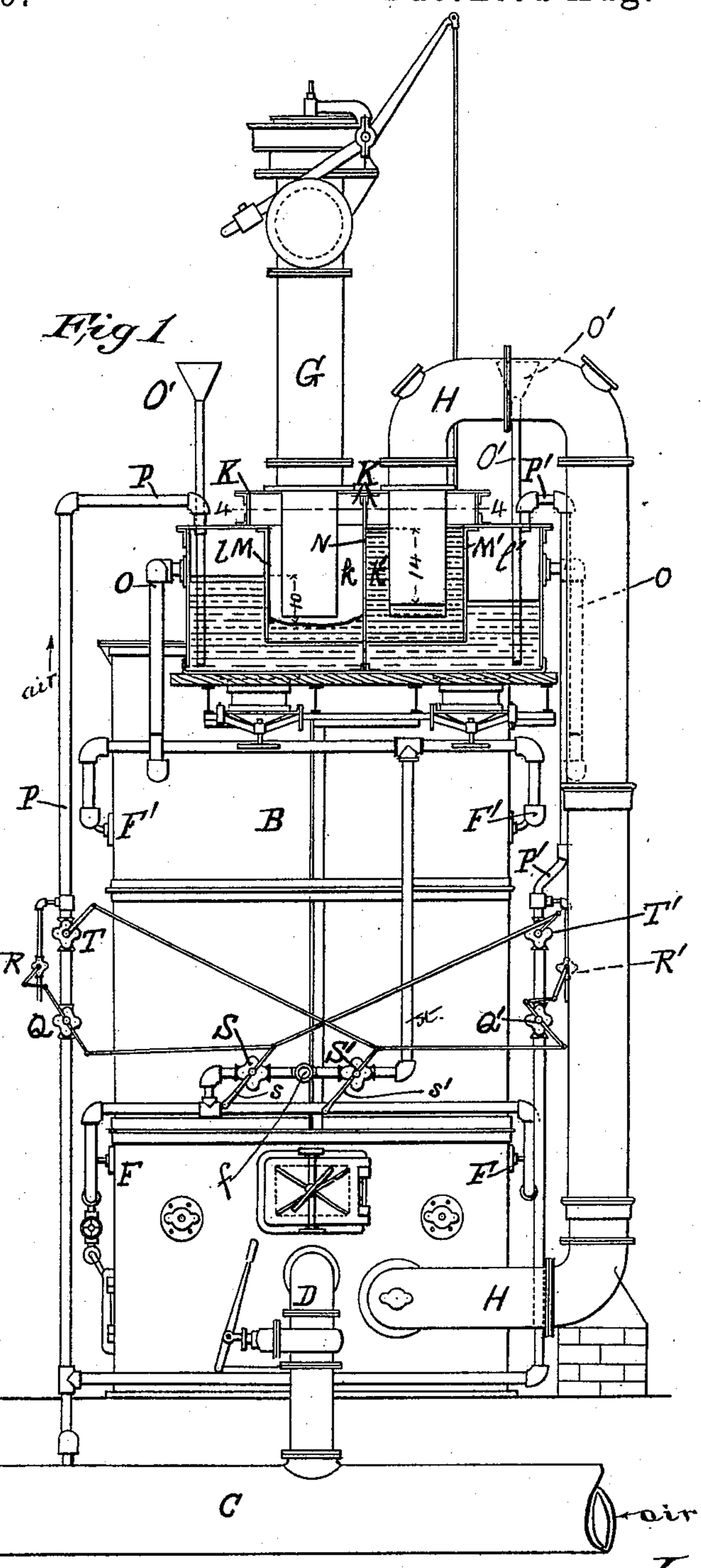
(No Model.) 4 Sheets—Sheet 1.

J. W. OGDEN.

GAS APPARATUS.

No. 589,219. Patented Aug. 31, 1897.

Fig 1



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4 Sheets—Sheet 2.

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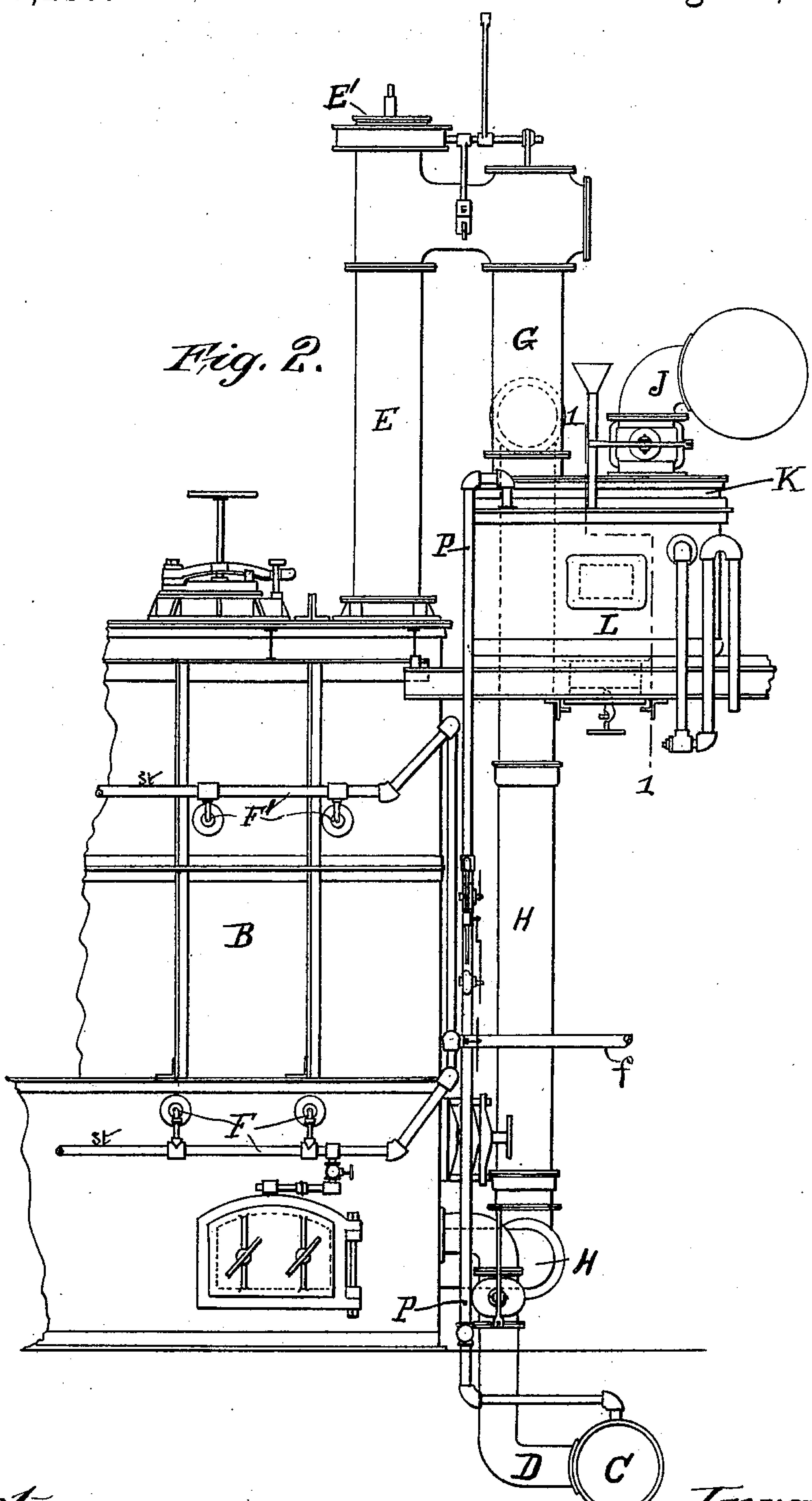
Fig. 2.



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(No Model.)

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GAS APPARATUS.

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Fig. 4.

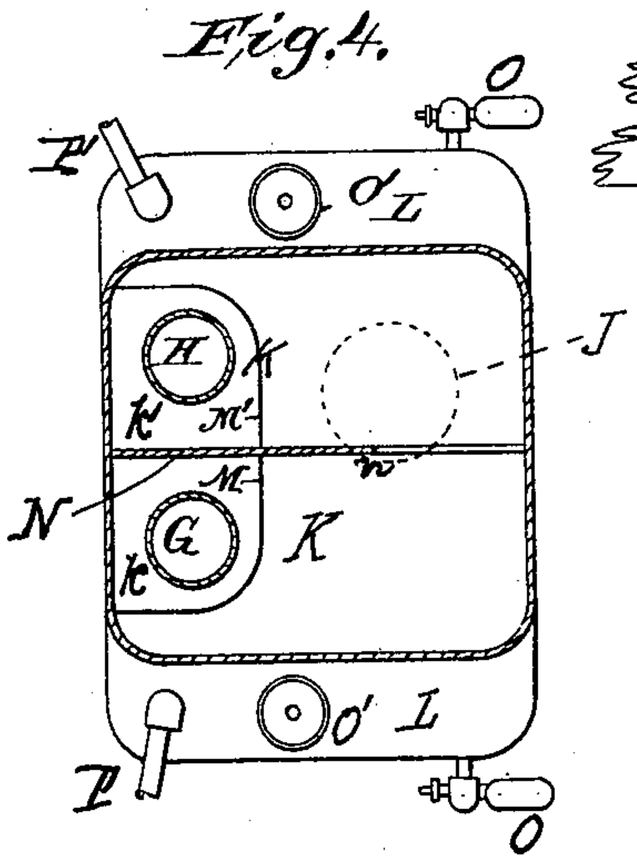
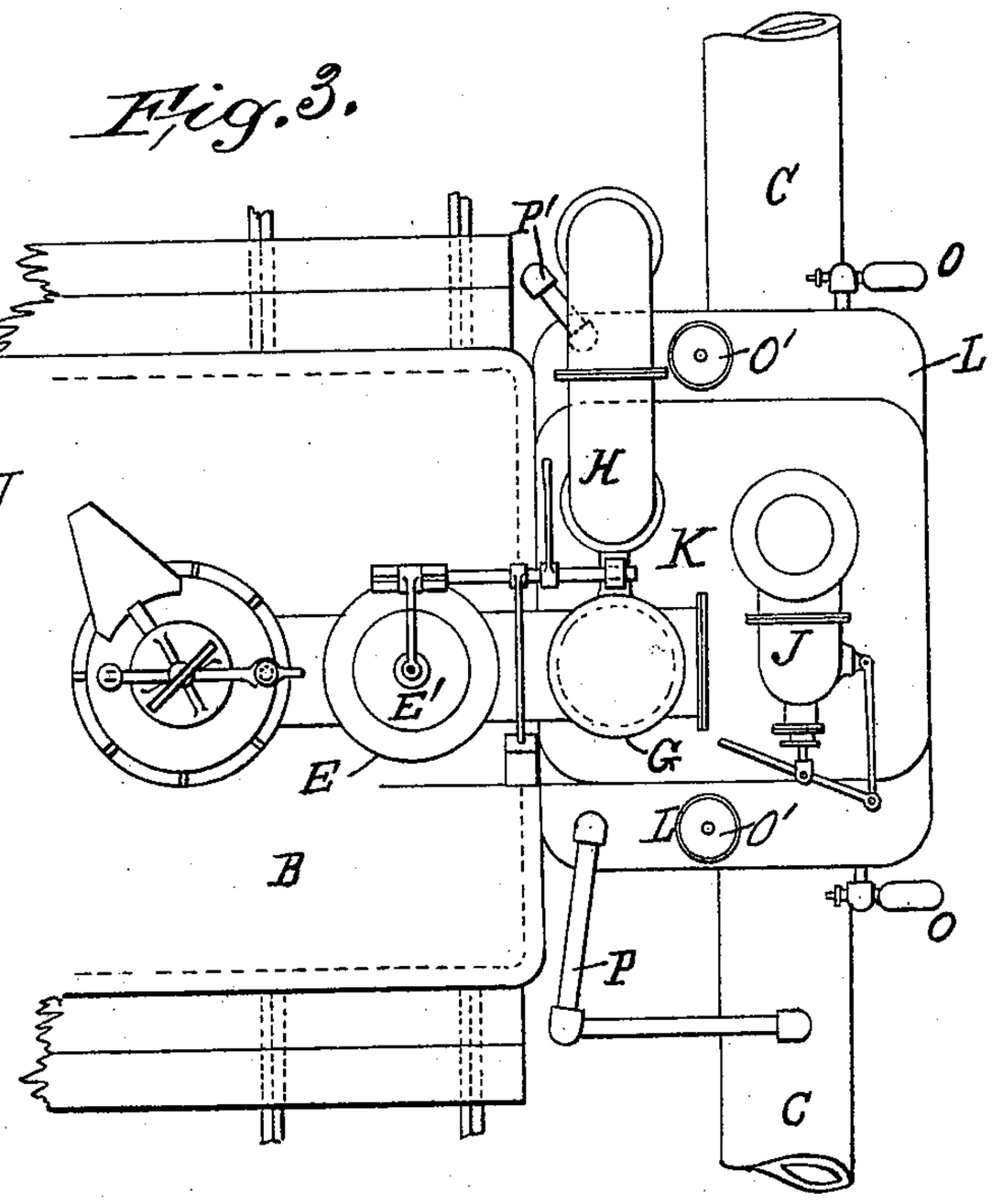


Fig. 3.



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4 Sheets—Sheet 4.

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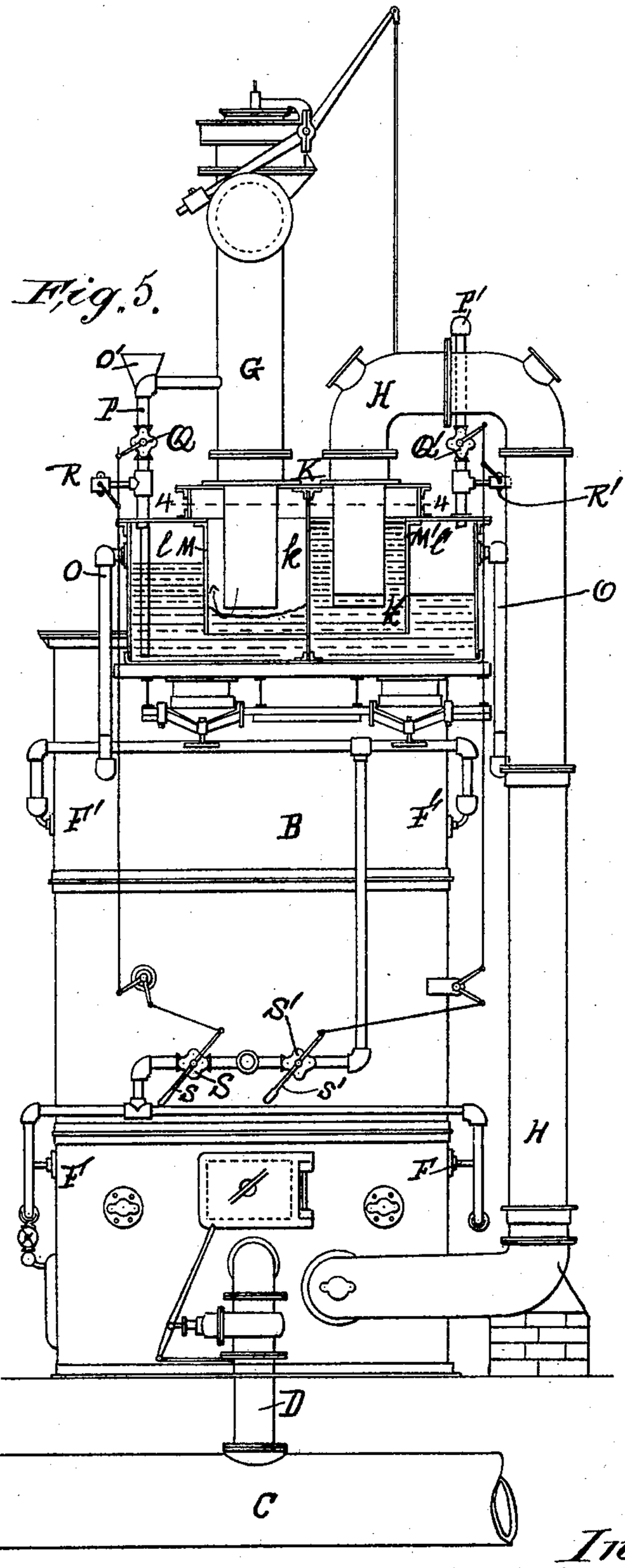
GAS APPARATUS.

No. 589,219. Patented Aug. 31, 1897.

Fig. 5.



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UNITED STATES PATENT OFFICE.

JOHN W. OGDEN, OF PLAINFIELD, NEW JERSEY.

GAS APPARATUS.

SPECIFICATION forming part of Letters Patent No. 589,219, dated August 31, 1897.

Application filed April 23, 1897. Serial No. 633,436. (No model.)

To all whom it may concern:

Be it known that I, JOHN W. OGDEN, residing at Plainfield, New Jersey, have invented certain new and useful Improvements in Gas Apparatus, of which the following is a description, referring to the accompanying drawings, which form a part of this specification.

The object of my invention is to simplify and improve the type of apparatus now in general use.

The invention is particularly applicable to gazogenes for making water-gas, though it will be seen that it is not so limited in its application.

By my invention I do away with the plungers, metal valves, or other mechanical means which have been used in water-boxes to close at will the gas-passage from one end of the generator and open the passage from the other end.

With this end in view I have devised a pressure-controlled water seal or valve, which I will now explain in full and illustrate by two approved embodiments.

In the drawings, Figure 1 is a front elevation of a gas-generator, showing the water-box in section and provided with my improvement. Fig. 2 is a side elevation of the same. Fig. 3 is a plan view of the water-box and its connections. Fig. 4 is a horizontal section of the water-box on the plane 4 4 of Fig. 1. Fig. 5 is a view similar to Fig. 1, showing a modification.

Throughout the drawings like letters of reference indicate like parts.

My invention will be understood from a description of the drawings.

The generator itself is indicated at B. It will be understood that the generator is duly charged with coal, and the coal then raised to the high temperature required by means of the air-blast from the main C and pipe D. The products of combustion pass up through the pipe E, which is open at the top, the valve E′ being then raised for that purpose. In the drawings the parts are shown in the position during generation. After the coal has reached a suitable temperature for the generation of gas the air-blast is shut off and the valve E′ closed. Steam is then introduced by the connections or twyers F beneath the mass of incandescent fuel. The steam, coming in contact with the hot coals, is decomposed, as will be understood, into hydrogen and oxygen, the oxygen uniting with the carbon of the coal to form ultimately carbon monoxid. The water-gas so formed passes up the pipe E and down pipe G, breaking the water seal in the water-box L, as shown by the arrow in Fig. 1, and passing from the water-box through the discharge pipe or passage J to the so-called "hydrogen-holder." After running some time in this manner the steam is shut off from the lower twyers or connections F and supplied in turn through the upper ones F′, reversing the operation. The pipes E and G are now sealed by the water-box in the manner which will be explained later, and the generated gas is delivered from beneath the coal through the pipe H, breaking in turn the corresponding seal in the water-box, and finally escaping through discharge-pipe J to the gas-holder.

By my invention I so control the water in the water-box that one of the pipes G and H is alternately sealed against and the other one unsealed by the gas from the generator. As steam is admitted to the generator under a pressure of perhaps twenty-two inches it is clear that the pipe which is sealed off has to be sealed against a possible pressure of twenty-two inches, but the gas is finally delivered through the discharge-pipe J at a pressure of about six or eight inches, leaving a resultant pressure of only about fourteen or sixteen inches to be dealt with. I make use of pneumatic pressures upon the surfaces of water in reservoir-chambers within the water-box in such a way that I control both seals without the use of the plungers, metal valves, or other mechanical devices, merely supplying and relieving the pressures as needed.

I will not describe in detail any of the well-known parts of the generator, as they do not directly concern my invention.

Considering first the construction shown in Figs. 1, 2, 3, and 4. In Fig. 1 is shown the interior of the water-box as it is when gas is being delivered from the generator through the pipe G. The pipes G and H enter and run down into the water-box through the top of the raised upper portion K, from which also the discharge-pipe J leads. This will be

clearly understood from the plan view, Fig. 3, and the section, Fig. 4, in which latter figure the top of the portion K is removed, but the position of the pipe J is indicated in dotted lines. The pipes G and H extend down into the lower part of the box L sufficiently to give good depth of water for sealing. Where the maximum pressure is twenty-two inches and the pressure in the pipe J and in the communicating double chamber or spaces *k k'* within the compartment K is six or eight inches this sealing height must exceed somewhat the difference between these two pressures fourteen or sixteen inches. The lower part L of the water-box is divided centrally by transverse partition N into two entirely separate chambers or compartments *l l'*. Above water-level these compartments *l l'* are separated from the compartment K by means of the partitions M M', which extend from the top of the box L nearly to its bottom, but leave the water in *l* in communication with water in *k* and that in *l'* in communication with *k'*. The top of the box L is cut away within partitions M M' to leave chambers *k k'* open into compartment K. The pipes G and H pass through the top of the compartment K and extend down in respective chambers *k k'* into the water, as clearly seen in Fig. 1. The central partition N, which divides the lower portion of the box L in two parts, preferably extends up to the top of the compartment K, but at a part of its width only, as is shown in Fig. 4 at *n*. This is done to prevent the water surrounding the pipe G splashing over into the space surrounding the pipe H, or the reverse; but at the portion of the partition N which is removed from the vicinity of the pipes G and H and is above the top of the main box L the partition will either not extend at all, or preferably will extend upward about an inch for the purpose of preventing water which may be splashed up on either side of it from passing from one chamber *k k'* to the other. The chambers *l l'*, which form reservoir-chambers, are provided with overflows O with a U-seal or other seal sufficient to stand a pressure of twenty-two inches. The seal is shown in the drawings in the form of a U-tube. The compartments or chambers *l l'* are filled by the funnels O', which have a sufficient length and depth to keep sealed at the maximum pressure. Connected with the respective air-spaces *l l'* within the box L are the control or pressure pipes P P', which lead from the air-main in Figs. 1 and 2 and from the gas-pipe in Fig. 5. The relief-valves R R' open the chambers *l l'* to the atmospheric pressure or cut them off. The pressure control-valves Q Q' respectively connect the pipe P and the pipe P' with the source of controlling-pressure. In Figs. 1 and 2 this is the air-blast main C. Secondary or cut-off valves T T' are required when this controlling-pressure is less than the maximum steam-pressure, as will be presently explained. The valve S admits steam from the main *f* to the connections or twyers F—that is to say, beneath the incandescent fuel. This valve is controlled by handle *s*, which also operates the valves Q R T'. The lever *s'* works the steam-valve S', which introduces steam through the connections F', as already explained, and this lever similarly is operatively connected with the valves Q', R', and T. In the position shown in Fig. 1 the valves S and R are open. Q and T' are closed. The valves S' and R', which are connected to the levers *s'*, are closed, and Q' and T are open; but before the steam-valve S was opened the relief-valve R was closed, and pressure-valve Q was open, so that the air-blast pressure was admitted from the main C through the valves Q and T and pipe P to the chamber *l* and through valves Q' T' and pipes P' to chamber *l'*, a pressure, let us say, of fourteen inches, sufficient to raise the water in pipes G H fourteen inches above the level in the chambers *l l'* and to raise the level around these pipes in the chambers *k k'* to six or eight inches less, owing to resisting pressure in these chambers and in discharge-pipe J. When, however, the steam-valve S was opened, the connected cut-off valve T' was closed, pressure-valve Q closed, and relief-valve R opened, so that atmospheric pressure is restored in chamber *l*, while chamber *l'* is completely cut off and forms a cushion-space in which exists at first a pressure of fourteen inches. The steam-valve S being open, full pressure of steam is now admitted beneath the coal, giving a pressure, say, of twenty-two inches to be sealed in the gas-pipe H and a pressure of only eight or ten inches in pipe G, owing to the free escape of the gas through the seal into space *k*, this latter pressure being sufficient to break the seal of two inches or thereabout around the bottom of the pipe G against atmospheric pressure in reservoir-chamber *l*. To understand this clearly, it will be necessary to consider the hydrostatic conditions in the left half of the water-box, as viewed in Fig. 1. In the pipe G there is a pressure, say, of ten inches, and immediately surrounding the pipe is a pressure of about eight inches. The delivery of the volume of gas from the pipe G not only breaks the seal but keeps the water in the condition roughly shown in the figure. There being atmospheric pressure in the chamber *l* the water must reach a level of about eight inches above the level of the water in the space *k* immediately surrounding the pipe G. The surplus water, if any, runs off through the U-tube O. On the right-hand side of the water-box, however, the air under pressure of fourteen inches in the space *l'*, which had raised the level of the water surrounding the mouth of the pipe H to about six inches higher than in the space *l'* and raised it within the pipe H to fourteen inches, is now confined and forms a resisting-cushion to the rise of the water in chamber *l'*. Therefore as the pressure within the pipe H depresses the water in the pipe that water, being able to flow into the chamber *l'* to a

very limited extent by reason of the complete closure and cushioning in that chamber, backs up around the pipe H in the chamber *k'* until the level reaches fourteen inches above the level in pipe H and hydrostatic balance is produced, as shown, and without breaking the seal about pipe H.

The horizontal cross-section of the several compartments may be of about the proportions shown, which will produce these results. In the condition shown in Fig. 1 the amount of water contained in the left-hand side *k* of compartment K is a minimum, while in chamber *l* it is correspondingly at its highest. The surface area of the water in the reservoir-chambers *l l'* should be considerable as compared with the areas in chambers *k k'* within the partitions M M', so that the variations in the levels of the water within chambers *k k'* will not greatly affect the level in the corresponding chamber *l* or *l'*.

When it is desired to reverse the generation of gas by closing the steam-valve S and opening the steam-valve S', so as to admit steam through connections or twyers F' and deliver gas through pipe H, the handle *s* is thrown to the right of Fig. 1, closing the steam-valve S and relief-valve R and opening the pressure control-valves Q and T'. This also is the position of the parts during "blowing up"—that is to say, while the coal is being raised to the necessary temperature for generating the water-gas. Both chambers *l l'* are now subjected to the pressure of fourteen inches and the pipes G and H are sealed to the maximum depth.

When, now, the handle *s'* is thrown to the right, admitting steam through the steam-valve S' to twyer connections F', the relief-valve R' is opened, restoring atmospheric pressure in the chamber *l'*, while the pressure-valve Q' and cut-off T are closed, the latter confining the air in chamber *l*. The parts will then be in the reverse position as to that shown in Fig. 1, gas being delivered through the pipe H, the pipe G being sealed, chamber *l* forming a cushion.

In Fig. 5 a modification and simpler form are shown, in which the maximum pressure of gas in the generator is used instead of the air-blast pressure in the chambers *l l'*. No cushioning is therefore required to resist the maximum pressure in pipes G and H and the pressure-control is simpler. The pressure control-pipes P P' connect the gas-pipes G and H with the respective chambers *l l'*. The pressure-valves Q Q', which control these connections P P', are operated through rods, chains, or other mechanical connections by the levers *s s'*. These same levers control the steam-valves S S' and relief-valves R R'. When both steam-valves S S' are closed, the relief-valves R R' are also closed and the pressure-valves Q Q' are open. When now the valve S is opened and steam is admitted at the connections F, the pressure-valve Q is closed and relief-valve R is opened. Gas is delivered through pipe G, as before described. The space above the water in the chamber *l* being at atmospheric pressure the seal around pipe G is readily broken. The chamber *l'* is, however, subject to pressure from the connection P'. This may be twenty-two inches, and is in any event the same pressure as acts in the pipe H, so that the level of the water in the mouth of the pipe H and in the chamber *l'* must be the same, while the level around the pipe H will be sixteen inches higher, giving sixteen inches water-pressure added to the six inches gas-pressure in the space *k'* to balance the twenty-two inches pressure in pipe H and chamber *l'*.

It must be understood that other sources of pressure than the air-main C and the pipes G and H may be used for operating my pressure-controlled hydraulic or hydrostatic sealing apparatus, but I have described in the foregoing the two most approved means now known to me.

I will omit all description of the valves, manholes, openings, and various apparatus for charging the generator, admitting and cutting off the air-blast, cleaning out, firing, and performing operations well understood by those skilled in this art.

I will also omit the further description of the details of the various parts and elements of my improvement, because such details are foreign to the essentials of the invention and would obscure, rather than make clear, the important features.

What I claim, however, and desire to secure by these Letters Patent, is as follows:

1. As an improvement in sealing devices for gas apparatus, the chamber *l* partially filled with liquid and closed above the surface of the liquid, means for varying at will the pressure on the surface of the said liquid within the chamber *l*, a second chamber *k* in which opens the mouth of a gas pipe or passage as G, and with which the said liquid communicates, and a second gas pipe or passage, as J, communicating with the said second chamber, whereby the said liquid may seal or unseal the said gas pipe or passage G, according to the pressures therein and to the pressure in the said chamber *l*, substantially as set forth.

2. In combination in a water-seal apparatus, an inclosing casing containing a body of liquid divided at its surface into three separated areas, the spaces above two of the said areas being connected respectively with gas receiving and delivering connections, and means for varying the pressure at will upon the third said area, and thereby affecting the levels in the other two said areas, substantially as set forth.

3. In combination in a water box or seal for gas apparatus, the respective pipes or passages G and H extending down into the said water-box, and connection J for delivering gas from the said water-box, the partition N dividing the said water-box between the pipes

or passages G and H, other partitions dividing off the surface of the water in each side of the box into two separate portions or areas *k k'*, into which dip the mouths of the respective pipes G and H, such portions or areas *k k'* of the water immediately surrounding the pipes G and H being subjected to the pressure in, and in communication with, the said pipe J, and means for controlling at will the pressure to which the remaining portions or areas of the water are subjected, substantially as set forth.

4. The improved water-box divided into two portions by the partition N, the gas-pipes G and H extending into the water in the respective portions of the box, the partitions M M' extending down into the water around the respective pipes G and H and subdividing the space above the water in each said portion into two chambers, namely, the space immediately surrounding each pipe, which space is in connection with the outlet or discharge pipe J, and the space or chamber containing the remainder of the liquid, which latter chamber is closed and provided with means for varying the pressure upon the surface of the water therein, substantially as and for the purposes set forth.

5. In combination in water-gas-generating apparatus and with the means for introducing steam above and below the incandescent fuel, the respective gas pipes or passages G and H, the water seals for the said passages G and H, reservoir-chambers for the said water seals, and means for introducing air or gas under pressure upon the liquid in said reservoir-chambers and thereby altering the depth of the seal at will, substantially as set forth.

6. In combination in water-gas-making apparatus, the pneumatically-controlled water seal therefor, and pneumatic connections for the said seal coöperatively connected with the steam-valve, substantially as set forth.

7. In combination in water-gas apparatus, with connections and valves for introducing the steam from above or below the fuel at will, the respective gas-passages G and H therefor, and the pneumatically-controlled water seals therefor, substantially as set forth.

In testimony whereof I have hereunto set my hand this 15th day of April, 1897.

JOHN W. OGDEN.

Witnesses:
GEORGE H. SONNEBORN,
HAROLD BINNEY.