

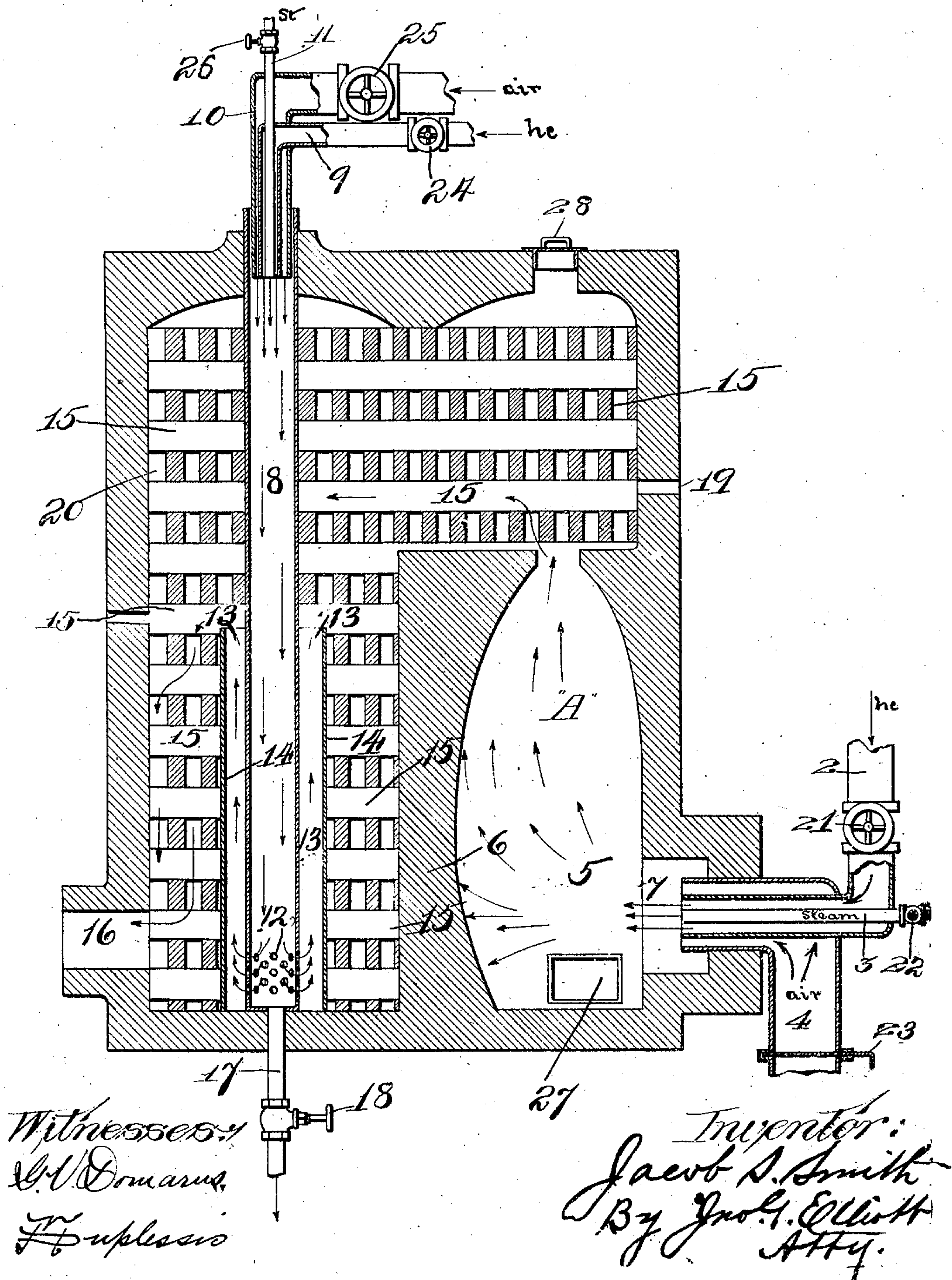
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PATENTED JULY 16, 1907.

J. S. SMITH.

APPARATUS FOR THE MANUFACTURE OF GAS.

APPLICATION FILED JAN. 23, 1905.



UNITED STATES PATENT OFFICE.

JACOB S. SMITH, OF CHICAGO, ILLINOIS.

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Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, JACOB S. SMITH, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain
5 new and useful Improvements in the Manufacture of Gas for Heat and Illuminating Purposes, of which the following is a full, clear, and exact specification.

This invention relates to improvements in the manufacture of gas for heating and illuminating purposes
10 from hydrocarbons, pulverized coal, coke and such other finely divided hydrocarbons as may be passed continuously through pipes or nozzles with air or steam or both.

One of the objects of this invention is to provide
15 means whereby the dissociation of the elements in the gas producing materials is instantaneous.

Another object is to manufacture gas from oil or liquid or pulverized hydrocarbons, air and steam continuously without interruption.

20 A further object is to reduce the gas materials to gaseous form and combine the elements with the least loss in the conversion and in the shortest possible time.

A still further object is to enrich the gases made by the combustion of gas materials, by a secondary
25 distillation in which the heated gases from combustion are utilized for supplying heat in such secondary gasification of fresh materials.

With these ends in view, my invention consists in certain features of novelty in the construction, combination and arrangement of parts by which the said
30 objects and certain other objects hereinafter attained, all as fully described with reference to the accompanying drawing in which similar characters indicate like parts, and more particularly pointed out in the claims.

In the practice of my invention, I preferably use as a matter of economy a generator of cupola form
35 "A" above and also extending lengthwise the rear side thereof a gas fixing chamber, the discharge orifice of which is located substantially on a plane with that of the nozzles supplying the gas producing materials to the generator, within which fixing chamber is a gas retort supplementing the generator for the three fold
40 purpose of maintaining the desired degree of heat in the fixing chamber, for enriching, if desired, the gases from the generator and increasing the supply of gas from a gas producing apparatus as a whole.

The gas retort generator above referred to consists of two tubes or conduits one within the other, one of
50 which tubes extends from the top to the bottom of the gas fixing chamber and another tube or conduit surrounding the former so as to form a chamber external to the long tube, which chamber is closed at its bottom end and opens at a point substantially above perforations at or near the bottom of the long tube, but at a
55 point below the top of the fixing chamber so that the

gas retort generator is exposed to the heat of the fixing chamber and will discharge the gases generated therein from the materials introduced at the upper end of the retort into the path or current of the gases passing from
60 the cupola generator through the fixing chamber and thence to the discharge orifice of the latter. In practice I also prefer to have a breaker wall in the cupola generator opposite the nozzle through which the gas producing materials are injected and to have a checker
65 work in the fixing chamber adjacent the rear side of the breaker wall for the purposes of maintaining the highest possible degree of heat in the breaker wall at the point where it receives the discharge of gas producing materials from the nozzle, consistent with the necessary strength of said wall, and thereby promote the dissociation of the gases from the materials striking said
70 wall. The fixing chamber is also preferably substantially entirely filled with checker work not only to promote the heating of the breaker wall and the retort generator, but for maintaining a degree of heat best promoting the fixing of the gases discharging from either
75 or both the cupola generator and the retort generators.

The gas materials if liquid are supplied at a pressure, by tanks or pumps, the air by proper compressors or
80 blowers and the steam under pressure from a boiler.

If the gas materials be pulverized coal, coke or other dry and finely divided substances, they may be supplied to the generator and generators through any preferred form of feeding nozzle for that purpose, and in
85 contact with a swiftly moving current of air or steam.

As this invention relates to the generation of gas only, the several devices in use for supplying the nozzle or nozzles shown or described and for scrubbing and treating the gas after it leaves my gas producing structure, are, for the purposes of my present invention,
90 not necessary to be shown or described and are therefore omitted from Figure 1, which represents a central vertical section of a generating apparatus embodying my invention.

In practicing my invention, hydrocarbons are introduced through a pipe 2, and air through a pipe 4 into the generating chamber 5 of the cupola "A", and when the breaker 6, and the interior of the generator are sufficiently heated pressure is supplied through the air
100 pipe 4 or steam pipe 3, or both, to propel the gas producing materials forcibly against the heated surface of the breaker 6, for the purposes of quickening the dissociation and increasing the volume of gases in their initial dissociation from the gas producing materials
105 and whereby their subsequent fixing and mechanical combination is materially promoted even before their discharge from the generator and fully after they have passed out of the generator upwardly into the fixing chamber and thence downwardly to the discharge
110 orifice thereof, and this whether or not the fixing chamber contains the checker work 15.

The pipes for supplying the hydrocarbons, air and steam to the generator are interchangeable so that air, steam and carbon may be indiscriminately introduced through the one or the other, as desired, to meet any requirements as to their feed, and all of said pipes discharge into a nozzle 7, arranged in a line directly opposing the breaker wall, and this in order that the impact of the materials discharged from the nozzle shall strike at a right angle to the surface of the breaker wall with which they contact, or as nearly as may be when said surface is curved, so that the impact of the gas producing materials shall be utilized to the best possible advantage in breaking them, dissociating their gases and perfecting their mechanical mixture within their generating chamber.

When it is desirable to enrich the gases passing through the fixing chamber from the cupola generator fresh materials are introduced at the top of the inner tube 8 of the retort, the hydrocarbons preferably through the pipe 9, air through the pipe 10 and steam through the pipe 11, the gases from which, after passing downwardly through the length of the inner tube 8, discharge through perforations 12 near the bottom thereof into a surrounding chamber 13, external of the tube 8, and formed by a larger surrounding pipe 14, closed at its bottom end and opening at its upper end within the fixing chamber 15. The discharge end of said pipe is shown as terminating some distance above the perforations and slightly below the extreme upper end of the retort generator, in order that the gases discharging therefrom will meet and heat the gases from the cupola generator at about the best point in the circulation of the gases through the fixing chamber, for maintaining both gases in a highly heated condition and the mechanical mixture thereof, before they are discharged from the apparatus through the outlet 16, and without retarding or obstructing the passage of any of the gases from either generator in their onward course to the discharge orifice 16, of the fixing chamber.

The best results for enriching and for securing an additional output of gas due to the fixing chamber are secured when said chamber is filled with checker work or other refractory material because of the substantially higher temperature thereby maintainable. It is, however, within the spirit of my invention to omit said checker work or other refractory filling both in whole or in part when for immediate use the gases are discharged directly from the cupola generator without passing into a fixing chamber, and also when the gases pass upwardly into the fixing chamber and thence outwardly through the outlet 16 located towards the bottom thereof, and this when the retort generator is employed and the fixing of the gases is dependent entirely upon heat produced from the combustion in the fixing chamber of the retort gases. The heating of the retort is likewise dependent for its heat from the same source, with that of the gases discharging from the cupola through the fixing chamber, for the purposes of producing the best results in quality of the gases from the cupola generator and increasing the volume and quality of the gases from the retort.

There is, of course, a substantial advantage in employing and passing all of the gases through the checker work shown and described in the fixing chamber, because of the extended heated surface to which the gases

are exposed, and the uniformly maintaining of a high degree of heat both in the retort and throughout the fixing chamber.

Refractory particles in the tube 8 may as fast as accumulating be withdrawn through a drain pipe 17, controlled by a valve or gate 18, and the peekholes 19, 20, are provided for observing the heats and currents of the gases as they discharge from the cupola, and as the cupola gases are met by this discharging from the retort into the fixing chamber.

Gates or valves of any commonly used and desirable construction 21, 22, and 23, are employed for respectively regulating the supply of hydrocarbons through the pipe 2, the steam through the pipe 3, and air through the pipe 4 to the nozzle 7, and also for regulating an otherwise excess of pressure in any of those pipes, the pipes 9, 10 and 11 supplying the tube 8 with hydrocarbons, steam and air are also respectively supplied with gates or valves 24, 25, 26, of the ordinary construction for such purposes.

The cupola generator is provided towards its bottom with a handhole 27, for the removal of refractory deposits in the generator, and the fixing chamber is also provided with a trap or manhole 28, for access to said chamber.

I have found in practice that the use of force for violently propelling gas making materials, against a highly heated surface is of very valuable assistance in breaking up and atomizing the materials, that the explosive effect accruing to this impact against a hot surface within a highly heated chamber results in instantaneous dissolution of the elements and reassociation in the desired gaseous form.

It is obvious that the dissociation of the elements and their association is concurrent with this combined explosive and mechanical mixture of the released gases, and that this is accomplished with a minimum of heat and a consequent saving of materials in the conversion, and that thereby the capacity of my gas generating apparatus is substantially increased as compared with a slower generation and gives a high heat unit value to the gas so made, because of the smaller quantity of gas materials required for heat or lost in combustion.

It is well known that gas manufactured from gas making materials through their own combustion in air, a large percentage of nitrogen results, and that it is difficult on this account to reach a high unit value.

To reduce the percentage of nitrogen and thereby increase the value of the gas per cubic foot, I employ the before described retort inserted in the fixing chamber in a direct current of the gases flowing through and out of the generator, which heated current flowing around the retort and through the adjacent checker work yield sufficient heat to gasify a considerable quantity of fresh gas materials introduced into the retort and mix the resulting gases with those passing from the generator through the fixing chamber.

The quantity of the gas generated in the retort may be increased and a high quality be maintained by adding a little air through the pipe 10 so as to supply by combustion within the retort any deficiency in heat from the surrounding current, and so also when the temperature is properly maintained, steam may be introduced through the pipe 11 instead of air, or both

may be added to affect the quality or quantity of gas as a whole.

It is apparent that gases passing from the generator around the retort in the fixing chamber will maintain the said retort at a high temperature, and that by adding combustion to the gas materials admitted to the retort, a very much less quantity of air in proportion is necessary to gasify the materials in the retort than the quantity of air required to generate gas in and maintain the necessary temperature in the generator. It is also evident that as a less quantity of air is so required in the retort, the product of the retort will contain less nitrogen, and will add to and improve the total gas output of the apparatus. It is also evident that if only the hydrocarbons or hydrocarbons and steam be gasified in the absence of air in the retort, the product will contain practically no nitrogen and that when it is desirable to use gas entirely void of nitrogen and by means of heat solely derived from the generator, it would, to this end, be no departure from my invention to draw off and conduct them elsewhere for that purpose.

In the production of gas for furnace or immediate use, the checker work in the fixing chamber may be entirely dispensed with, and in that case the heat carried by the cupola gas in its downward course through the chamber 20, may be utilized without loss while not only conversely a very great saving may be secured by the secondary conversion of the gas materials in the retort, but the product coming from the breaker will thereby be increased and enriched by the adding or mixing of the gases discharged from the retort into the current of the gases from the cupola generator to the discharge orifice 16, of the fixing chamber.

While the fixing chamber is shown and described to extend over and downwardly back of the cupola and filled with checker work or other refractory material, it will be no departure from the spirit of my invention to have the fixing chamber extend practically in a horizontal or perpendicular line away from the discharge orifice of the cupola nor for some purposes to omit the checker work or refractory material in whole or in part from the fixing chamber.

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

1. In an apparatus for the manufacture of gas for heating and illuminating purposes a cupola gas generator provided with an imperforate breaker wall in combination with a nozzle and means for simultaneously discharging gas generating materials from said nozzle with forcible impact against the breaker wall, whereby when said wall and chamber are in a highly heated condition the impact of the gas producing materials against said breaker wall produces instantaneous dissociation of the gaseous elements therefrom, in combination with a gas generating retort, adjacent to said breaker wall, another chamber projecting downwardly within the gas generated chamber and discharging the gases therefrom into the current of the moving gases from the cupola, whereby the gases from the generator are united with the gases from the cupola before discharging from the apparatus, substantially as described.

2. In the manufacture of gas for heat and illuminating purposes, a gas generating and fixing apparatus comprising in combination a gas generating chamber provided with a breaker wall and a contracted throat outlet above said breaker wall, a nozzle and means for forcibly discharging through said nozzle and against said breaker wall gas generating materials, and a gas fixing chamber filled with checker work or other refractory material af-

fording a free passage for the gas and so arranged relative to the gas generating chamber that the gases from the latter are discharged upwardly and thence downwardly through the gas fixing chamber to a point substantially below the point of discharge from the gas generating chamber, substantially as described.

3. In the manufacture of gas for heat and illuminating purposes, a gas generating chamber, a breaker wall therein, means for discharging the gas generating materials forcibly against said breaker wall, a gas fixing chamber so arranged relative to the generating chamber that the gases discharging from the latter shall first pass upwardly and then a substantial distance downwardly through said fixing chamber before discharging therefrom, a gas generating retort projecting downwardly through the gas fixing chamber and provided with perforations towards its bottom end, of a larger pipe surrounding said retort closed at its lower end and opening at its upper end within the gas fixing chamber at a point below the upper end thereof, whereby the heat from the fixing chamber is utilized to separate gases from gas producing materials supplied to the retort and the gases therefrom are caused first to descend and after discharging therefrom to ascend upwardly through a surrounding chamber and discharged thence downwardly before escaping from the generator apparatus.

4. In the manufacture of gas for heat and illuminating purposes, an apparatus comprising in combination a gas generator cupola in form, a breaker wall therein, a nozzle, and means whereby differing gas producing materials simultaneously discharged from said nozzle are delivered in a direct line forcibly against said breaker wall and thence rising are discharged through the contracted neck of a cupola, a gas fixing chamber filled with checker work or other refractory material relatively arranged to said cupola whereby gases discharged from the latter rise in the fixing chamber and are thence compelled to descend to a plane approximately corresponding with the base of the cupola chamber, a retort extending downwardly through said checker work provided with passages at or near the lower end thereof, a pipe forming a chamber surrounding said retort, and closed at its bottom end and opening at a point below the upper end of the gas fixing chamber and within the confines of said checker work, and a discharge orifice common to the gases from both the cupola and the retort arranged at or near the bottom of the gas fixing chamber, substantially as described.

5. In a gas generating apparatus, a generator chamber, cupola in form, a nozzle, an imperforate breaker-wall opposing the entire discharge from said nozzle, means continuously supplying gas producing materials with forcible impact against said breaker-wall, a fixing chamber and a nozzle therefor discharging gas producing materials therein, whereby enriching gases are added to and mixed with the cupola gases before discharging from the apparatus, substantially as described.

6. In a gas generating apparatus, a cupola gas generating chamber, a gas mixing chamber substantially filled with checker work and extending both above the neck of said cupola and downwardly at the rear side of a point at or near the bottom of said cupola, a gas retort inclosed by said checker work and discharging at or near the bottom thereof, means whereby said retort gases are forced to first ascend and then descend to a discharge orifice at or near the bottom of the fixing chamber common to both the cupola and the fixing chamber, means for continuously supplying gas producing materials to said cupola and retort and means for forcibly discharging said materials against the breaker wall in the cupola whereby gaseous elements of said materials injected into a cupola generator are continuously dissociated in the shortest possible time and before their discharge from a gas generating apparatus are fixed and enriched by gases primarily distilled within the confines of the fixing chamber and at the same time the temperature of the fixing chamber is thereby increased, substantially as described.

7. In a gas generating apparatus, a cupola gas generating chamber one wall of which is a breaker wall, a gas fixing chamber provided with a vertical retort, means injecting gas materials into the generating chamber against

- the breaker wall thereof, means igniting said materials, means contracting and then expanding the gaseous products into the gas fixing chamber, means introducing gas materials into said vertical retort and means conducting the gases therefrom upwardly and then downwardly, whereby gases from the cupola generator and the gases from the retort are fixed in the gas fixing chamber before their discharge from the apparatus, substantially as described.
- 10 8. In a gas generating apparatus, a cupola gas generating chamber, a gas fixing chamber receiving the discharge from the generating chamber, a gas retort inclosed in the fixing chamber discharging at or near the bottom of said fixing chamber, means whereby said retort gases are forced to ascend and mix with the gases from the generating chamber before escaping from the apparatus, a breaker wall, means for continuously supplying gas materials forcibly against the breaker wall in the generating chamber and means for continuously supplying gas materials to said retort whereby the heats of said generating chamber assist in the gasification of the materials supplied to the retort and the heats of the retort may be increased by additional air supplied thereto, substantially as described.
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Witnesses:

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