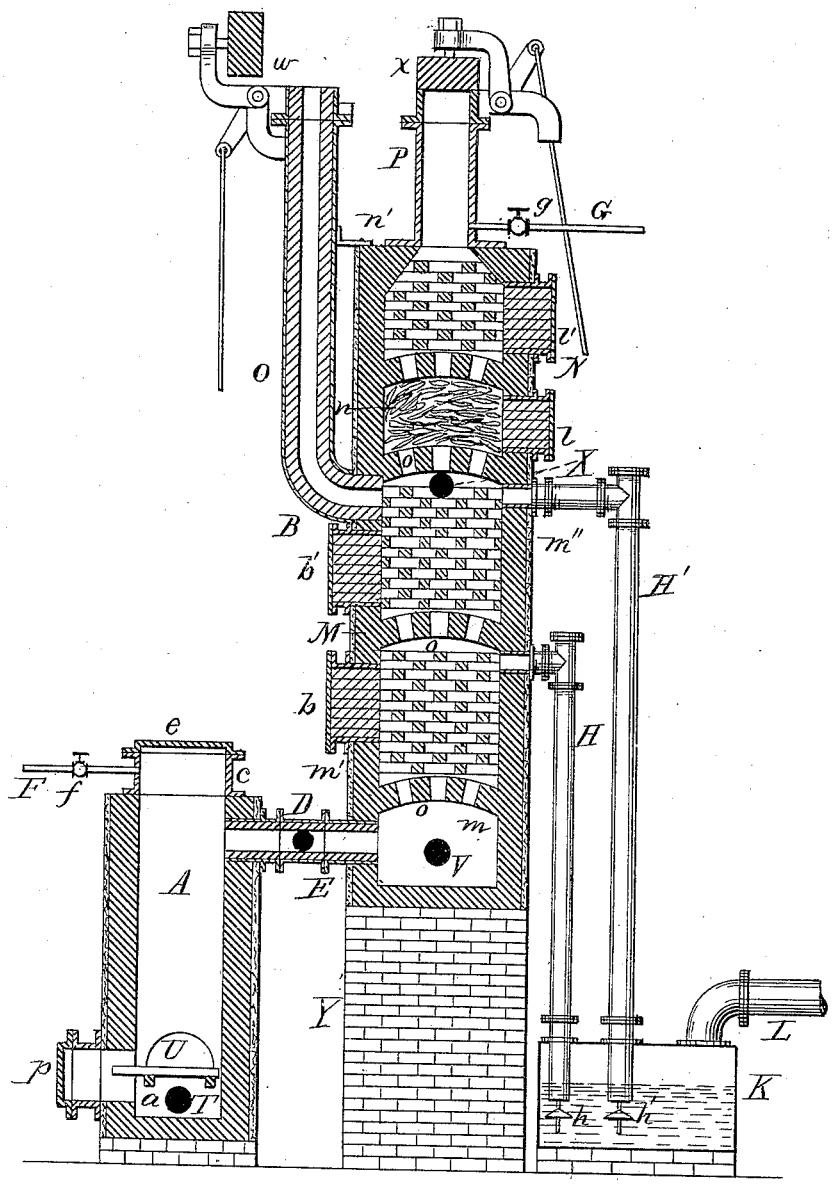
(No Model.) 2 Sheets—Sheet 1.

J. HANLON.

APPARATUS FOR MANUFACTURING ILLUMINATING AND HEATING GAS.

No. 418,016. Patented Dec. 24, 1889.

Fig. 1



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(No Model.) 2 Sheets—Sheet 2.

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Fig. 3

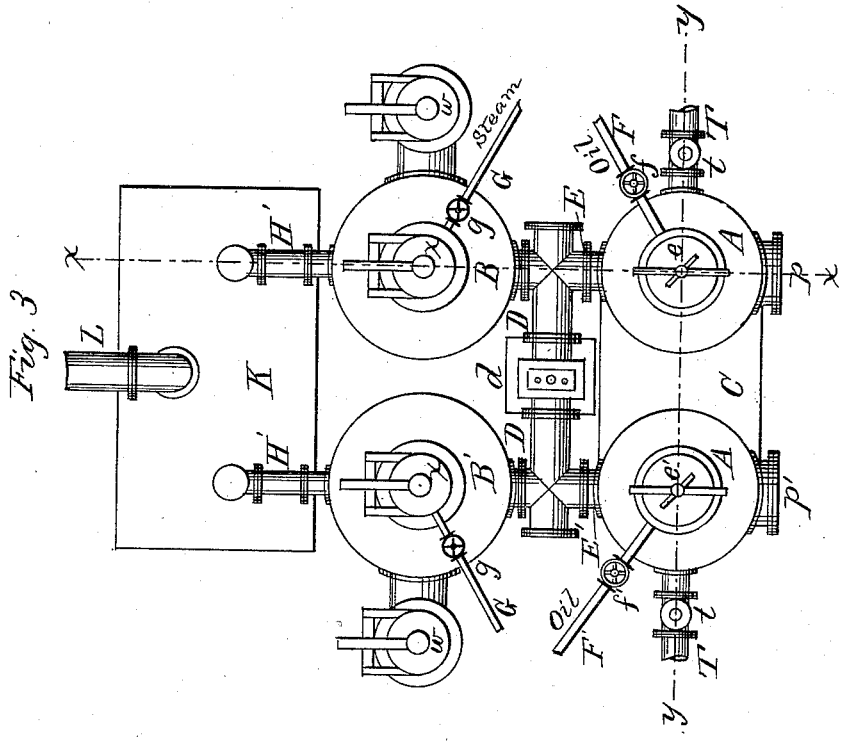
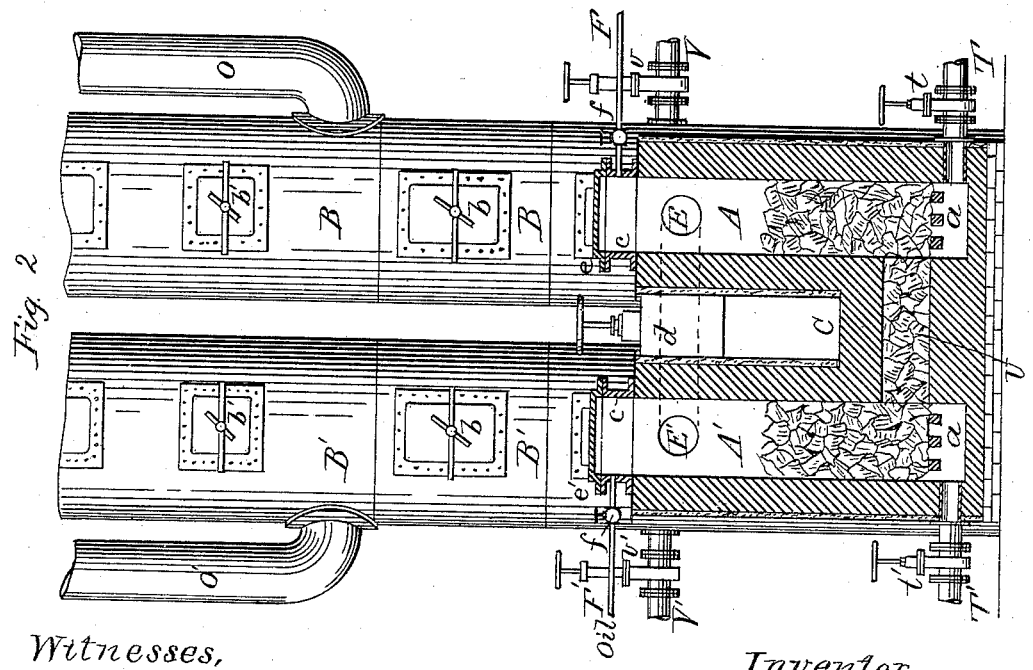


Fig. 2



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UNITED STATES PATENT OFFICE.

JOHN HANLON, OF NEW YORK, N. Y.

APPARATUS FOR MANUFACTURING ILLUMINATING AND HEATING GAS.

SPECIFICATION forming part of Letters Patent No. 418,016, dated December 24, 1889.

Application filed September 24, 1886. Serial No. 214,450. (No model.)

To all whom it may concern:

Be it known that I, JOHN HANLON, a citizen of the United States, residing at New York, in the county of New York and State of New York, have invented certain new and useful Improvements in Apparatus for Manufacturing Illuminating and Heating Gas; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to apparatus for manufacturing illuminating and heating gas, and embraces improvements on the apparatus described and claimed in Letters Patent granted to me June 17, 1884, No. 300,466, and January 20, 1885, No. 311,124, whereby the apparatus is made more compact and simple in construction and more convenient to operate.

The object of the invention is to provide for both superheating steam and fixing gas in one regenerator divided into suitable compartments and provided at different heights with stacks for products of combustion and with take-off pipes for gas, so that a separate structure for the gas-fixing chamber, as in my patent, No. 311,124, is done away with and expense of construction thus lessened.

Another object is to provide for conveniently heating one of the combined superheating and fixing regenerator-chambers to a higher temperature than the other by conducting the gaseous products while blowing up from both fuel-chambers of the double generator through either regenerator at will, whereby the chamber to be used for superheating steam may be heated to a higher temperature and the chamber for fixing gas may be heated to a lower temperature, as desired.

My invention embraces a novel construction and arrangement of parts, whereby the above objects may be attained; also certain details of construction whereby improved results are secured in manufacturing gas, as will be hereinafter more fully described, and then defined in the claims.

In the accompanying drawings, Figure 1 represents a vertical section, on line $x\ x$ of Fig. 3, through one generating-chamber and one gas-fixing and steam-superheating regenerator. Fig. 2 represents a vertical section, on line $y\ y$ of Fig. 3, through the double generator, and also shows the two superheating and fixing regenerators in elevation back of the generator. Fig. 3 represents a top plan view of the apparatus.

The two fuel-chambers A A′ of the generator are built with separate walls, each having an iron jacket, and are connected by base C, having a communicating passage U above the grates, and the chambers have ash-pits $a\ a'$, respectively. Doorways having tight-fitting doors $p\ p'$ open to the ash-pits and grates. Fuel-openings having necks or mouth-pieces $c\ c'$, provided with tight-closing lids $e\ e'$, are placed at the tops of chambers A A′. Oil-supply pipes F F′, having valves $f\ f'$, connect with the tops of chambers A A′. The two combined steam-superheating and gas-fixing regenerators B B′ are mounted on the high foundations of masonry Y, as shown, just back of fuel-chambers A A′, so that the connecting-pipes from the tops of such fuel-chambers will pass horizontally, or nearly so, into the bases of regenerators B B′. Pipes E E′ connect the tops of chambers A A′ with the bases of regenerators B B′, and pipe D, having water-cooled valve d, connects the two pipes E E′, so that by opening the valve communication is made between both fuel-chambers with either superheating and fixing chamber.

The flow of products of combustion or gases from the fuel-chambers through one of the other of the regenerators B B′ is controlled by opening the outlet-valves or caps of one chamber and closing them in the other chamber, as more fully set forth in the description of the operation of the apparatus.

The regenerators B B′ are divided by perforated arches o into compartments $m\ m'\ m''$, forming the gas-fixing chamber M, extending up to stack O and the upper gas take-off pipe H′, and into other compartments $n\ n'$, constituting chamber N, which is used only for superheating and partially decomposing steam, since the fixed gas is passed off below this chamber. The compartments $m'\ m''$ are filled with brick checker-work supported upon the arches o, and each chamber has a large rectangular side opening into which an iron

door-frame is fitted, and to such frame is secured, by means of a screw-clamp, a tight-fitting lid or door, as *b b'*. Compartment *n* is filled with iron scrap—such as borings or turnings—and compartment *n'* is filled with brick checker-work. The door-frames are filled with removable brick to prevent loss of heat by radiation. By means of the doors the brick checker-work and iron scrap in the compartments may be readily removed, repaired, or cleaned.

Gas-take-off pipes, as H H', lead off from the gas-fixing chambers, one from the top of each compartment *m' m''*, and connect with the hydraulic seal-box K, so as to dip at their lower ends into the sealing-liquid in such box. The open ends of the pipes are provided with conical valves, which in practice are provided with suitable operating mechanism, (not here shown,) whereby either pipe may be closed at will. This arrangement of the gas-take-off pipes, leading from different compartments at different heights, permits the carbureted gas to be passed through only a portion of the heated brick-work at a time, as in compartment *m'*, till such portion becomes too cool to act efficiently and then to be passed through the remaining portion which is still hot. By these means and the method of operating the exposure of gas to too large an expanse of heated surface, and consequent formation of lamp-black at the commencement of the run, is prevented; and further, a portion of the heated brick-work is held in reserve for properly fixing the gas at the latter end of the run. A run is the period of ten, fifteen, or twenty minutes, during which gas is made between the operations of blasting with air and heating up the apparatus. Pipe L leads from seal-box K for conducting the gas to the condenser or scrubber and purifier. A stack or chimney O, having at the top a closing-cap *w*, connects with the top of chamber M and extends up above chamber N for conducting off products of combustion, so that when chamber N is sufficiently heated or requires no heating the products may be passed directly off by chimney O. A short stack P, having a closing-cap *x*, extends from chamber N. Steam-supply pipes G G', having valves *g g'*, connect with the tops of regenerators B B', above chambers N, preferably through the stacks P. The caps *w x* are provided with the usual operating devices. Air-blast pipes T T', having valves *t t'*, connect with the ash-pits *a a'*, and air-blast pipes V V', having valves *v v'*, connect with the bases or compartments *m* of regenerators B B'. Air-blast pipes X may also connect with the tops of chambers M, as shown in Fig. 1, for causing complete combustion of gaseous products which may pass unburned through fixing-chamber M. When it is desired to heat chamber N higher than chamber M, the air-blast is shut off from compartment *m* and the gaseous products from the generator passed directly up to chamber N, where the air-blast is alone admitted and the entire combustion caused to take place in chamber N, thereby highly heating it. In this operation cap *w* is closed and cap *x* is opened.

For convenience of illustration the stack is shown at the front of chamber B in Fig. 1, though in practice it would preferably be placed at the side, as shown in Figs 2 and 3.

The operation is as follows: Fires are kindled and beds of incandescent fuel formed in the generating-chambers A A' by open draft. Then lids *e e'* and doors *p p'* are closed, while caps *x x* are left open. Air-blasts are admitted by pipes T T' to the ash-pits and the resulting gaseous products rising from the fuel and containing combustible carbonic oxide are passed into both regenerators B B', where complete combustion is effected, either by admitting air-blast by pipes X at the bases of chambers N and first heating such chambers, or by admitting the air-blasts through pipes V V', and simultaneously heating both sets of chambers M N for a time, and then when chambers M are sufficiently heated shutting off the blasts in pipes V V' and opening blast-pipes X, thereby heating chambers N to a higher degree than chambers M. When the air-blast is being admitted by pipes V V', the caps *x x* may be closed and caps *w w* opened for securing a better draft directly through stacks O. Then when the air-blasts are admitted by pipe X the caps *w w* are closed and caps *x x* are opened. Gas is fixed in either of the regenerators B B', and they may be used alternately for such purpose. In case gas is to be fixed in regenerator B', then steam will be superheated in regenerator B, and therefore this latter is more highly heated by opening valve *d* in connecting pipe D and closing the chimney-caps of regenerator B', so that all the products from both fuel-chambers will be passed into and burned in regenerator B, raising it to a high heat throughout all its compartments. In that regenerator B or B' where gas is to be fixed only chamber M requires heating, as such chamber only is used for fixing gas, and therefore the gaseous products are burned in compartment *m* and the waste products are passed off through stack O. The greater proportion of gaseous products may therefore be applied to heating the other regenerator in which steam is to be superheated and where the highest heat is required. The apparatus having been properly heated, the valves of the blast-pipes, valve *d*, and the caps *w x* are closed and steam is admitted by pipe G into the most highly heated regenerator B, and is therein superheated and partially decomposed by contact with the hot iron scrap, and the resulting hydrogen and superheated steam pass down through the incandescent fuel in chamber A, where decomposition of the steam is effected, and the resulting gases pass through passage U and up into the fuel in chamber A', where the gases are completely converted into

carbonic oxide and free hydrogen. Hydrocarbon oil is admitted by pipe F′ into chamber A′ as the gases begin to rise from the fuel and is thereby vaporized. The gases and oil-vapors then pass into fixing-chamber M of regenerator B′ and are there combined and converted into a fixed gas. As heretofore stated, gas is fixed during the first portion of the run in compartment *m′* and passed off by pipe H, its valve being then open, and when compartment *m′* is reduced too low in temperature the valve of pipe H is closed and the valve of pipe H′ is opened and gas is fixed in compartment *m″*, whereby it is uniformly combined and fixed throughout the run. The manufacture of gas is continued, as above described, till the fuel and the superheating and fixing chambers are reduced below an operative temperature, when the steam and oil are shut off and the apparatus is again heated up, as above described, only in this instance the regenerator B′ is most highly heated for subsequent use in superheating steam. The direction of the currents of steam and gas through the chambers need not be reversed at every consecutive run, but as often as found desirable. It is advantageous to occasionally reverse the currents, because lamp-black and hard carbon are apt to deposit in the fixing-chamber, and by passing steam and hydrogen through such chamber the carbon is taken up and assists in decomposing the steam and forming carbonic oxide. The chambers are thus cleaned and the carbon is utilized. When the iron scrap becomes oxidized, it is reduced to the metallic state by passing hot gaseous products containing carbonic oxide through it without admission of air, whereby the oxygen of the iron unites with the carbon in the gas. In case the products of combustion flowing from the generators do not contain enough carbonic oxide, then part of the hot water-gas, carbureted, if desired, may be passed through the oxidized iron, whereby it will quickly be reduced to the metallic state, and will thus serve repeatedly to decompose steam.

Either anthracite coal or coke is used in the fuel-chamber.

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

1. In combination with a gas-generator, a regenerator having a gas-fixing chamber at its base provided with one or more gas-take-off pipes leading to a seal-box and a smoke-stack, and a steam-superheater placed above the fixing-chamber and having a separate smoke-stack and a steam-supply pipe.

2. A regenerator divided into a fixing-chamber and a steam-superheater, the latter having a filling of iron scrap in one of its compartments, in combination with gas-take-off pipes leading from the fixing-chamber, a smoke-stack connecting with each chamber and having a closed cap at top, a steam-supply pipe connecting with the superheater, and a gas-generator connecting with the base of the fixing-chamber.

3. The gas-generator composed of two fuel-chambers connected at their bases, in combination with two regenerators, pipes connecting the fuel-chambers at the top with the regenerators, and a pipe having a valve connecting such pipes, whereby products may be passed from both fuel-chambers into either regenerator, as described.

4. In combination with the two-chambered generator, two regenerators having stacks provided with caps, the connecting-pipe E, E′, and D, having valve *d*, and suitable blast and steam pipes connecting, as and for the purposes described.

5. The generator composed of two connected fuel-chambers having oil-supply pipes at the top, in combination with two regenerators, each containing a fixing-chamber and a superheater, having each a capped smoke-stack, gas-take-off pipes connecting with the fixing-chambers, and connecting-pipes E, E′, and D, having valve *d*, as and for the purpose described.

In testimony whereof I affix my signature in presence of two witnesses.

JOHN HANLON.

Witnesses:
C. K. LEONARD,
GEO. D. STINEBAUGH.