No. 652,082.

Patented June 19, 1900.

J. W. CHISHOLM.

WATER GAS GENERATOR.

(No Model.) Application filed Oct. 4, 1899.)

2 Sheets—Sheet 1.

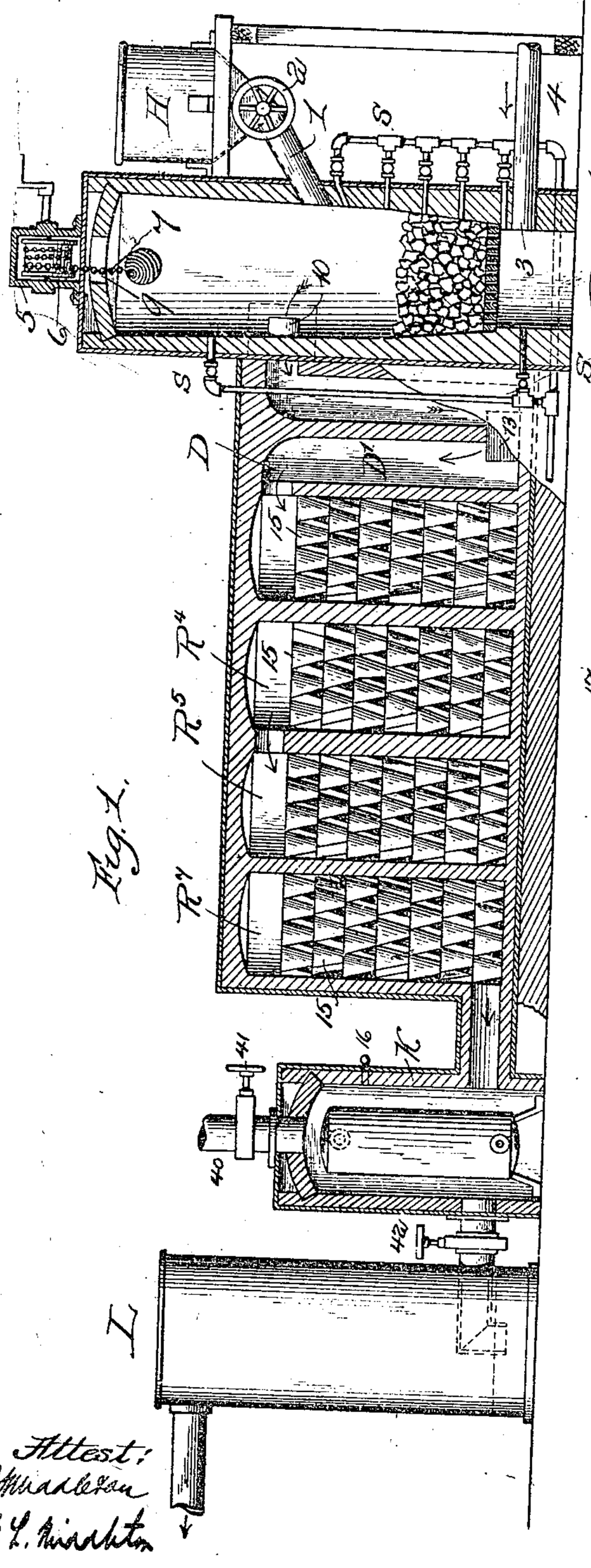

Fig. 1.

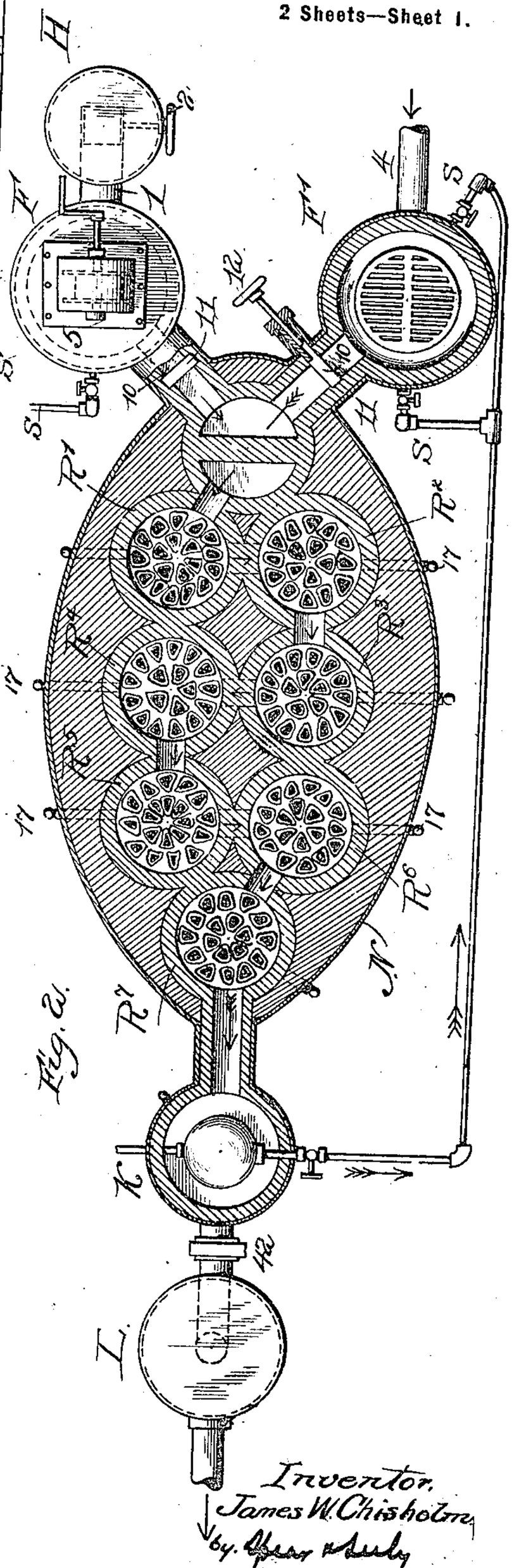

Fig. 2.

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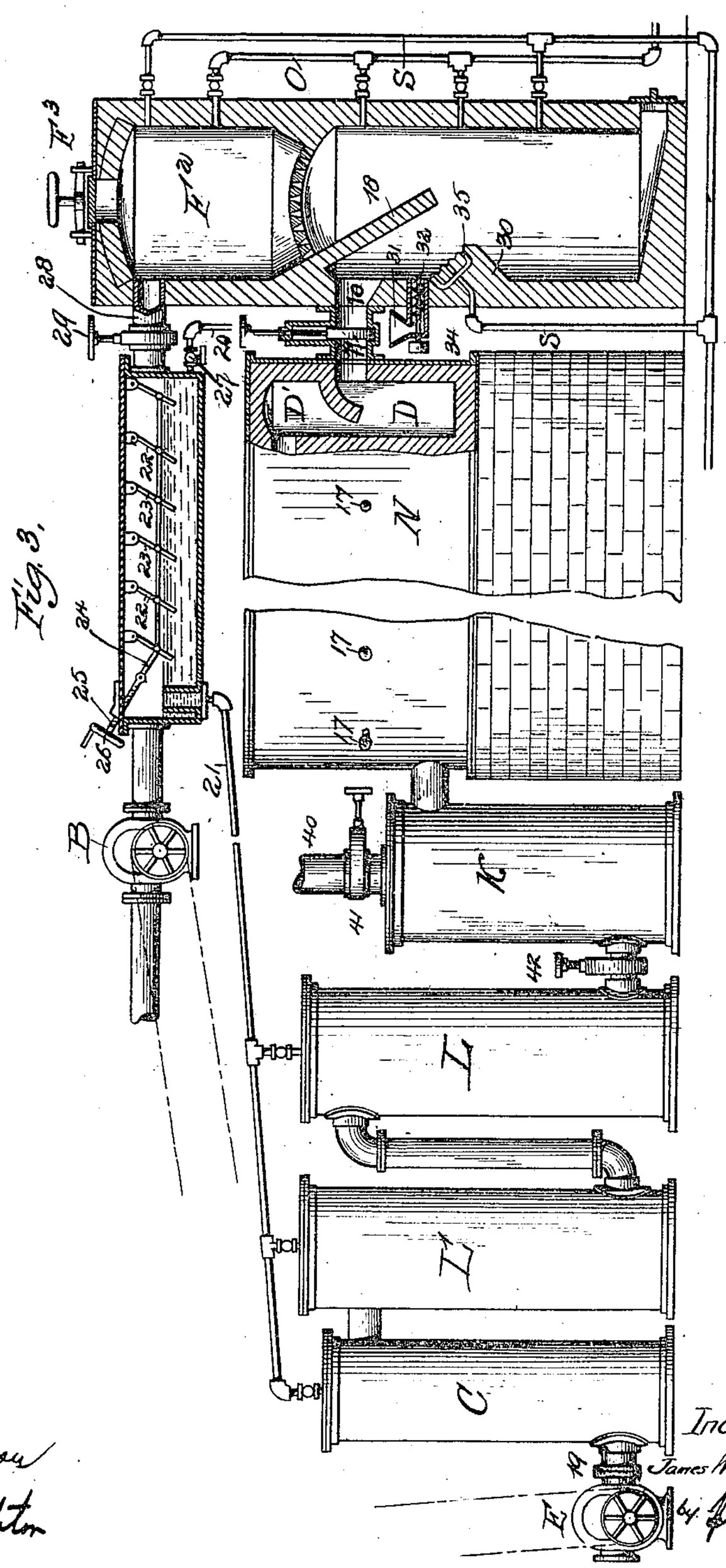
Fig. 3.



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UNITED STATES PATENT OFFICE.

JAMES W. CHISHOLM, OF SAN FRANCISCO, CALIFORNIA.

WATER-GAS GENERATOR.

SPECIFICATION forming part of Letters Patent No. 652,082, dated June 19, 1900.

Application filed October 4, 1899. Serial No. 732,545. (No model.)

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 Apparatus for Manufacturing Gas, of which the following is a specification.

My invention is an improvement upon the apparatus for generating gas shown in Letters Patent of the United States granted to Hall on the 23d day of March, 1893, and numbered 494,200, said patent also having relation to patents of the United States numbered, respectively, 494,198, 494,199, and 494,201. The special points of the said improvement and the purposes thereof are fully set forth hereinafter in connection with the accompanying drawings, in which—

Figure 1 shows a longitudinal section of my improved gas-making plant. Fig. 2 shows a horizontal section of the same; and Fig. 3 shows, partly in section and partly in side elevation, a form in some respects modified.

In the reorganization of the apparatus shown in the Hall patent, No. 494,200, I have sought to economize heat and to obtain a more perfect and even continuity of operation, and, further, to improve the effectiveness generally and durability. To this end I have used a single regenerator, in which an even and controlled heat is maintained, and have connected therewith two generating-furnaces, symmetrically arranged in their relation to the single regenerator, so that their action is uniform, and one may be made to reinforce or take the place of the other under precisely the same conditions, and thus maintain the same even action which I have found necessary to the best operation of the peculiar form of regenerator of the said Hall patent. These 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 explained, 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, 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 an 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 a dust-cleaning space in the ash-pit and tends to bring the furnace practically nearer to the 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 the reorganization 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 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' R², &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 regenerator-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 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. In a gas-generating apparatus, a regenerator consisting of several closely-connected chambers, each having receptacles containing materials of opposite polarities, a dust-chamber in direct and close communication therewith, and a furnace in direct and close communication with the dust-chamber, substantially as described.

2. In a gas-generating apparatus, a regenerator consisting of several closely-connected chambers each having receptacles containing materials of opposite polarities, a dust-chamber connected closely and directly to the generator, and a pair of furnaces each closely and directly connected to the dust-chamber, substantially as described.

3. In a gas-generating apparatus, a regenerator consisting of several closely-connected chambers each having receptacles containing materials of opposite polarity, a dust-chamber or dust-chambers in close and direct communication therewith and a pair of furnaces in close and direct communication with the dust chamber or chambers, substantially as described.

4. In a gas-generating apparatus, a regenerator consisting of several closely-connected chambers each having receptacles therein containing materials of opposite polarities, with passages for the products of combustion among said receptacles, a dust-chamber in close and direct communication with said regenerator, and a pair of furnaces in close and direct communication with said dust-chamber, substantially as described.

5. In a gas-generating apparatus, a regenerator consisting of several closely-connected chambers each having electrical means within itself actuated by the heat of the products of combustion passing through it, a dust-chamber closely and directly in communication therewith, and a furnace connected closely and directly to the dust-chamber, substantially as described.

6. In a gas-producing apparatus, a downdraft-furnace, a dust-chamber connected closely and directly thereto, and a regenerator consisting of several chambers each having receptacles containing within it materials of opposite polarities closely and directly connected to the dust-chamber, substantially as described.

7. In a gas-generating apparatus, a regenerator comprising a plurality of cylindrical chambers symmetrically arranged in parallel rows with a single chamber at each end of said rows, and surrounding structure of substantially-elliptical form, embedding and surrounding said plurality of chambers, substantially as described.

8. In a gas-generating apparatus, a regenerator consisting of several closely-connected chambers each containing receptacles filled with materials of opposite polarities, a downdraft-generator, a pressure-blower connected with said downdraft-generator and arranged to force the products of combustion through the regenerator, and a suction-blower arranged on the opposite end of the apparatus and acting to draw the products of combustion in the generator, substantially as described, thereby equalizing the pressure throughout the apparatus.

9. A regenerator consisting of several closely-connected chambers each having receptacles containing materials of opposite polarities in combination with the downdraft-furnace, of a gas-producing apparatus, and a downwardly-inclined deflecting-wall arranged below the grate, and, in the path of the products of combustion and with an ash-pit below the wall, substantially as described.

10. In a gas-generating apparatus and in combination a regenerator consisting of several closely-connected chambers each provided with electric means within itself excited to action by the heat of the products of combustion, and a generator consisting of a furnace for carbonaceous material and closely connected therewith, and means for supplying air and steam to said furnace, substantially as described.

11. A regenerating-chamber consisting of a series of subordinate cylindrical chambers arranged side by side and connected to form a continuous passage for the gases therethrough, said subordinate chambers being provided with receptacles containing materials of opposite electric polarities said chambers embedded in a common brickwork, the contour of which is curved to conform to that of the inclosed series, substantially as described.

In testimony whereof I have affixed my signature, in presence of two witnesses, this 8th day of September, 1899.

JAMES W. CHISHOLM.

Witnesses:
SIDNEY C. EASTMAN,
JAMES W. DAVIS.