No. 652,081. Patented June 19, 1900.

J. W. CHISHOLM.

PROCESS OF MANUFACTURING GAS.

(Application filed July 17, 1899.)

(No Model.) 2 Sheets—Sheet 1.

Fig. 1.

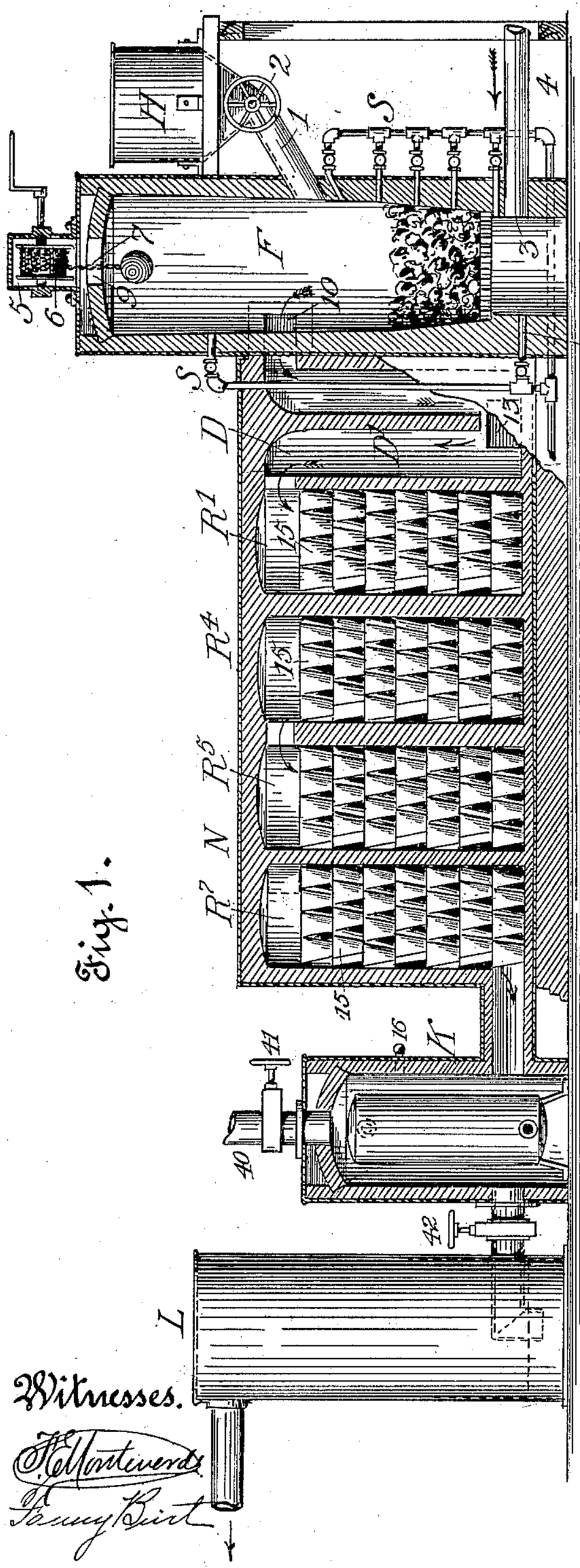
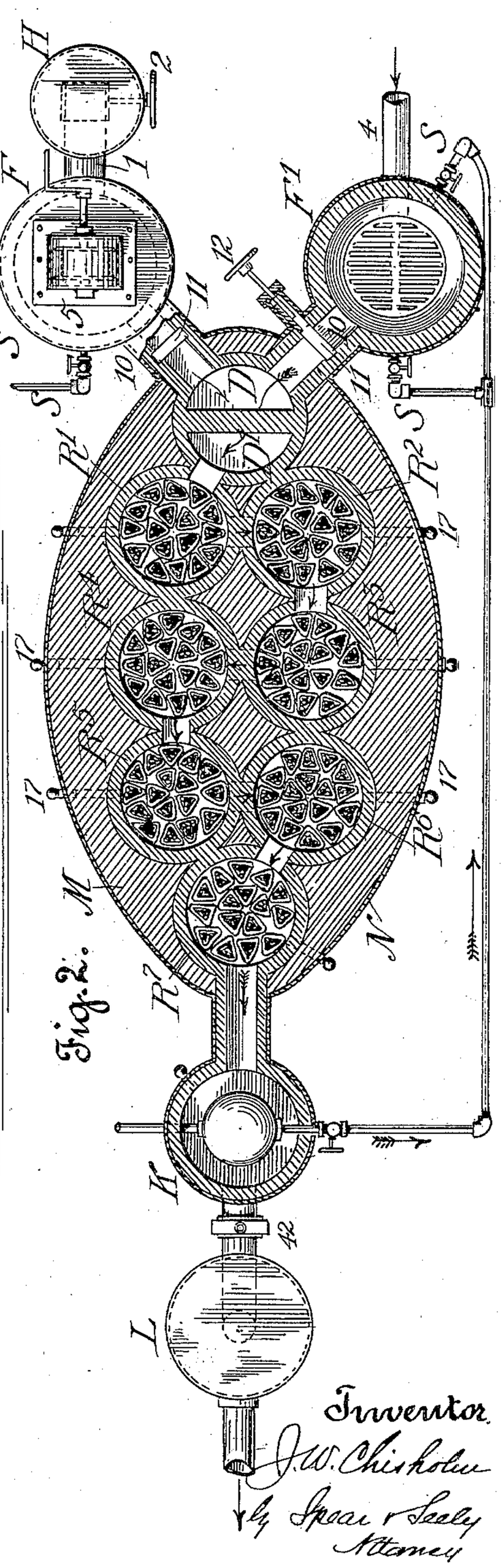


Fig. 2.



Witnesses.

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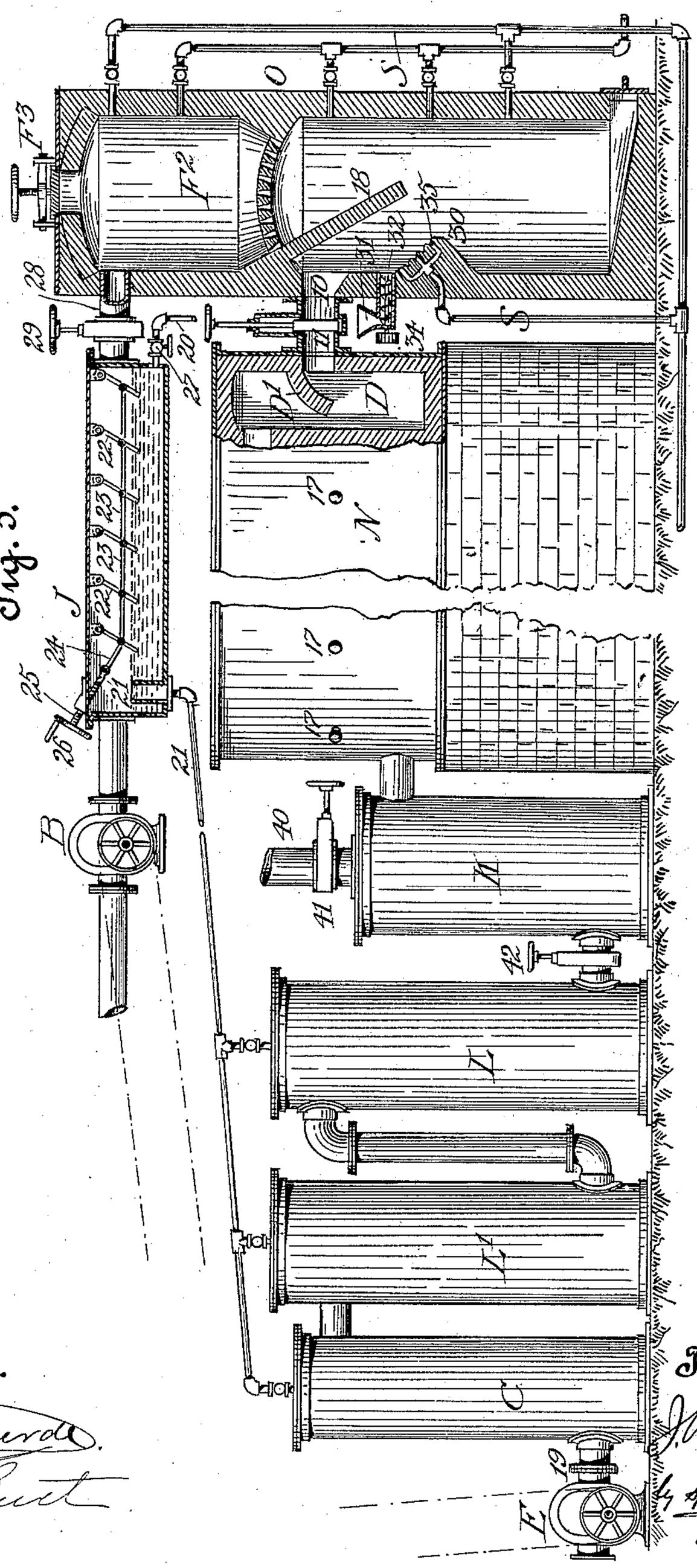
Fig. 3.



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UNITED STATES PATENT OFFICE.

JAMES W. CHISHOLM, OF SAN FRANCISCO, CALIFORNIA.

PROCESS OF MANUFACTURING GAS.

SPECIFICATION forming part of Letters Patent No. 652,081, dated June 19, 1900.

Application filed July 17, 1899. Serial No. 724,160. (No specimens.)

To all whom it may concern:

Be it known that I, JAMES W. CHISHOLM, 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 Processes for the Manufacture of Gas, of which the following is a specification.

My invention relates to the manufacture of gas for heating and illumination; and it consists of a process as hereinafter described, and specified in the claims. I use in this process the peculiar filling and construction of regenerating-chamber shown in the Letters Patent of the United States granted to Hall on the 23d day of March, 1893, and numbered, respectively, 494,198, 494,199, and 494,200.

My object is to improve upon the process used in the apparatus described in said patents, and thereby increase the production and quality of the gas.

I have shown an improved apparatus in the accompanying drawings by which I carry out my said process, this apparatus being the subject of another application made in the United States Patent Office and having the Serial No. 732,545.

In the drawings referred to, Figure 1 is a longitudinal section of the apparatus. Fig. 2 is a horizontal section of the same. Fig. 3 shows a modified form of furnace in vertical section, the other parts being mostly in side elevation.

In the aforesaid patent of Hall, No. 494,200, are shown duplicate sets of apparatus, including a special construction of regenerator, containing metals or materials of different polarities, each with one generator and each connected with its appropriate set of gas-forming apparatus, but also with cross-connections and valves, by means of which by a route more or less circuitous the products of combustion from the generator on one side could be caused to pass to a mixing-chamber, receiving at the same time steam and the products of combustion, and thence to the regenerator, both on the other side. I have found in practice that this special form of regenerator in the Hall patent requires high heat, and therefore the directest possible delivery of the products of combustion from the generator, and, further, that the steam should be subjected to decomposing action before it is received in the regenerator. In the reorganization, therefore, I have introduced the steam into the furnace instead of introducing it into the mixing-chamber and after eliminating the dust have delivered the products of combustion directly to the regenerator. I have also found that for the best effect it is necessary to maintain an even pressure in the regenerator and a uniform degree of heat throughout the series of regenerator-chambers. In the process and apparatus as carried on in the Hall apparatus aforesaid the gases were forced through by pressure from the generator alone, and this not only caused different pressures at different stages of advance or flow of the gases through the apparatus, but also consequently different degrees of heat at different points. This interfered unfavorably with the required action. To remedy this unfavorable action, I have applied exhaust or suction at the delivery end to act in conjunction with the pressure at the generator end of the apparatus. By the adjustment of these forces I am able to maintain an even pressure through the entire length, and consequently more even heat, and at the same time to maintain such a pressure that while the heat is maintained no leakages of the gases occur, and, further, that no material change in heat and pressure arises in the necessary occasional manipulation of the furnace.

In order that this process may be fully understood, I have hereinafter described the apparatus by which I have been carrying it out.

The furnaces are shown in Figs. 1 and 2 at F and F′, each having a fuel-chute leading from a hopper H and provided with a valve 2, these serving to maintain the pressure. An inlet-passage for air in this form is provided below the grate by pipes 4. Steam-pipes S discharge into, above, or below the fuel. In this I have changed the organization of the said Hall patent, and thereby dispense with the intermediate mixing-chamber of that patent. By this change I bring the furnace nearer to the regenerator and introduce therein a materially-different product better fitted to be acted on by this special kind of regenerator.

As will be observed in Fig. 2, the furnaces

are symmetrically arranged in relation to the regenerator and are connected therewith by pipes 10, having cut-off valves 11. These pipes, as shown in Figs. 1 and 2, pass directly into a dust-chamber embedded in the brickwork with the regenerator-chamber. Both furnaces bear the same relation to the regenerating-chamber, and therefore act precisely alike upon it, and one or the other may be used with precisely the same effect upon it. When one furnace begins to fail or from any cause needs to be withdrawn from action, the other may be started and turned on, and when fully in action the one may be shut off without any interruption of the even action. By draft and suction, hereinafter referred to, the conditions within this one regenerator are controlled, and this regenerator, therefore, with the duplicate furnace and the like construction, may be used continuously without change from one regenerator to another, and consequent loss of heat. It will be observed that this furnace (shown in Figs. 1 and 2) is an updraft-furnace. In order, however, to maintain the pressure therein, and thus make the process evenly continuous, I use a mechanical poker, consisting of a weight 9, suspended by a chain from a drum inclosed in a box covering a hole in the top of the furnace through which the chain moves. Further, I have shown a mechanical stoker consisting of a chute 1, leading from a hopper H, whereby coal may be supplied to the furnace without opening the fire-chamber.

The preferred form of furnace shown in Fig. 3 is a downdraft-furnace having air-forcing pipe leading from a blower B to near the top of the furnace. I have shown an agitating mechanism in a water-tank J, through which the air passes, but make no point of this.

The downdraft-furnace permits the convenient use of the dust-chamber in the ash-pit and has below the grate a downwardly-inclined wall 18, extending partially across the path of the descending products of combustion, so as to cause the particles of dust impinging thereon to be deflected out of the current, and thereby eliminated therefrom. This dust-chamber may be as large and complete as necessary for the removal of the dust. It can be supplemented in its action by utilizing for the same purpose a part of the first regenerator-chamber. I have shown such a supplemental chamber at D associated in the brickwork with the regenerator-chamber and in which a deflecting-wall D′ extends in front of the passage 10, controlled by valve 11, leading from the furnace. The downdraft-furnace not only thus affords dust-cleaning space in the ash-pit and tends to bring the furnace practically nearer to the regenerator and maintains the heat required by this regenerator, but the forced downdraft also acts more advantageously in connection with the special kind of regenerator and with the suction which I use at the discharge end of the apparatus. This may consist of an exhaust pump or fan E. It acts in conjunction with the forcing mechanism to maintain the pressure in the apparatus at about atmospheric pressure, preventing inward leakage of air or outward leakage of gas even when the fuel-door is opened. It also in like conjunction serves to control the distribution of heat throughout the regenerating-chamber and to make the movement of the products of combustion even and uniform throughout the apparatus. This I have found to operate with best effect in the peculiar kind of regenerator of the Hall patents aforesaid. It is specially adapted to the construction and arrangement of the series of aggregated regenerator-chambers shown herein and forming an important feature in my invention. In carrying on the process also I have abandoned the rectangular form of regenerator of Hall and adopted a cylindrical form as having peculiar effect on the Hall electric regenerating devices. These devices being excited to action by heat are in a cylindrical form heated uniformly, and therefore operate uniformly, as they do not in the rectangular shape. Further, the gases moving evenly therethrough the deposit of carbon occurring in the rectangular form and interfering with the electric action is avoided. Further, for the best effect I have found that prolonged action of the electric regenerating devices was required, as well as uniformity of movement of the gases through all parts of the cross-section of the chamber. I therefore have used several subordinate cylindrical chambers each of such area of cross-section as to maintain a uniform movement of the gases among the electric devices and have aggregated these in such numbers as to secure continuous exposure for a sufficient time of the gases to the electric action. Thus I have sought at the same time even and prolonged action of these electric devices on the passing gases. A further problem presented itself—how to aggregate these subordinate cylindrical chambers so as to best resist strain, retain heat, and provide for access to each chamber. This is explained more fully hereinafter. The subordinate chambers or passages are indicated at R′ R^2, &c., in Fig. 2, and in these are arranged the electric devices, such as those shown in the Hall patents, Nos. 494,199 and 494,200 aforesaid, the arrangement also being such that passages are provided for the movement of the products of combustion through the chambers. If the form of furnace shown in Fig. 1 be used, one of the cylindrical chambers (marked D) nearest the furnace and next also to the first regenerator-chamber is used as a dust-chamber, being provided with an opening 10 from the furnace and a deflecting-wall D′, against which the products of combustion impinge and, being deflected, pass under the lower edge and up to the opening 15 leading to the contiguous regenerator-chamber. This dust-chamber (shown in Figs. 1 and 2) wholly

occupies the cylinder at D; but in the form shown in Fig. 3 it only partly occupies that cylinder, where it only supplements the dust-chamber in the furnace. It will be observed first that these chambers are of comparatively-small area in cross-section; but by these connections (shown at 15) alternately at top and bottom the products of combustion move through an extended passage of comparatively-small area in cross-section at any point and throughout provided with the electric devices, which thus act upon the gases throughout the entire length of the aggregated chambers, and by reason of the even movement, due to the combined suction and blast, act uniformly and always with their full effect.

In order to afford mutual support to resist and counteract strains and to economize heat by reducing radiation, I have aggregated these chambers side by side and embedded them and inclosed them in a brickwork. It will be observed that the subordinate or individual chambers are so located that each is accessible from opposite sides (through a suitable manhole) from the outside, while one is arranged at each end. This arrangement affords mutual support, serving to retain the heat and to inclose the whole. I form the wall with its inclosing shell in curved shape to equalize the heat resistance and the strains and prevent unequal action and bulging. The form shown is in cross-section, approximately oval, and the chambers are in two lines, with one at each end. In the chambers I have shown the crucibles which contain, respectively, the iron and copper or other material of opposite polarities. The passage from the last generator-chambers leads directly to a water-heater K, through which the gases are made to pass merely to save heat. Thence said gases pass directly to a scrubber L, of which two are shown in Fig. 3, with a cooler or condenser C, outside of which is the suction-fan or pump.

The exhaust-pump E is connected to the gas-passage in the condenser C at 19, and thus is in position to draw the gases as they pass through the apparatus. It will be understood that the force of suction is regulated and made to correspond to that of the forcing blast of the furnace. As the said blast acts with greatest force at the beginning and diminishing to the end, so the suction acts reversely at the end of the apparatus with greatest force, diminishing toward the furnace, so that these two blasts are the complement of each other in the apparatus, and by varying one in relation to the other any required pressure may be maintained in the apparatus, and the movement of the gases is made more uniform.

The downdraft-generator is specially adapted to the peculiar kind of regenerator of the Hall patent. For its successful action the quality of the gases and their component parts should be constantly regulated. This can be done in a downdraft-furnace without interfering with the draft, the condition of the fire may be watched, the formation of the crusts broken, and cavities destroyed, preventing excess of air or other inequalities in the products of combustion, which would impair the operation of the electric regenerators.

I claim—

1. The continuous process of making gas which consists in burning carbonaceous fuel, supplying air and steam to said fuel, then conducting the gases through a heated regenerator containing materials of opposite electric polarity, said filling being so disposed as to leave passages for the gases therethrough, substantially as described.

2. The continuous process of making gas which consists in burning carbonaceous fuel, supplying air and steam to said fuel, eliminating the dust from the products of combustion and then passing the said products through a regenerator containing materials of opposite polarity, substantially as described.

3. The continuous process of manufacturing gas which consists in burning carbonaceous fuel, supplying air and steam to said fuel, eliminating the dust from the products of combustion, then passing said products through a regenerator containing materials of opposite electric polarity by means of force and suction, substantially as described.

4. The process herein described of manufacturing gas, the same consisting in generating in one furnace products of combustion of carbonaceous fuel with air and steam, passing the same into a regenerator, having receptacles containing a filling of materials of opposite polarity, and then supplementing the action of the one generator with that of the other of the same kind and capacity, whereby continuous and even action is maintained.

In testimony whereof I have affixed my signature, in presence of two witnesses, this 26th day of June, 1899.

JAMES W. CHISHOLM.

Witnesses:
LEE D. CRAIG,
L. W. SEELY.