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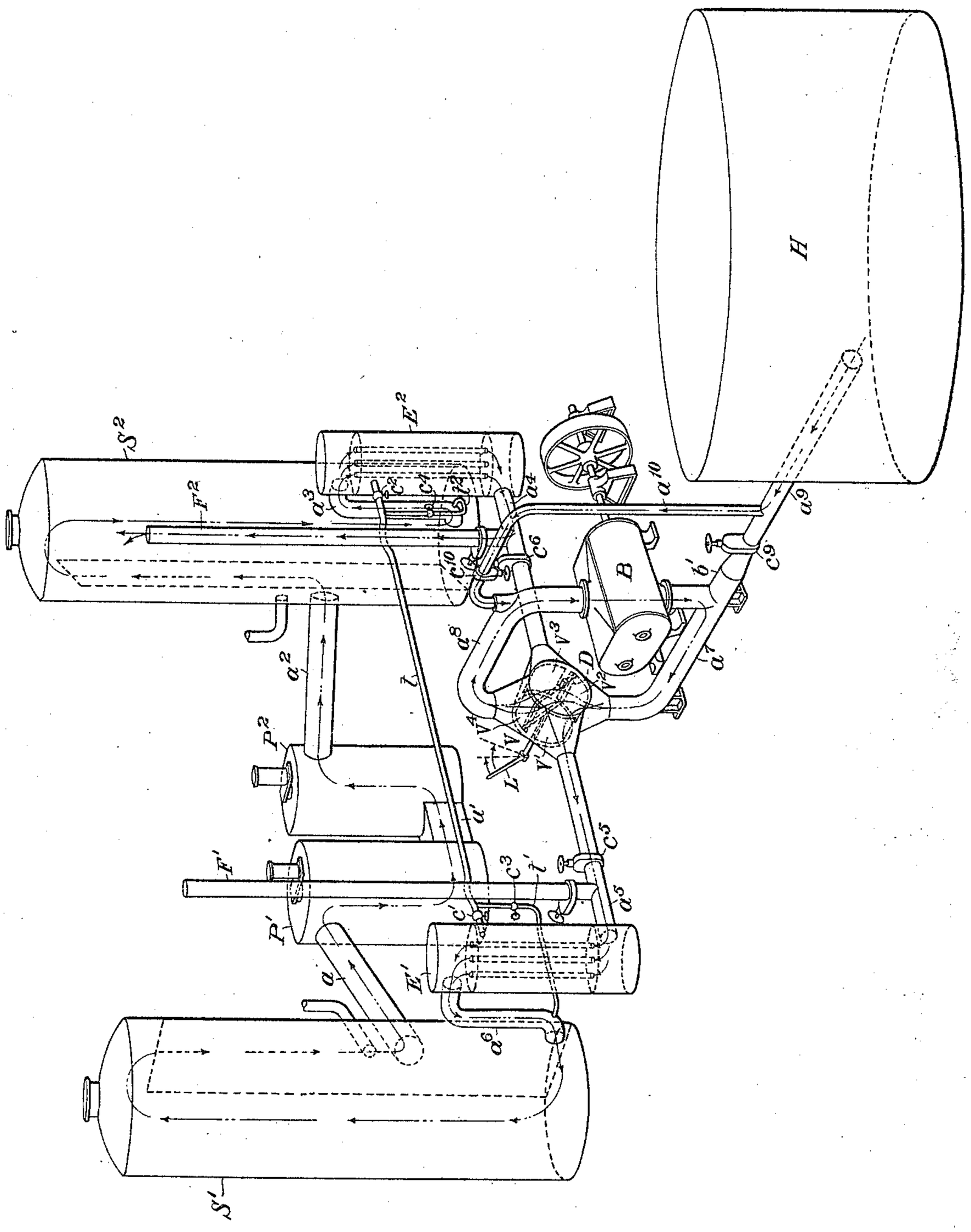
J. E. FRY.

METHOD OF MANUFACTURING GAS.

(Application filed Dec. 9, 1899. Renewed Jan. 22, 1901.)

(No Model.)



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METHOD OF MANUFACTURING GAS.

SPECIFICATION forming part of Letters Patent No. 680,770, dated August 20, 1901.

Application filed December 9, 1899. Renewed January 22, 1901. Serial No. 44,302. (No specimens.)

To all whom it may concern:

Be it known that I, JOHN EDWIN FRY, a citizen of the United States, and a resident of Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented certain new and useful Improvements in Methods of Manufacturing Gas, of which the following is a specification.

My invention relates generally to that class of gas-manufacturing processes in which heat is conveyed into the producers by circulating a quantity of the gas produced, this circulating gas being heated to a high temperature before it enters the producers and being cooled to a greater or less extent as it passes from the producers by being passed through a stove which has previously been used as a heating-stove, but has delivered up its heat to such an extent as to require reheating. In the process referred to the direction of the circulation of gas is reversed after this stove has been reheated; and my invention relates particularly to a novel method of reheating the stoves.

The general plan which I employ for reheating the stoves is to cause a portion of the gas which has been produced to be drawn from the gas-holder or other convenient part of the system and passed through the producers and into the stove to be heated and there consumed by the admission of a proper amount of air. It has heretofore been proposed to reheat the stoves by burning gas or other fuel therein, this gas or fuel being supplied from any convenient source and delivered directly to the stove; but by so doing the remaining portions of the system are liable to cool, and thus lower their pressures, and therefore not be in the best operative condition when the succeeding "gas run" is commenced. It has also been proposed to heat up the stove by blowing air through the producers, thus generating blow-gas, and burning this blow-gas in the stoves. This method is objectionable in some instances, for the reason that it is liable to leave a surplus of air in the stove, and unless care is exercised when the stove is subsequently used for heating the gas which is to be passed into the producers the retained air may cause an explosion. By my method the entire system will be kept hot and filled with gas, and there will be left in the stove which has been reheated merely products of combustion, which cannot combine with the gas to produce an explosion. Moreover, the wasteful general practice in water-gas making of blowing air through the fuel-beds of the producers to obtain a temperature sufficiently high to decompose steam is entirely dispensed with in the use of the apparatus to which my invention is applicable.

The accompanying diagram illustrates an organization of apparatus for carrying out the invention.

Referring to the drawing, P′ P² represent two producers, of any usual well-known construction. They are connected together by a suitable pipe a'. Two stoves are represented at S′ and S². The stove S′ is connected by pipe a with the producer P′. The producer P² is connected by the pipe a^2 with the stove S². The stove S² is connected by a pipe a^3 with an economizer or steam-generator E², and this in turn is connected by a pipe a^4 with a valve device V. A pipe a^5 connects the valve device V with a steam-generator E′, and a pipe a^6 connects this steam-generator with the stove S′. In this manner the entire series of stoves and economizers is connected in a closed circuit through the valve device V. The valve device V is provided with four ports v', v^2, v^3, and v^4, the ports v' and v^3 being connected with the pipes a^5 and a^4, respectively. The ports v^2 and v^4 are respectively connected with opposite sides of a blower or fan B for causing a circulation of gas. The blower may be of any convenient form adapted to cause a circulation of gas through the pipes a^7 and a^8 in the direction indicated by the arrows. The valve device V is fitted with a valve D, made to be adjustable on its axis as to the angle of its position relative to the ports v', v^2, v^3, and v^4 by the lever-arm L or any convenient mechanical equivalent, so that the movement of gas through the system may be in complete control, being thus wholly or in any desired proportion caused to flow through the circuit in either direction, according to the degree of deflection of plate D, or, when desired, to stop the flow of gas through the circuit and

cause a circulation of the gas only through the blower B itself, which is accomplished by setting the plate D in line with the centers of ports v^2 and v^4. An outlet b' from the blower B is connected by a pipe a^9 with a gas-holder H or a gas-main. The pipe a^9 has a stop-valve c^9, and a pipe c^{10} connects pipe a^9 with the blower B from a point beyond valve c^9 to the inlet side of blower B through the pipe a^8, so that when the stop-valve c^9 of the pipe a^9 is closed the gas in the pipe a^9 and in the connected holder H can be caused to flow or be drawn back into the inlet side of the blower B. The pipe a^{10} has a stop-valve c^{10} to sever this connection when gas is being made.

When the system has been filled with a quantity of gas in any convenient manner and the valves are set in such positions that the gas will be circulated from the blower B, through the pipe a^5, steam-generator E', stove S', producers P' P^2, stove S^2, steam-generator E^2, valve device V, and pipe a^8, back to the blower B, then if the stove S' has been previously heated to the proper temperature the gas entering it will be heated to the gas-making temperature, and a suitable quantity of steam entering through suitable steam-pipes t t' and mixing with the circulating gas will result in the production of water-gas in producers P' and P^2. This gas as it passes from the producers into the stove S^2 will deposit heat to a greater or less extent in the stove, thence passing into the economizer will deliver up additional heat, which generates steam, and passing to the valve device V and the blower B an amount of gas practically equivalent to that generated in the producers will be delivered to the holder H through the outlet-pipe a^9. This process will be continued until the stove S' has delivered up heat to the circulating gas and the steam to such extent as to no longer be suited for carrying on the process. Meanwhile the stove S^2 will have been somewhat heated by the gases from the producers, but will require additional heat in order to render it sufficiently hot to be used as a heating-stove. At this point the valve device V is so adjusted as to gradually reduce the speed of flow of the circulating gas through the circuit to such degree that only sufficient flow is kept up to maintain a slight pressure throughout the system, and the steam-supply will then be shut off to stop gasification. The valve c^9 will now be closed and valve c^{10} opened, so as to connect the inlet side of the blower B with a supply of made gas from outside the circuit, which will thus be drawn into the circuit to be burned in stove S^2 in the following-described manner: Air will be gradually admitted to stove S^2 to ignite the gas there. The pipe a^4 is meanwhile closed by means of a valve c^6 and communication is opened with a chimney at F^2, located on pipe a^4, between the steam-generator E^2 and valve c^6. The products of gas combustion in stove S^2 pass from it to and through steam-generator E^2 and out of the chimney at F^2 to the atmosphere. As the gas burns away in stove S^2 the blower B takes gas from pipe a^9 through pipe a^{10} and circulates it through pipe a^5, steam-generator E', stove S', producers P' and P^2, and through pipe a^2 to stove S^2, where it is burned, this operation being continued until stove S^2 becomes sufficiently reheated. The quantity of gas thus drawn off and burned is regulated as to the rate of flow by the position given to the deflecting-plate D in the valve device V, and the supply of air for combustion is made proportional. When stove S^2 has thus been reheated, the deflecting-plate D is turned to the position in which the blower B ceases to force a circulation into the pipe a^5. The flue F^2 is closed. The valve c^6 is opened, and the valve c^{10} is closed. Steam is again admitted into the system to renew gasification. The deflecting-plate D in the valve device V is then turned in an angular position opposite that which it had during the preceding water-gas "run" or, as indicated on the accompanying drawing by a dotted line, at an angle with lever-arm L, so as to connect pipe a^5 with the inlet side of blower B through pipe a^8 and to connect the outlet side of blower B through pipe a^7 with the pipe a^4 in order that the continuous operation of the blower B may force a circulation of the inclosed gases in the direction opposite to that shown on the drawings by the arrows—that is to say, through the pipe a^4, steam-generator E^2, stove S^2, (which is now hot,) into and through producers P^2 and P', (where gasification now begins again,) to the stove S', (which now is the relatively cold stove,) thence to and through steam-generator E', back to and through the valve device V, and to the blower B, the circulation in which and in pipes a^7 and a^8 being the same as before. Valve c^9 is then opened sufficiently to allow the gas being produced to pass through the pipe a^9 to the holder H, as before.

Any convenient means for conveying steam into the pipes a^6 and a^3 as required may be employed. In the drawing I have shown the steam-pipe t as provided with valves c' and c^2 adjacent to the steam-generators E' and E^2, respectively, and with branch pipes t' and t^2 leading from the steam-pipe t to the pipes a^6 and a^3, respectively.

The pipes t' and t^2 are respectively provided with valves c^3 and c^4, and by suitably manipulating these valves it is evident that steam may be allowed to pass either from the generator E^2 to the pipe a^6 or from the generator E' to the pipe a^3.

It will be noted that after the reheating of the stove S^2 has been accomplished the subsequent operation consists is forcing a circulation through and from that stove into the producers P^2 and P', and any products of combustion which remain in the system will thus be forced through the producers P^2 and P' and reconverted there into combustible

gases. Any slight quantities of nitrogen remaining in the system will be so small relatively to the quantity of combustible gas it will be mixed with as to be practically negligible.

After the stove S^2 has been cooled by the cirulation of gas in the direction opposite that indicated by the arrows the stove S′ will be reheated in the same general manner as described with reference to the stove S^2 and the operation repeated, a flue F′ and valve c^5 being provided for the pipe a^5.

I claim as my invention—

1. The hereinbefore-described method of producing gas which consists in circulating a quantity of gas produced, heating the same before it enters the producers, cooling the gas as it passes from the producers and then imparting additional heat to the cooling device by passing a quantity of the generated gas through the producing device and burning it in the cooling device and thereby rendering the latter capable of being employed as a heating device.

2. The hereinbefore-described method of securing and maintaining the requisite heat in a gas-producing plant, which consists in periodically interrupting the production of gas and heating a quantity of produced gas in one portion of the system, passing the same thence through a producing device, thereby imparting heat to the producing device; then burning it in another heating device, thereby heating the latter, substantially as described.

3. The hereinbefore-described process of restoring heat to a heating-stove of a gas-producing plant and at the same time maintaining a high temperature in the producing portion of the plant, which consists in periodically interrupting the production of gas and heating produced gas, passing the heated produced gas through the producing portion of the plant, passing the gas thence to a stove to be heated, and burning it within said stove, substantially as and for the purpose described.

4. The hereinbefore-described process of manufacturing gas which consists in circulating a portion of the gas produced together with steam through a heating device, thereby imparting a high temperature thereto, passing the mixture of heated gas and steam into a producing-chamber, generating gas in the producing-chamber then cooling the circulating and generated gases as they pass from the producer, withdrawing from circulation a portion of the gas and continuing the circulation of the remainder; then discontinuing the supply of steam, circulating a portion of the gas previously generated through the heating device and the producing device, burning it in conjunction with air in the device previously employed as a cooling device, thereby heating the same for the purpose of rendering it a heating device and thereafter circulating gas and steam through the apparatus in the reverse direction and producing additional gas.

5. The hereinbefore-described method of operating a gas plant which consists in generating gas by passing heated gas and steam into a producing portion of the plant, thereby producing gas and gradually abstracting heat from the heating portion, then interrupting the production of gas and continuing a circulation of gas but at a diminished rate and discontinuing the supply of steam, burning the diminished quantity of gas circulated, for the purpose of imparting heat to the system and then ceasing the combustion of gas and renewing the generation of gas by the circulation of gas through the heating portion of the system into and through the producing portion and supplying steam thereto.

Signed at Pittsburg, in the county of Allegheny and State of Pennsylvania, this 18th day of November, A. D. 1899.

JOHN EDWIN FRY.

Witnesses:
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