

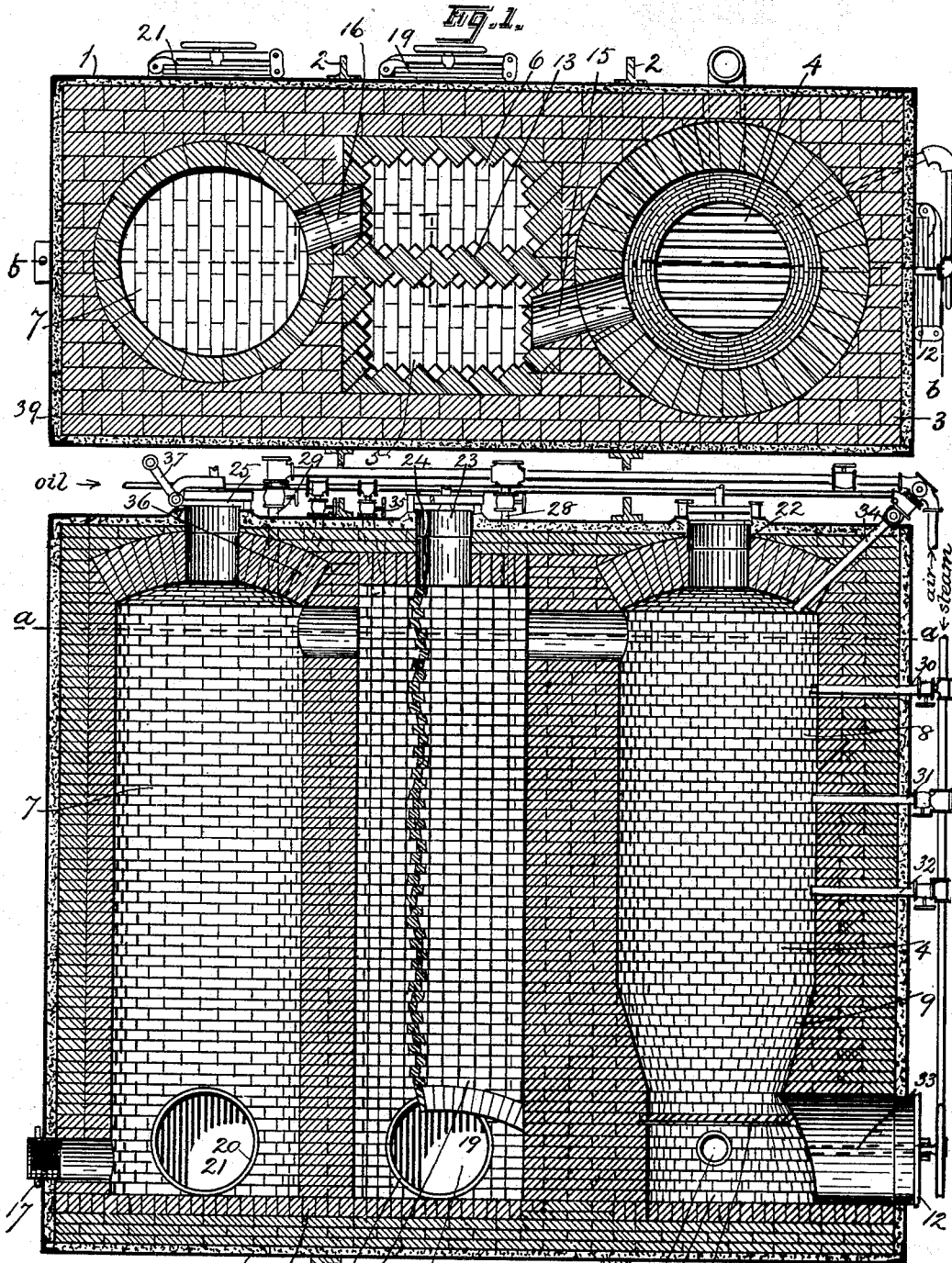
No. 647,618.

Patented Apr. 17, 1900.

A. C. SWAIN.  
GAS GENERATING APPARATUS.

(Application filed Oct. 17, 1899.)

(No Model.)



Witnesses  
W. R. Daniels  
J. A. Daniels

Fig. 2.

By his Attorney

Inventor  
A. C. Swain  
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# UNITED STATES PATENT OFFICE.

APPIUS C. SWAIN, OF SAN FRANCISCO, CALIFORNIA, ASSIGNOR OF ONE-HALF TO JAY M. BOWERS, OF SAME PLACE.

## GAS-GENERATING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 647,618, dated April 17, 1900.

Application filed October 17, 1899. Serial No. 733,894. (No model.)

*To all whom it may concern:*

Be it known that I, APPIUS C. SWAIN, a citizen of the United States, residing at San Francisco, in the county of San Francisco and State of California, have invented certain new and useful Improvements in Gas-Generating Apparatus, of which the following is a specification.

My invention relates to improvements in apparatus for the manufacture of illuminating-gas, the object of my invention being to provide an apparatus of this character which shall be cheap and simple to construct, easily operated, produce a good quality of gas at a small cost from either coal, coke, or wood and from any kind of crude oil, naphtha, or distillates and in which the candle-power can be varied at will by the operator.

My invention therefore resides in the novel construction, combination, and arrangement of parts for the above ends hereinafter fully specified, and particularly pointed out in the claims.

In the accompanying drawings, Figure 1 is a horizontal section on the line *aa* of Fig. 2, and Fig. 2 is a vertical section on the line *bb* of Fig. 1.

Referring to the drawings, 1 represents a rectangular prismatic air-tight metallic casing suitably braced against deformation resulting from internal pressure by means of the T angle-irons 2 around the exterior of the casing. The space within this metallic casing is subdivided by fire-brick work 3 into several compartments—namely, a generating chamber or furnace 4, fixing-chambers 5 6, and a mixing or equalizing chamber 7.

The generating-chamber comprises an upper main cylindrical portion 8, a lower conical portion 9, a grate 10, and an ash-pit or draft-chamber 11. Access to said ash-chamber is had by means of a self-sealing door 12, so located that it gives access also to the grate 10 and that portion of the chamber 9 immediately above said grate. This particular arrangement dispenses with the necessity of using a rise and fall or a rocking grate.

Next to the generating-chamber are located the two vertical fixing-chambers 5 6, separated by a wall 13 and connected by an arched

passage 14 beneath said wall. Of these the chamber 5 is connected with the generating-chamber 4 by a passage 15, leading from the top of said generating-chamber, and the chamber 6 is connected at its top by a passage 16, leading to the mixing or settling chamber 7. The brickwork forming the walls of the fixing-chambers 5 6 is so constructed as to offer the greatest surface obtainable to the gas passing through said chambers and also to retard the movement of the gas. For this purpose the fire-bricks are laid obliquely at an angle of about forty-five degrees with the wall, so that the outline or surface of each separate layer presents a serrated appearance. Joints will naturally be broken between layers in the building up of the work, so that the projecting corner of each brick lies in the same vertical plane with the receding corners of the bricks next above and below it.

From the equalizing-chamber 7 a passage 17 leads through the metallic casing to the usual scrubbing, cooling, and purifying apparatus, which being of the usual construction and forming no part of my invention are not here shown.

A manhole 18, with self-sealing door 19, is provided, through which access may be had to the fixing-chambers 5 6 for inspection and cleaning, and a manhole 20 and self-sealing door 21, leading into the chamber 7, are provided for the same purpose.

On the top of the generating-chamber 4, centrally located, is a feed-door 22, through which coal is fed at suitable intervals into the generating-chamber. The two fixing-chambers 5 6 are provided with cover-plates 23 24, made removable to provide for accidents, but normally kept closed.

Above the chamber 7 is provided a gravity-actuated valve 25, which can be held open by means of a lever 37. This valve is kept open on starting the operation, but is closed the moment combustion is well under way and is kept closed during the period of generating gas. Should, however, the pressure in any part of the apparatus become excessive, this valve will open, thereby allowing the gas to escape without doing any damage. There is also provided an air-inlet 27, leading into the ash-chamber 11, and similar smaller conduits

28 29, leading into the chambers 5 6 7. Through pipes 30 31 32 33 live steam from a boiler suitably placed may be supplied into the generating-chamber at different levels above, at, or below the grate 10. Oil or other carbonaceous fluid may likewise be fed into the various chambers through pipes 34 35 36, and air may also be supplied to the top of the generating-chamber 11 through the oil-pipe 34 when desired.

A layer 39 of sand or magnesia, mineral wool, or other poor conductor of heat is interposed between the fire-brick work and the metallic casing 1. This arrangement not only materially reduces loss of radiation, but also allows the brickwork to expand or contract within certain limits without deleterious effects upon the outer metallic casing.

The apparatus is operated as follows: The valve 25 is first opened and the connection between the apparatus and scrubbers closed, so as not to allow any inferior gas to pass on through them, eventually into the purifiers and holders. A wood fire is then started under the grate 10 and combustion maintained and air supplied through the pipe 27. As combustion progresses coal is added through the feed-door 22 in small quantities from time to time until an incandescent coal-bed of sufficient height is obtained, the products of combustion escaping all the while through the valve 25. The passage of the products of combustion through the fixing-chamber 5 6 in the course of about thirty minutes brings the walls of the latter into a state of incandescence. When this stage of the process has been reached, the valve 25 is closed and the connection to the scrubber opened. At the same time a small quantity of superheated steam is fed onto the top of the incandescent coal-bed through the pipe 30 and a likewise predetermined quantity of oil, which has been superheated to a temperature of about 200° Fahrenheit, supplied to the top of said incandescent bed. At the same time the air-supply through the pipe 27 is reduced to just the exact quantity necessary to keep the coal-bed at the proper temperature. As the generation of gas progresses and the heat of the upper portion of the incandescent bed is reduced by the disassociation of the steam the pipe 31 is opened and steam is admitted to the incandescent bed at a lower level and then in like manner through the pipe 32. The gas thus produced is fixed by passage through the mixing-chambers 5 6, and then passes into the mixing-chamber 7, through which it travels at a much slower rate, and is brought thereby to a much lower temperature than that at which it entered said chamber. It then continues on into the scrubbers, coolers, and purifiers, to be finally stored away in the holders, awaiting consumption.

I have succeeded with this apparatus in continuously manufacturing water-gas for a period of ninety minutes without shut down, a performance which, so far as my knowledge

extends, is not possible with any other form of apparatus. After a run is thus made the same cycle of operation is repeated, except, of course, the starting of the wood fire. The coal-bed, which during the run has lost somewhat in heat as well as in height, is replenished and by a liberal air-supply brought to its proper working temperature again, and the process of making gas continues in this manner indefinitely. If through any reason a deposit of free carbon is formed on the walls of the fixing-chambers, interfering with their proper working, atmospheric air is admitted into said chambers through the pipes 28, reducing the deposit to carbon dioxide.

The gas may be enriched as desired by admitting oil into the fixing-chambers or the mixing-chamber, and if the candle-power is too high it may be reduced by the addition of air first to the mixing-chamber and then, when the heat of said chamber has been reduced, to the fixing-chamber.

In case it should be desired to raise the heat of the upper portion of the incandescent bed independently of the lower portion air can be supplied to the top of said bed through the oil-pipe 34, for which purpose said pipe has a connection with the air-pipe 28.

In the actual operation of my apparatus I have found that I can produce a satisfactory commercial gas with almost any kind of coal, either soft or hard, and likewise with crude oil, naphtha distillate, or almost any kind of mineral oil will give very good results, a feature not possessed by any other apparatus in use at the present day, so far as my knowledge extends. I have also found that condensation in pipes through which the gas manufactured under this process is flowing is almost totally absent, irrespective of conditions. This overcomes one of the greatest drawbacks to the use of water-gas, as it insures a permanently good and reliable service and greatly reduces the cost of operation, as well as maintenance and repair of a gas-works.

Having thus fully described my invention, what I claim as new, and desire to protect by United States Letters Patent, is—

1. In a gas-generating apparatus, the combination, with a generating-chamber, of a vertical fixing-chamber connected therewith, and means for causing the gas to flow through said chamber, the interior surface of said chamber being formed of bricks laid obliquely to the wall, with broken joints between layers, whereby the free ends of the bricks present a serrated or jagged appearance, substantially as described.

2. In a gas-generating apparatus, the combination of a generating-chamber, a series of chambers connected therewith each having obstructions to impede the flow of the gas therethrough, a chamber of increased transverse capacity connected with the last of the series and free from obstructions, an oil-pipe discharging into the upper portion of the gen-

erating-chamber, and an air-pipe for admitting air directly into each of the other chambers, said air-pipe having a connection with said oil-pipe to transmit air therethrough, 5 when desired, substantially as described.

3. In a gas-generating apparatus, the combination of a generating-chamber, a series of chambers connected therewith each having obstructions to impede the flow of the gas 10 therethrough, a chamber of increased transverse capacity connected with the last of the

series and free from obstructions, and oil-pipes discharging independently into said latter chamber and into the chambers of the series, substantially as described. 15

In witness whereof I have hereunto set my hand in the presence of two subscribing witnesses.

A. C. SWAIN.

Witnesses:

JAY M. BOWERS,  
F. M. WRIGHT.