(No Model.) 2 Sheets—Sheet 1.

T. G. SPRINGER.

PROCESS OF AND APPARATUS FOR THE MANUFACTURE OF GAS.

No. 263,985. Patented Sept. 5, 1882.

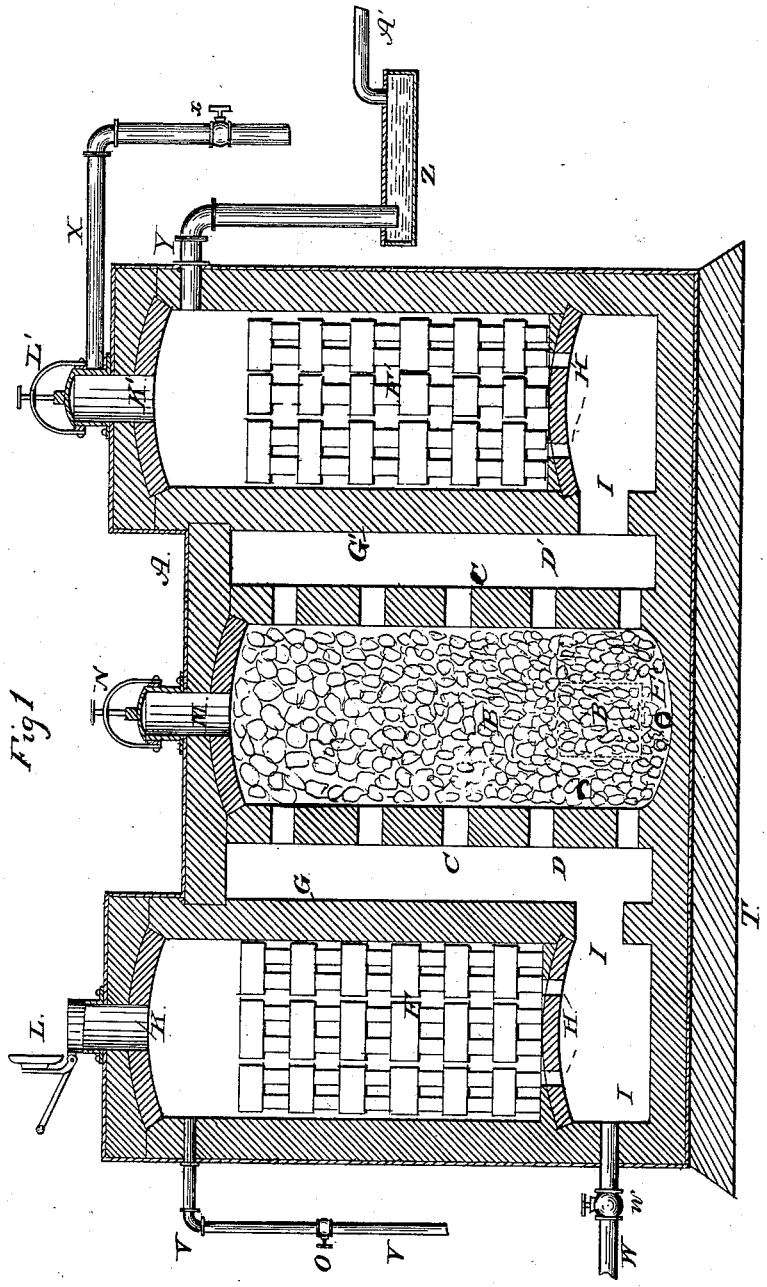

Fig 1

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(No Model.) 2 Sheets—Sheet 2.

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Fig. 2

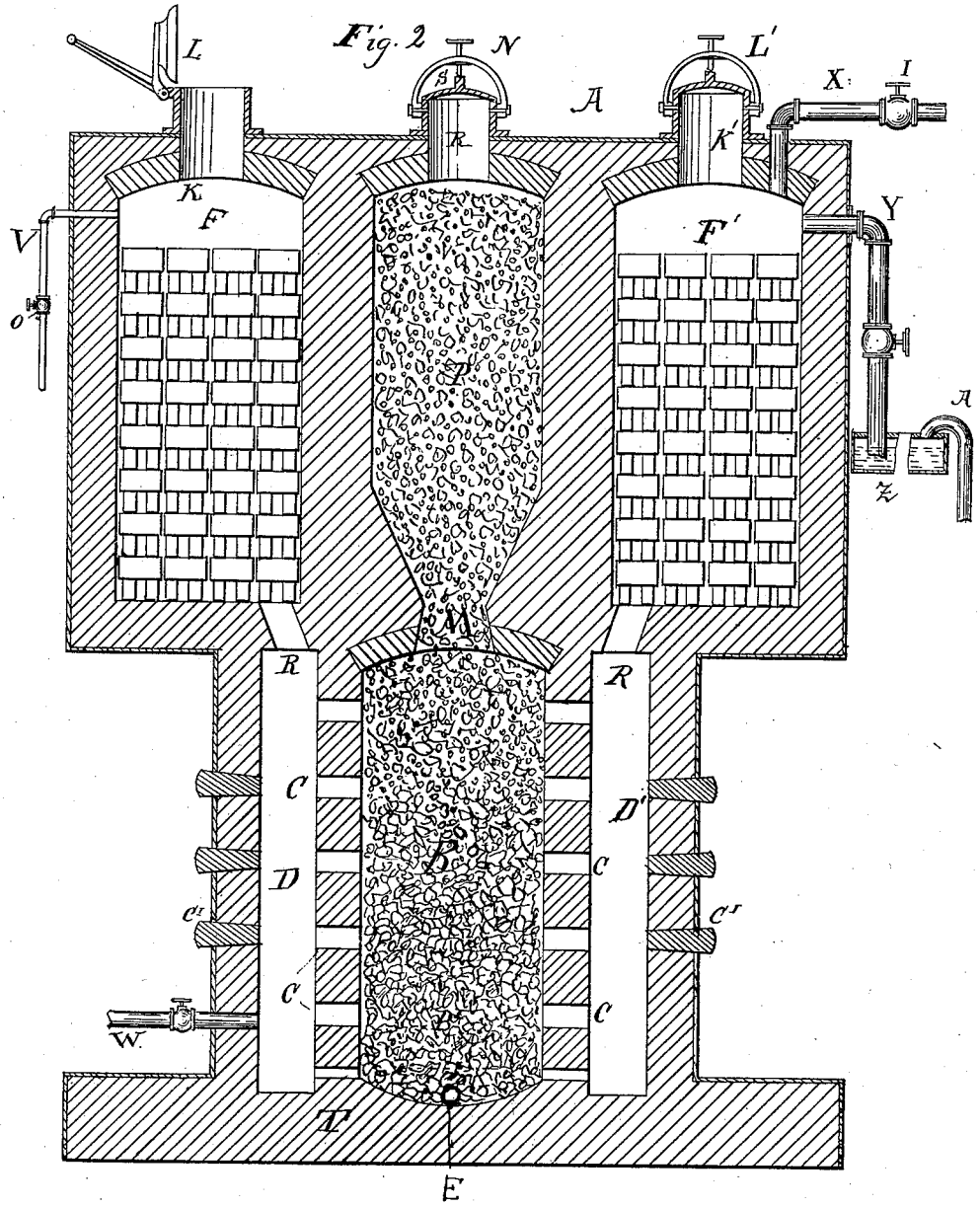
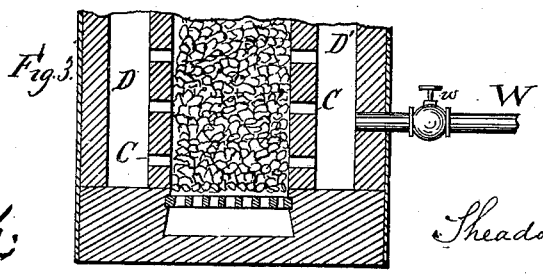


Fig. 3.



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THEODORE G. SPRINGER, OF NEW YORK, N. Y.

PROCESS OF AND APPARATUS FOR THE MANUFACTURE OF GAS.

SPECIFICATION forming part of Letters Patent No. 263,985, dated September 5, 1882.

Application filed August 14, 1882. (No model.)

To all whom it may concern:

Be it known that I, THEODORE G. SPRINGER, of the city, county, and State of New York, have invented certain new and useful Improvements in the Process of and Apparatus for Manufacturing Gas; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings.

This invention relates to certain improvements in the manufacture of water-gas; and it is designed to provide for saving the heat of the hot gases generated by the decomposition of water, which has hitherto been allowed to go to waste, and for utilizing such waste subsequently in the production of gas.

The invention also is designed to provide for automatically supplying the combustion-chamber and generator of the apparatus with carbonaceous material, and also to provide for automatically removing the ashes in the form of slag, whereby the manufacture of the gas may be continued without interruption as long as desired.

This invention consists in certain improvements in the construction of the combustion-chamber and generator and in the combination and arrangement of such combustion-chamber and generator with one or more regenerators or heat-storing chambers, as will more fully hereinafter appear.

In the manufacture of water-gas by the "cupola" process the products of combustion of burning carbonaceous material, which consist mainly of nitrogen and carbonic-acid gases, have usually been allowed to escape, and as they leave the combustion-chamber and generator at a highly-elevated temperature they carry off much effective heat, which it is my object to utilize, and which object I accomplish by the apparatus which are the subjects of illustration in the drawings hereunto annexed, in which—

Figure 1 illustrates a vertical sectional view of one form of my improved apparatus; Fig. 2, a similar view of a modification thereof; and Fig. 3 is a sectional view of a modification, showing grate-bars for supporting the bed of fuel.

The letter A indicates the outer walls of my gas-generating apparatus, which are constructed preferably of boiler-iron and lined with fire-brick.

The letter B indicates the combustion-chamber and generator, the walls of which are constructed of fire-brick or other refractory material, with a series of horizontal passages or tuyeres, C, on opposite sides and at different elevations. These tuyeres establish communication between the interior of the combustion-chamber and the vertical flues D and D′ at each side thereof, the side flues being formed in the body of the structure. The lower portion or bottom of the combustion-chamber and generator is concave in cross-section, and is provided with an aperture, E, for the discharge of the slag, as more fully hereinafter set forth. At each side of the combustion-chamber and generator are located the regenerating-chambers F F′, which are formed within the structure by means of the partitions or dividing-walls G G′. The said regenerating-chambers communicate at their bottoms or lower portions with the vertical flues D D′ by means of suitable passages, A, which, as shown in Fig. 1, connect indirectly with said flues by means of horizontal flues I, but, as shown in Fig. 2, connect directly with said flues D D′. The regenerating-chambers are charged with fire-brick or other refractory material, and are provided at their tops with openings K K′, by which they may be charged and through one of which, K, the products of combustion in the initial operation of the apparatus may be discharged into the open air, and the said openings are provided with suitable covers, L L′, by means of which they may be closed when required.

As shown in Fig. 1 of the drawings, the combustion-chamber and generator is located directly between the regenerators and the vertical flues, and communicate, by means of the flues at their lower ends and the passages in the bottom of the regenerators, with said regenerators; but in the modification shown in Fig. 2 the combustion-chamber and generator is located below the regenerators and the vertical flues communicate directly with said regenerators. The combustion-chamber in both cases, as shown in Figs. 1 and 2, is provided with a passage, M, by means of which the carbonaceous material may be fed in, and, in the form of

apparatus shown in Fig. 1, the said passage is provided with a door, N, by means of which it may be closed. In the modification illustrated in Fig. 2, however, there is a magazine, P, located above the combustion-chamber and communicating with the same by the above-mentioned passage. This magazine lies between the two regenerators, and it has a passage, R, at its top, by means of which it may be charged with carbonaceous material, the passage being provided with a cover, S, by which it may be closed. The apparatus in either case is mounted upon a foundation of masonry, T.

The letter V indicates a steam-pipe provided with a valve, *o*, leading into the upper part of one of the regenerators, by means of which steam, superheated or otherwise, may be admitted thereto, when desired; and W indicates an air-pipe having a valve, *w*, and leading into the flue below such regenerator.

The letter X indicates an air-pipe provided with a valve, *x*, leading into the top of the opposite regenerator, and Y an eduction gas-pipe leading from near the top of said regenerator to a water-seal, Z, and from thence, by means of a pipe, A′, directly to the main or a holder.

The combustion-chamber and generator is designed to be provided with suitable doors, B′, for igniting the charge and cleaning the interior when required, and the walls of the vertical flues are provided with suitable openings, C′, having removable plugs, the openings being opposite the tuyeres, in order that the tuyeres may be cleared of obstructions when required. Any number of generators may be grouped together in one structure, passages being left between their outer walls for the entrance of a person for the purpose of attending to the tuyeres.

The operation of my invention is as follows: The combustion-chamber and generator being properly charged with carbonaceous material, and said material being ignited, the covers L′ and N are closed, and also the valve *o*. The cover L and valves *x* and *w* being opened, air is then forced through the pipe X, and from thence through the regenerator F′, and then through the flues I D′, the tuyeres C, and the carbonaceous material in the combustion-chamber and generator B, urging the combustion therein. The hot products of combustion pass out of opposite tuyeres into the opposite flues I D, into which a current of air is admitted through the pipe W, burning the products of combustion, which consist mainly of carbonic-oxide and nitrogen gases, the highly-heated products passing up through the refractory material in the regenerator F, where the heat is stored, the cooled products passing out through the passage K. When everything is in proper condition—that is to say, when the carbonaceous material has become incandescent and the refractory material in regenerator F has become heated—the cover L and valves *w* and *x* are closed and the valve *o* is opened, letting steam into the upper part of regenerator F at the top. The steam passes down through the refractory material and becomes superheated thereby, and passes through the flues I D into the combustion-chamber and generator B, where it is decomposed, forming water-gas, which passes up through regenerator F′, giving up its heat to the refractory material, and from thence through pipe Y to the seal Z and pipe A′ to the main or holder. When the carbonaceous material is reduced below a decomposing-temperature the valves *x* and *w* and cover L are opened and air is blown through pipe X into the apparatus, as in the first instance, the air in this case forming a hot blast by taking up the heat of the refractory material in regenerator-chamber F′. The carbonaceous material is mixed with a suitable flux—such as lime or clay—whereby the ash, by the intense heat, is converted into slag and run off automatically at the bottom of the generator. The steam being passed through the incandescent material at different elevations results in the formation of different grades of gas, which are drawn off at different elevations and are mixed in the flue D′; and in order to insure a uniform grade of gas the feed-magazine is provided, which keeps the combustion-chamber and generator constantly filled, and the ash is fluxed and run off as slag, as before mentioned, in order to provide room for fresh carbonaceous material. The feed-magazine also serves to primarily heat the carbonaceous material by heat that would otherwise be wasted, thus economizing in the manufacture of the gas.

I claim—

1. The process of generating water-gas and utilizing the heat of the gas for heating air and superheating steam, which consists in first raising to incandescence a body of carbonaceous material by a blast of air and burning the resulting hot products of combustion by an air-blast and storing the heat in a body of refractory material, superheating steam by passage through such refractory material, then decomposing such steam by passing it through the incandescent fuel and passing the resulting hot gas through a body of refractory material and storing the heat, at the same time cooling the gas, continuing the operation until the fuel is reduced below the decomposing-temperature, then heating a blast of air by passage through the last-mentioned refractory material and forcing such air through the carbonaceous material for again raising it to incandescence, and burning the resulting gaseous products and storing the heat in the steam-superheating body of refractory material, as at first, and thus continuing the operation.

2. The process of generating gas, the same consisting in passing steam, superheated or otherwise, through a column or body of incandescent carbonaceous material at different heights, drawing off the resulting gases at different elevations and renewing the carbonaceous material as it is consumed, whereby gases of different qualities—that is, poorer and

richer gases—are simultaneously carried off and mixed together, forming a homogeneous gas.

3. The combination, in a gas-generating apparatus, of a generator having horizontal tuyeres and eduction-passages at different elevations, and one or more heat-storing chambers connected with the generator by means of flues, and suitable means for admitting or forcing air and carrying off gas, substantially as specified.

4. The combination, in a gas-generating apparatus, of a generator having horizontal tuyeres and eduction-passages at different elevations, and one or more heat-storing chambers connected with the generator by means of flues, and suitable air and steam supply pipes and gas-eduction pipes, and a feed-magazine located above the generator, the generator being provided with an aperture at the bottom, through which the ash may be run off as a slag to make room for fresh material, which is fed automatically by the magazine, substantially as specified.

5. The combination, in a gas-generating apparatus, of a generator having one or more tuyeres and one or more eduction-passages, the heat-storing and superheating chamber F, having connecting steam and air pipes and an escape-flue for waste products of combustion, the heat-storing and air-heating chamber F′, having the connecting gas-eduction pipe and air-supply pipe, and suitable connecting-flues, for the purpose described.

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