, leaving the latter in a thoroughly purified condition.

Having described my invention, what I claim is—

1. A gas-producer comprising a shell or generator, a header at each end thereof, a cover for the top header, means for introducing the charge through the cover, means for establishing a circulating connection between the headers, a series of water-tubes opening into the bottom header and spanning the space between the inner walls thereof and serving as a grate for the charge, a steam and air injector leading from the top header into the space above the charge, and means for withdrawing the producer-gas from a point below the grate, substantially as set forth.

2. A gas-producer comprising a shell or generator, a header at each end thereof, a cover for the top header, means for introducing the charge through the cover, means for establishing a circulation between the headers along the walls of the shell, a series of inclined water-tubes opening into the bottom header and spanning the space between the inner walls thereof and serving as a grate for the charge, a steam and air injector leading from the top header into the space above the charge, and means for withdrawing the producer-gas from a point below the grate, substantially as set forth.

3. In a gas-producer, a shell or generator, a header at each end thereof, a cover for the top header, means for introducing the charge through the cover, means for establishing a circulating connection between the headers, a series of water-tubes opening into the bottom header and spanning the space between the walls thereof and serving as a grate for the charge, an injector located above the fuel and below the cover for driving the producer-gas through the charge downward, and means for withdrawing the gas from a point below the grate, substantially as set forth.

4. A gas-producer comprising a shell or generator, a header at each end thereof, a cover for the top header, means for introducing the charge through the cover, a series of circulating-tubes disposed along the walls of



the shell and connecting the headers, a series of inclined water-tubes opening into the bottom header and spanning the space between the inner walls thereof, and serving as a grate for the charge, a steam and air injector leading from the upper header into the space above the charge, an exhaust-pipe leading from the shell at a point below the grate, an

open ash-pit below the grate and a water seal for the ash-pit, substantially as set forth. 10

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

CHARLES L. ARMSTRONG.

Witnesses:

EMIL STAREK,

MARY D. WHITCOMB.