

No. 763,313.

PATENTED JUNE 21, 1904.

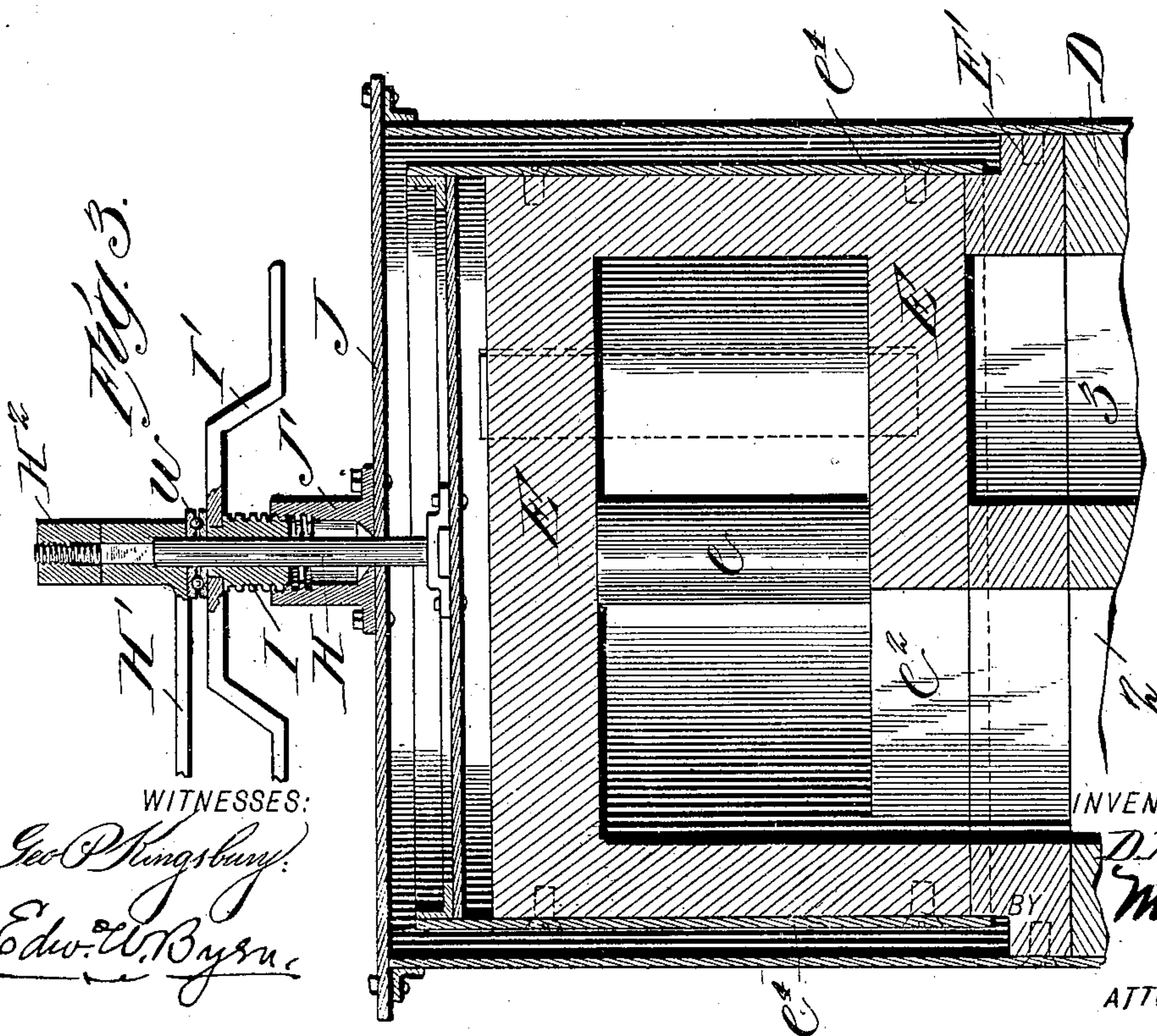
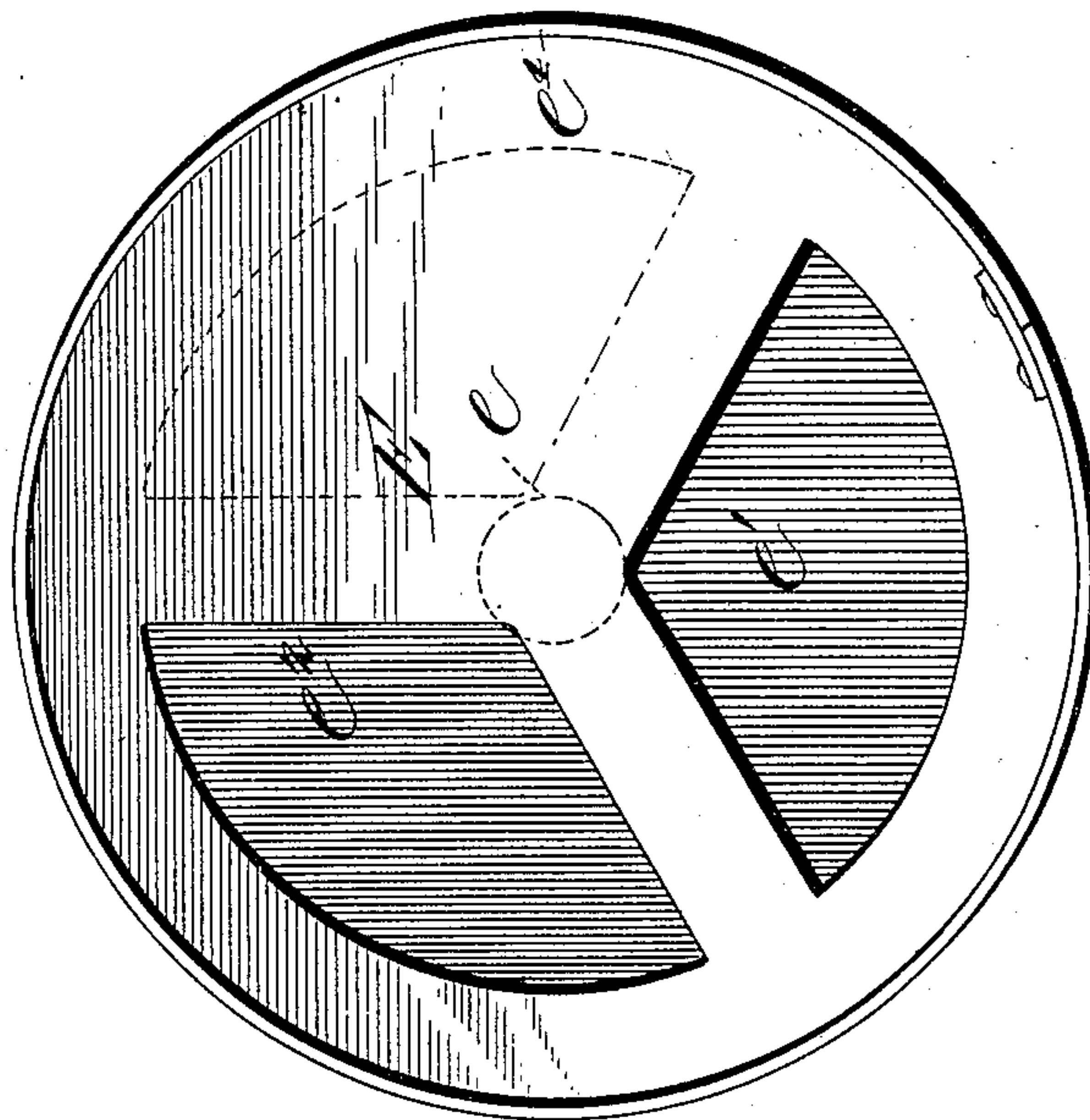
D. McDONALD.
WATER GAS GENERATOR.

APPLICATION FILED JAN. 21, 1903.

NO MODEL.

4 SHEETS—SHEET 3.

Fig. 4.



WITNESSES:
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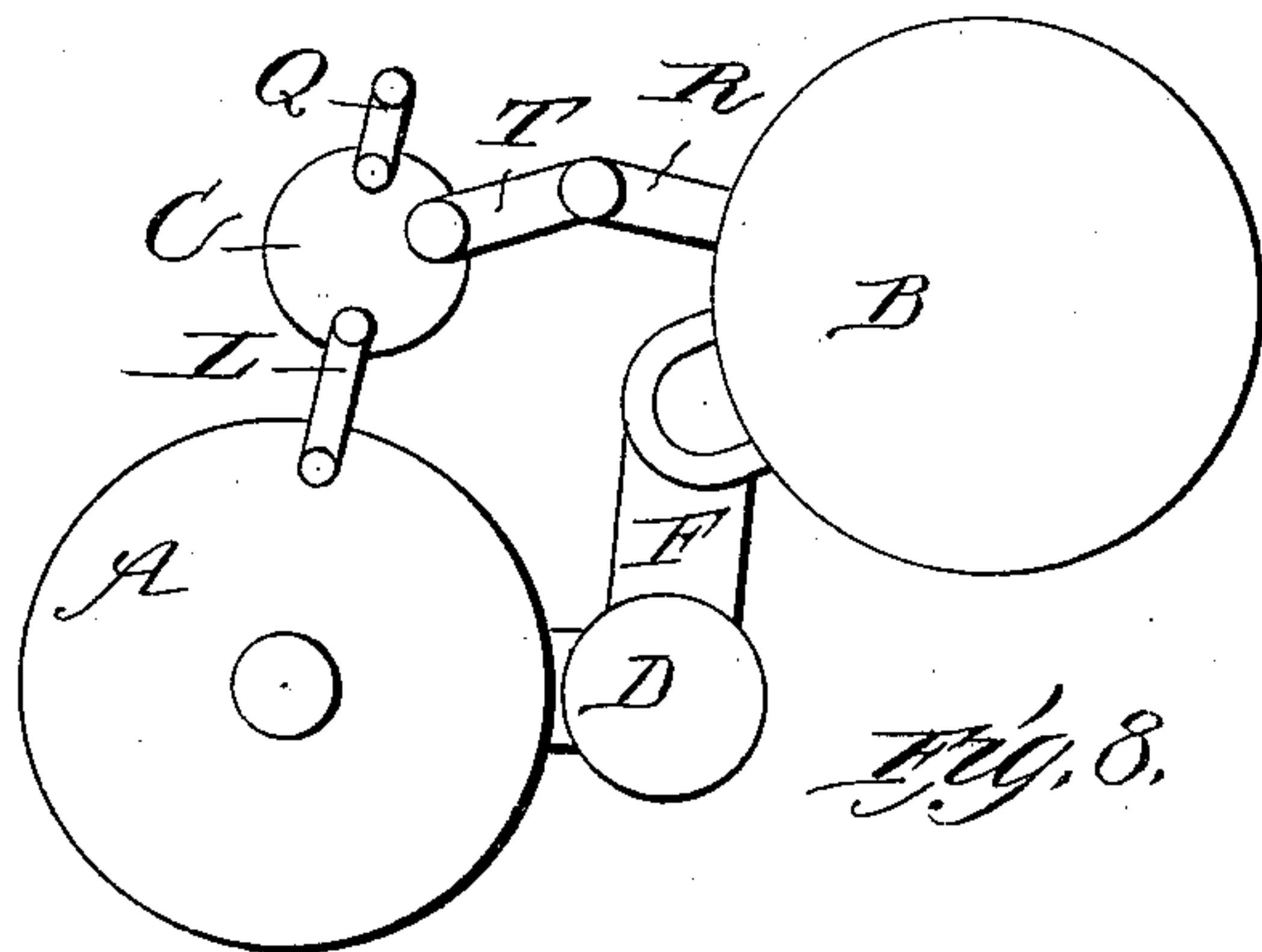
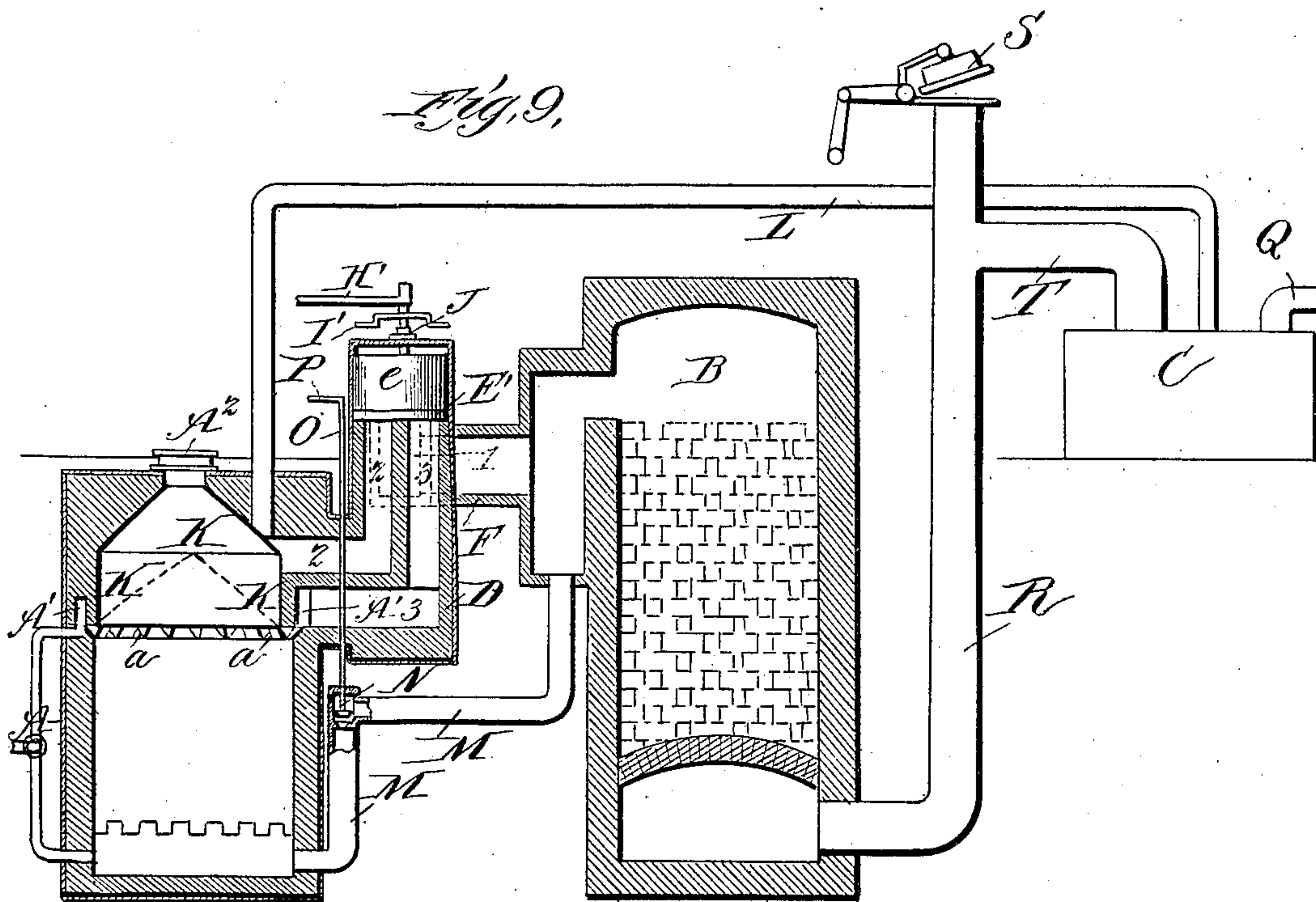
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UNITED STATES PATENT OFFICE.

DONALD McDONALD, OF LOUISVILLE, KENTUCKY.

WATER-GAS GENERATOR.

SPECIFICATION forming part of Letters Patent No. 763,313, dated June 21, 1904.

Application filed January 21, 1903. Serial No. 140,044. (No model.)

To all whom it may concern:

Be it known that I, DONALD McDONALD, of Louisville, in the county of Jefferson and State of Kentucky, have invented a new and useful
 5 Improvement in Apparatus for Making Water-Gas, of which the following is a specification.

My invention is in the nature of an apparatus for making water-gas from soft or bituminous coal by which the volatile matters
 10 in the soft coal are saved and utilized to enrich the gas and the soft coal is coked in a way to economically use it in this process of gas-making.

Attempts have heretofore been made to utilize soft coal for making water-gas; but a difficulty has been encountered in that the blast
 15 in passing through the soft coal carries away the volatile matters. A ton of soft coal contains about five hundred pounds of volatile bitumen and fifteen hundred pounds of coke.

In my invention the volatile bitumen is saved and utilized by being made to take the place
 20 of oils for enriching the water-gas, and the coke made is very much cheaper than coke purchased from ovens or coal-gas works.

My invention consists of a novel construction of apparatus which permits the above results to be carried out, which I will now proceed to describe, with reference to the drawings, in which—

Figure 1 is a vertical section of the upper part of a generator constructed in accordance with my invention. Fig. 2 is a horizontal
 35 section taken on the broken line 2^a 2^b 2^c 2^d, showing also the superheater and its connection. Fig. 3 is an enlarged detail, in vertical section, of the valve which controls the passage of gases from the generator to the superheater. Fig. 4 is an underneath view of the valve. Figs. 5, 6, and 7 show three different
 40 positions of the valve on the valve-seat. Fig. 8 is a general plan view of the entire apparatus; and Fig. 9 is a diagrammatic view, partly in cross-section, of the entire apparatus spread
 45 out to permit the operative relation of the parts of the apparatus to be seen.

In the drawings, A is an ordinary water-gas generator, B the superheater, and C the
 50 liquid seal, in which in a general way the wa-

ter-gas is made as usual—that is to say, steam is admitted to the fuel in the generator from a pipe below (not shown) and the gas passes to the top of and down through the superheater and then through another pipe R, Fig. 55 9, to the liquid seal.

In my invention (see Figs. 1, 2, and 9) I form in the top part of the generator a circular flue A' about six feet below the charging-door A². This flue is built in the wall of the generator, 60 occupies a horizontal position, and opens into the generator through a series of openings *a a a*.

On the side of the generator near the top is built an offsetting vertical stack D, formed 65 of a metal jacket and a fire-brick lining, the lower part of the stack being divided into two flues 2 and 3, of which the flue 3 communicates with the circular flue A' in the generator, while the flue 2 communicates on a higher 70 level with the interior of the top of the generator. At the top of the stack D there is also formed a recess 1, Fig. 2, which, with the flues 2 and 3, divides the top of the stack into three equal parts, surmounted by a valve-seat 75 E', of soapstone, which is fixedly held to the other casing of the stack by screws, lugs, or other suitable means, as seen in Fig. 3. The part 1 communicates with the pipe F, that leads to the superheater, while 2 and 3 com- 80 municate with generator, as already described. On top of the valve-seat E' there rests and turns about a vertical axis a hollow cylindrical cap-valve E, closed at the top and sides and having a chamber within it which opens 85 through the bottom through two equal ports *e'* and *e''*, (see Fig. 4,) corresponding in size and position to any two adjacent ports of the three ports 1 2 3 in the valve-seat E'. The valve E is made of soapstone and has a cen- 90 tral axial core *e* and is fixed to and carried in an external metal casing *e'*. This valve is arranged to be turned about a vertical axis, so as to place its two communicating ports *e'* *e''* into open communication with any two adjacent 95 ports of the ports 1 2 3, and for this purpose a central stem H is rigidly attached to the valve by means of the external metallic casing *e'* and extends through the cover J of the stack D and has a handle H' attached to it, by which 100

it is turned. The hub of the handle fits on the squared end of the shaft and is retained by a screw-nut H^2 . As the valve is rather heavy, in order to facilitate its turning upon the seat it is first raised slightly, and for this purpose (see Fig. 3) the stuffing-box J' , through which the stem H emerges, is screw-threaded on the inside, and a sleeve I is correspondingly screw-threaded on the outside and is provided with rigidly-attached handle I' , and when these are turned the sleeve I rises and bears against the hub of the arm H' and lifts the valve through stem H . To reduce friction between the handles I' and the hub of the arm H' , two movable washers w , with ball-bearings between them, are interposed between the same in such a way that when the handle I' is turned to the left the weight of the valve is suspended by means of the stem H and nut H^2 , which rests on the handle-hub H' , which latter is carried on the ball-bearing washer.

From the top of the generator there is carried an eight-inch cast-iron pipe L , (see Fig. 1,) leading over to the seal and dipping under the water of the same. This pipe has a butterfly-valve G , a test-light G' , and an escape-pipe G^2 , controlled by a stop-cock G^3 .

The operation of the apparatus is as follows:
 30 The generator, Figs. 1 and 9, is filled with coke a little above the line $K K K$. The air-blast is sent up through this coke until it becomes thoroughly heated and until the whole top of the generator is red hot. As soon as
 35 this coke is hot about one ton of soft coal is dumped on top of it and the rotary valve E is turned so as to leave flue 2 open to the recess 1, leading to the superheater, as seen in Fig. 5. Steam is then turned under the coke,
 40 passes up through the hot coke, and makes water-gas. This water-gas passes through the coal, taking up with it a large amount of the volatile matter, which passes out through flue 2 and pipe F and down through the super-
 45 heater and on through pipe R to the seal. As soon as the run is over—that is, when the coke ceases to be incandescent—the valve is turned, as in Fig. 6, so as to connect 1 and 3 and put circular flue A' into communication with the
 50 superheater. The blast is then again sent up through the coke, heating the coke thoroughly and also heating the coal, but not passing through the coal. Such coal-gas as is made during the blast passes over through the pipe
 55 L to the seal, the quality of it being judged by the test-light G' and the quantity regulated by the butterfly-valve G . The vent-pipe G^2 , Fig. 1, is left open during the early blasts on the machine—that is, the blasts which are
 60 made before the coal is dumped in—so as to prevent those blast-gases which leak past the butterfly-valve G from passing through the seal and mingling with the finished gas. While the coke is being blasted in the usual run, the
 65 blast-gases pass up through the generator A

into the circular channel A' , out through the flue 3 in vertical stack D , down through the checker-brick in the superheater B , up through the pipe R , and out of the stack-valve S . When gas is being made, it follows the same course, except that it does not enter the circular channel A' , but passes up through the soft coal and flue 2, thence to and down through the superheater, up through the pipe R , and the stack-valve S being in the meantime closed the gas passes through the pipe T , bubbles up through the water in the seal C , and passes out to the gas-holder through the pipe Q . The generator A has also a pipe $M M$ leading from the bottom of the generator into the top of the superheater B . This pipe is controlled by a valve N , opened and closed by means of a vertical rod O and a lever-handle P .

When three or four runs have been made up through the coke, the bottom part of it begins to get dead, and it is necessary to make what is called a "down-run" in order that this dead coke may be again heated up by means of the sensible heat contained in the hot water-gas which has just passed through the incandescent coke in the top part of the generator. This down-run is made by turning the valve E so as to close the opening 1, as seen in Fig. 7, thus shutting off the top part of the superheater entirely from the generator. At the same time the valve N , Fig. 9, is opened by means of the lever P and the vertical rod O , and the pipe M from the bottom part of the generator is in this way brought into connection with the top part of the superheater. When this has been done, steam is turned in, either on top of the coal or into the circular channel A' , and thus on top of the coke. This steam passes down through the coke, makes water-gas, and at the same time heats up the dead coke before spoken of, and the water-gas thus made passes through pipe M into the top of the superheater, down through the superheater, up through the pipe R and the pipe T to the seal. Before making this down-run the coke in the generator is blasted to incandescence; but that part of the coke which is too cold to ignite is not heated by the blast, and hence must be heated by the down-run in the manner described.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In a gas-generating apparatus, the combination of a generating-chamber, a superheater, means connecting the superheater with a point in the generating-chamber intermediate the top and the bottom thereof, means connecting the superheater with the generating-chamber above the first-mentioned connecting means, means for bringing either of said connecting means between the superheater and the generating-chamber into use at will, means for supplying steam and a blast at different times upwardly into the generating-chamber

from a point below both of said connecting means, a gas-seal, a pipe connecting the generating-chamber and the gas-seal, a test-light in said pipe, a pipe connecting the superheater and the gas-seal, and an exhaust-valve in said pipe.

2. In a gas-generating apparatus, the combination of a generating-chamber, a superheater, means connecting the superheater with a point in the generating-chamber intermediate the top and the bottom thereof, means connecting the superheater with the generating-chamber above the first-mentioned connecting means, means for bringing either of said connecting means between the superheater and the generating-chamber into use at will, means for supplying steam and a blast at different times upwardly into the generating-chamber from a point below the connecting means, means connecting the lower part of the generating-chamber and the superheater, a gas-seal, a pipe connecting the generating-chamber and the gas-seal, a test-light in said pipe, a pipe connecting the superheater and the gas-seal, and an exhaust-valve in said pipe.

3. A water-gas generator having around its upper portion a flue opening through holes into the generator and having an offsetting vertical stack with two flues in it one opening into the surrounding flue of the generator and the other into the generator above this flue, a superheater with pipe connection to the top of this stack, and a rotary valve arranged to

turn upon the top of the stack and to connect either of the stack-flues to the superheater substantially as described.

4. A water-gas generator having at its upper end a vertical stack with two flues opening at different levels into the generator as described and an outlet to the superheater, a three-port valve-seat surmounting the same, and a chambered valve controlling said ports said valve being made of refractory material incased in metal, and means for turning said valve substantially as described.

5. A water-gas generator having a vertical stack at its upper end with flues and openings as described, a rotary valve surmounting the same, a stem and crank-handle for rotating said valve, a stuffing-box with interior screw-threads, and an externally-threaded sleeve with handle for turning the sleeve in the stuffing-box and raising the valve substantially as described and for the purpose set forth.

6. A water-gas generator having at its upper end a vertical stack with two flues opening at different levels into the generator and an outlet to the superheater, a three-port valve-seat surmounting the same, a rotary chambered valve made of refractory material and controlling the said ports, and means for raising the valve to permit the same to be rotated.

DONALD McDONALD.

Witnesses:

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WM. H. CRUTCHER.