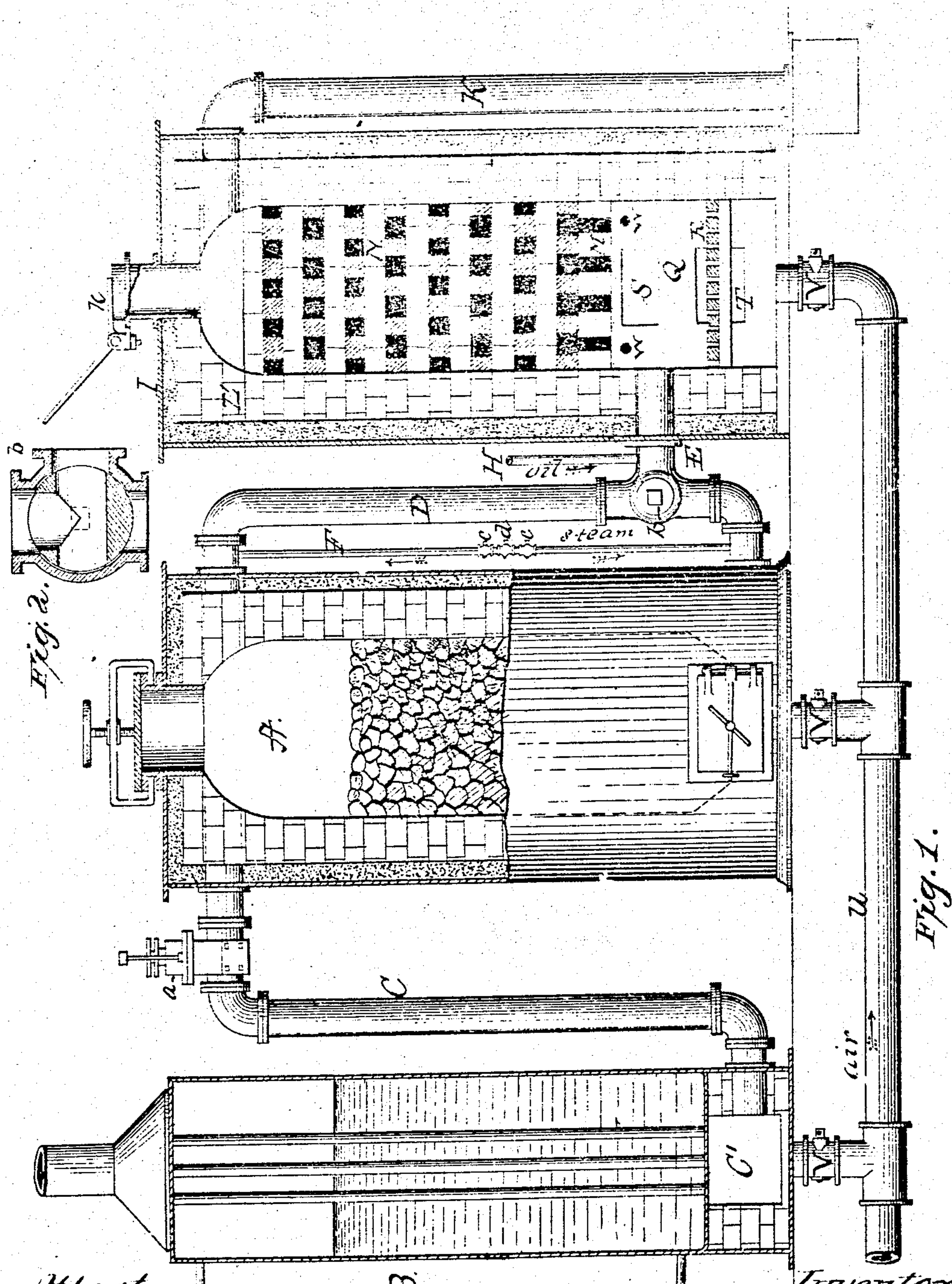


(No Model.)

H. C. SHIELDS.
GAS GENERATING APPARATUS.

No. 277,852.

Patented May 15, 1883.



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GAS-GENERATING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 277,852, dated May 15, 1883.

Application filed May 8, 1882. (No model.)

To all whom it may concern:

Be it known that I, HENRY C. SHIELDS, a citizen of the United States of America, residing at Troy, in the county of Rensselaer and State of New York, have invented certain new and useful Improvements in Gas-Generating Apparatus; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to means or gas-generating apparatus for carrying out the process of manufacturing what is termed "water-gas" for illuminating or heating purposes.

In all water-gas processes now in use, when hot brick-work is used for fixing the gases, the same is heated by gas produced in the generator by passing air through the fuel contained in the same, thus taking a long time, as to minutes, to heat and generate, and in this process the fuel in the center of the generator is heated to such a high degree that a large quantity of clinker is formed, which not only destroys the fuel, but diminishes the decomposing capacity of the generator.

The main objects of this improvement are to accomplish the heating of the refractory material contained in the superheater in less than half the time required to heat the same with the products of combustion or gases taken from the generator, as in some of the present processes now in use, whereby a great saving of fuel and time is effected, and to obviate the formation of clinker. This I accomplish by constructing the superheater with a fire-box at the bottom to receive the fuel, and heating the superheater by the direct internal combustion of the fuel introduced in the fire-box. It is a great advantage to have an independent furnace in the superheater, as the heat is under more perfect control, and is not maintained at the expense of the fuel used in the gas-generator, and a very cheap fuel may be used.

In the annexed drawings, Figure 1 represents a view, partially in section, showing one practical way of carrying out the invention. Fig. 2 represents a sectional view of a three-way valve used in connection with my apparatus.

The letter A represents a generator or a well-known construction, provided with the usual grate-bars and ash-pit, and also with the cap-plate and clamping-dog.

The letter B represents a water-heater with a combustion-chamber, and communicating with the generator by means of a connecting-pipe, C. The upper end of this pipe is provided with a valve, *a*, for opening and closing the communication between the said generator and heater. The generator is provided on the other side with a by-pass pipe, D, provided with a three-way cock, *b*, and communicating with the top and bottom of the generator, as seen. This by-pass pipe is provided with a branch or inlet pipe, E, leading into the superheater at an intermediate point between the upper surface of the coal-bed and the archway of the refractory material.

The letter F represents a steam-pipe communicating with the upper and lower horizontal portions of the by-pass pipe leading into the generator, and this pipe is provided with two valves, *c*, arranged above and below the T-connection *d* of the pipe leading from a steam source not shown.

The letter H represents an oil-pipe leading from an oil-supply attached to the by-pass pipe, preferably outside of the superheater, for conducting the hydrocarbon into the superheater I, for enriching and combining with the water-gas on its passage to the superheater.

The letter K represents an exit-pipe for conducting the fixed gas from the superheater to the hydraulic seal. The superheater is constructed of a shell or casing of boiler-iron or other suitable material with a filled space of non-conducting material—such as sand, lime, &c.—refractory lining L', perforated arch M, loose refractory material N, fire-box O, grate-bars R, door S, for introducing fuel, and door T, for cleaning fire-box.

The letter U represents a blast-pipe with a suitable blower (not shown) connected with the heater, generator, and superheater by the branch pipes V, supplied with valves.

Operation: When the apparatus is ready to manufacture gas, I build a separate fire-bed upon the grate-bars or bottom of both the generator and superheater and open the valves *a*

and *k*; then introduce carbonaceous material, preferably anthracite coal, through an opening in the top of the generator; then ignite the fire-beds and turn on the blast to the generator and superheater, so that the currents will ascend through the fuel. The products of combustion in the generator are carried through the pipe C, the valve thereof being opened to the combustion-chamber C' of the heater B, for the purpose of heating the water thereof preparatory for a steam-boiler, or otherwise used, and the combustion of these products of combustion is promoted by letting on a blast to the combustion-chamber. This blast will consume any carbonic oxide that may exist in the products of combustion from the generator. The products of combustion from its independent fire-bed in the superheater are carried upward through the refractory material and escape through the valve-opening at the top. When the carbonaceous material in the generator has become sufficiently heated for the decomposition of steam, and the refractory material in the superheater has reached a proper degree of heat for fixing the gases, all the blast-valves of the blast-pipe are closed, also the valves *a* and *k*, and the cock of the by-pass pipe opened for establishing a communication between the top of the generator and bottom of the superheater. Steam is now passed into the bottom of the generator, the fuel being hottest at this point, thence upward through the fuel, where it is decomposed by coming in contact with the incandescent carbonaceous material, and the resultant product—water-gas—is passed through the by-pass pipe and into the inlet of the superheater. At this point—the inlet to the superheater—the hydrocarbons, vapors, or liquid are admitted and mingle with the water-gas on its passage to the superheater, and these, as thus combined, are carried up through the hot refractory material of the superheater, where the chemical combination or union of the gases is effected, and then the fixed gas is passed out through gas-exit pipe into the hydraulic main. After considerable gas has been made the temperature of the carbonaceous material in the generator and the refractory material in the superheater become reduced, when it is again necessary to restore the desirable heat for manufacturing the gas. The steam and hydrocarbons are now shut off and the valves *a* and *k* and the valves of the blast-pipes are opened, and the temperatures of the generator and superheater are raised to the required degree in a few minutes for repeating the operation of making the gas.

Sometimes it may be, and, in fact, is, desirable to reverse the currents of steam into the generator by admitting the same at the top thereof and passing it downward through the incandescent carbonaceous material and out at the bottom of the generator into the by-pass pipe, then into the superheater, through the inlet-pipe, up through the heated refractory ma-

terial, out at the top of the superheater into the exit gas-pipe and hydraulic seal-box or main. The objects of admitting the steam alternately above and below the incandescent carbonaceous material are to maintain a uniformity of heat throughout the fuel contained in the generator and prevent the formation of clinker. When liquid fuel—for example, tar or hydrocarbon—is employed for heating the refractory material in the superheater, it is passed through pipes *w* and controlled by valves, and is shut off during the fixing of the gases.

In the process described the superheater is connected with the generator, so as to take the gas direct from the generator to superheater; but it is obvious that the gas from the generator may be conducted to a gas-holder, then to a carbureting-machine for carbureting the same, and then to the superheater for effecting the chemical union of the gases.

By heating the superheater and its refractory material contents according to my process, by introducing fuel into the fire-box, so as to heat by direct internal combustion, a cheap and an inferior quality of fuel is employed and a great saving of time is accomplished.

Long experience has shown that the best quality of anthracite coal is the most economical fuel for the decomposition of steam in a generator; but when the superheater is dependent upon the gas or carbonic oxide of the generator for heating, then it becomes expensive as to the quantity of material and time consumed.

The form and arrangement of the apparatus may be varied in carrying out the process. Hence I do not wish to confine myself to the special apparatus herein described and shown.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. In combination with the generator and water-heater and their connecting-pipe, the superheater connected to the generator by a by-pass pipe provided with a three-way valve and steam-pipe connecting with the upper and lower parts of said by-pass pipe, the said pipe being provided with valves for regulating the flow of the steam, substantially as specified.

2. The combination of the generator connecting directly with the combustion-chamber of a water-heater, a superheater connecting with said generator by a by-pass pipe, which is also connected with the water-heater by a suitable pipe, and the air-blast pipe having branches leading to the combustion-chamber of the water-heater, generator, and superheater, and the oil-supply pipe leading to the by-pass pipe, the pipes being provided with valves, respectively, as described, and the whole arranged to operate substantially in the manner specified.

3. In combination with a generator provided with a suitable combustion-chamber and connecting directly with the combustion-cham-

ber of a water-heater, a superheater charged
with refractory material and provided with an
independent fuel and combustion chamber hav-
ing a grate, the said generator being con-
5 nected with the superheater at an interme-
diate point between the upper surface of the
coal-bed and the a. chway of refractory mate-
rial, and an air-pipe connecting with the water-

heater, the generator, and the superheater, sub-
stantially as specified.

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

HENRY C. SHIELDS.

Witnesses:

D. D. KANE,

GEO. U. ROSE, Jr.