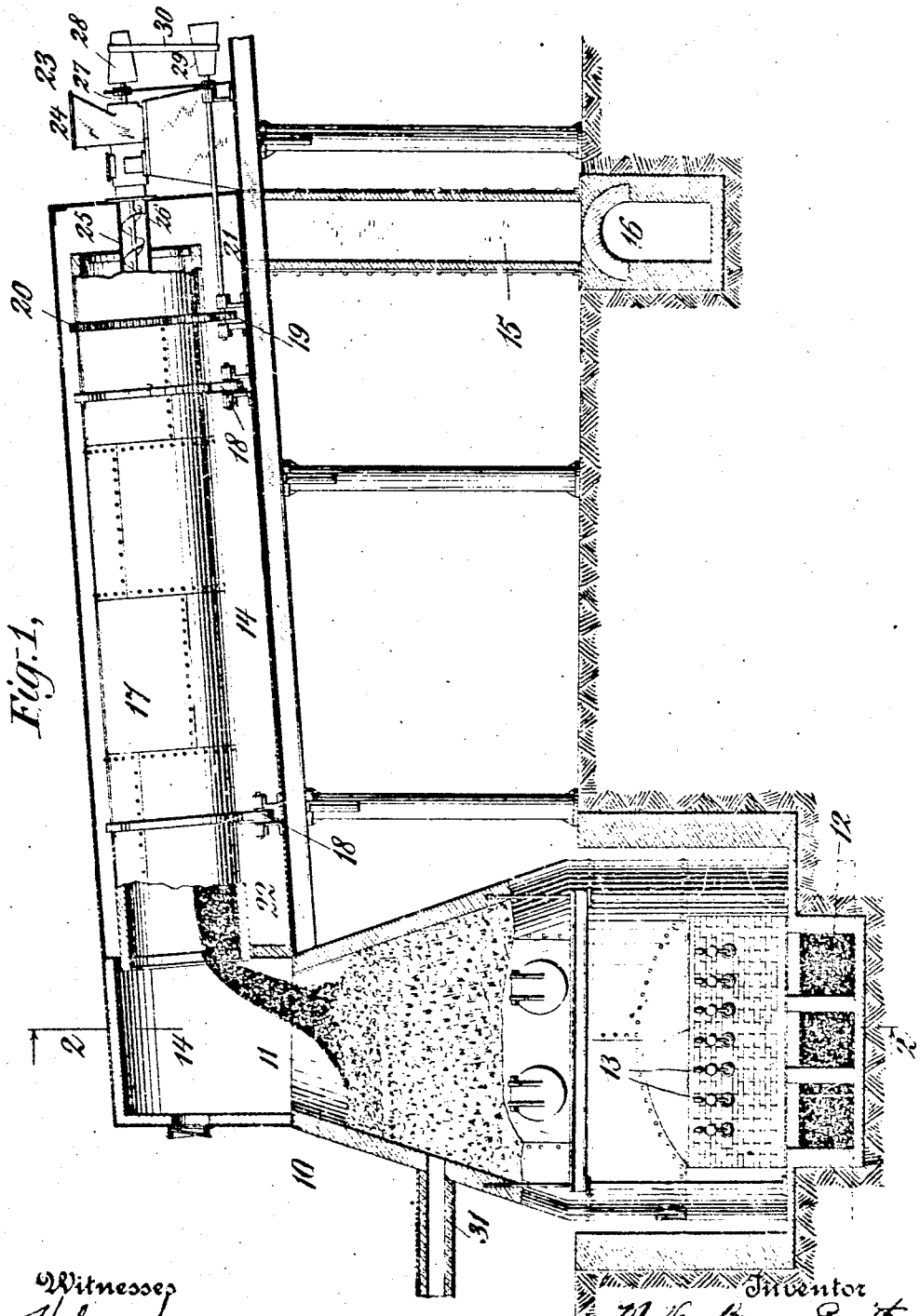
No. 868,026. PATENTED OCT. 15, 1907.

M. VAN B. SMITH.

GAS PRODUCER.

APPLICATION FILED DEC. 8, 1905.

3 SHEETS—SHEET 1.



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3 SHEETS—SHEET 2.

Fig. 2.

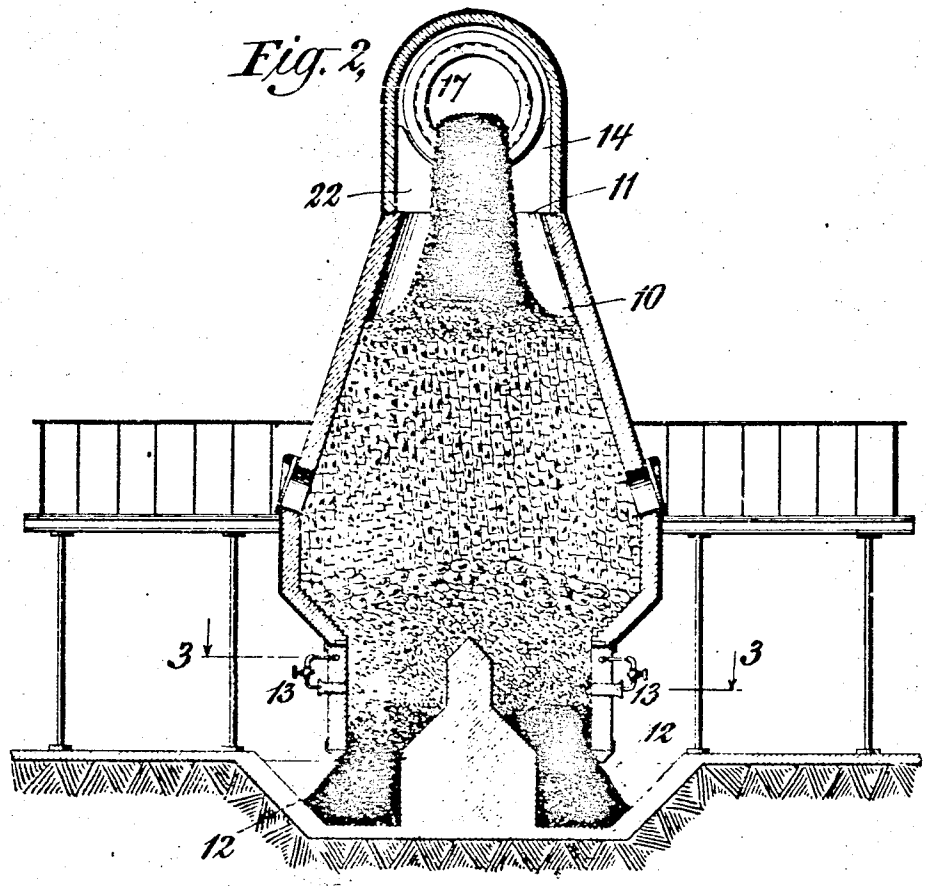
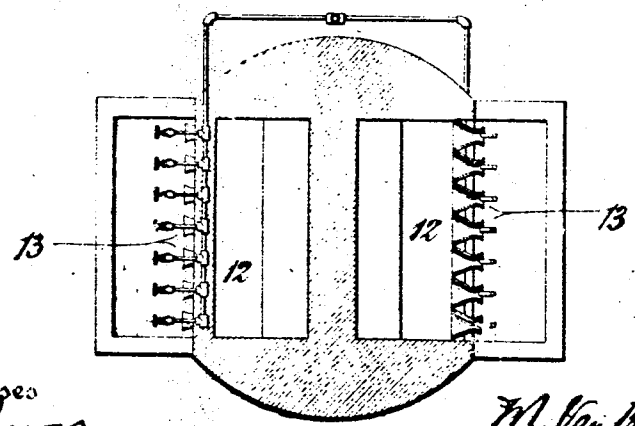


Fig. 3.



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3 SHEETS—SHEET 3.

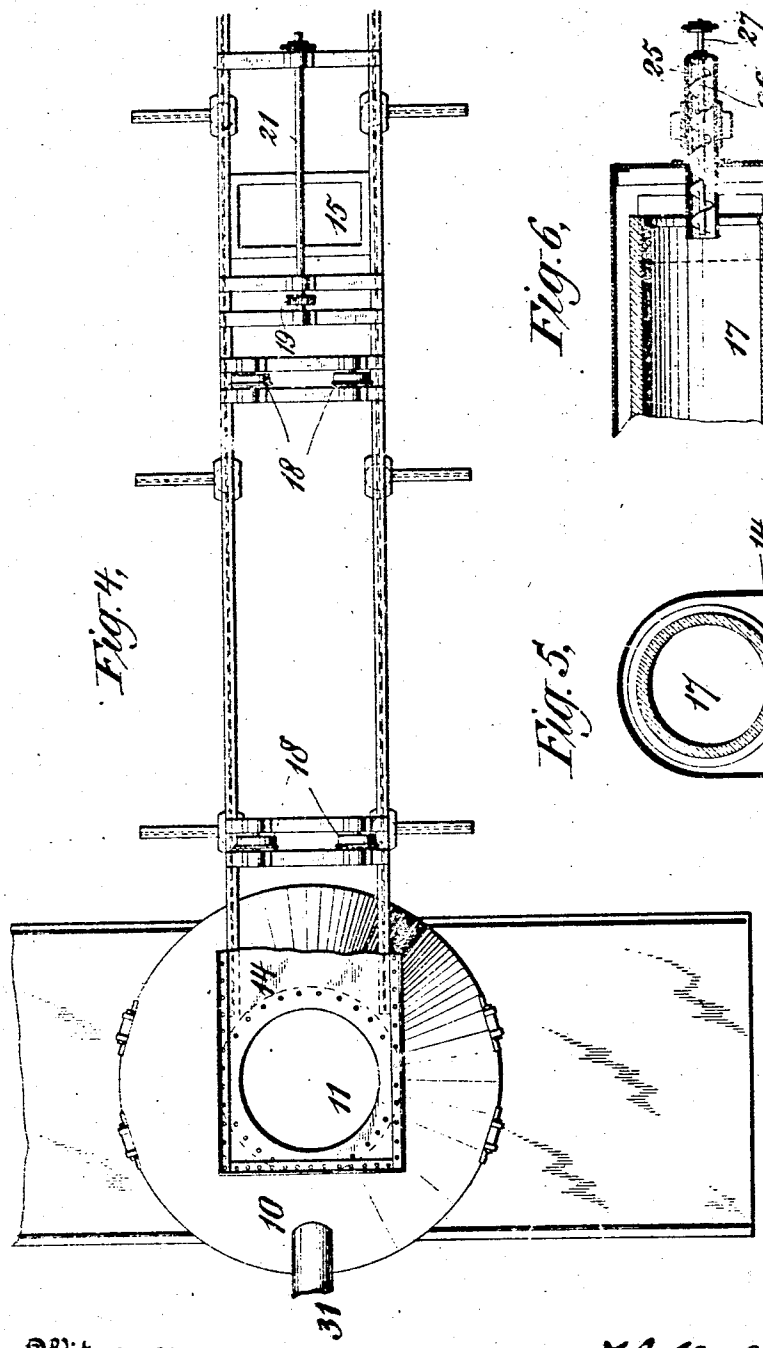

Fig. 4.

Fig. 6.

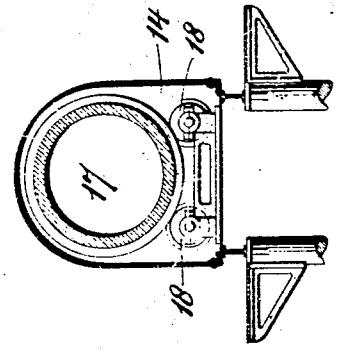

Fig. 5.

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UNITED STATES PATENT OFFICE.

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GAS-PRODUCER.

No. 868,026. Specification of Letters Patent. Patented Oct. 15, 1907.

Application filed December 6, 1905. Serial No. 290,526.

To all whom it may concern:

Be it known that I, MARTIN VAN BUREN SMITH, a citizen of the United States of America, and a resident of the city, county, and State of New York, have invented certain new and useful Improvements in Gas-Producers, of which the following is a specification, reference being had to the accompanying drawings, forming a part thereof.

My invention relates to improvements in gas apparatus, and particularly to apparatus for the manufacture of the class of gas known as producer gas.

My invention consists first in means arranged to produce the distillation of volatile gases from the incoming material prior to its subjection to treatment in the furnace chamber, whereby the lighter more volatile hydro-carbons may be available, with the other gases evolved, for use in the regenerator furnace, or wherever else the gas is to be employed. In the ordinary form of producer the green coal is fed directly to the furnace chamber where the intense heat destroys a large percentage of the volatile hydro-carbons, which not only deprives the final product of its full value but causes large deposits of soot to be made, which are deposited in the pipes and conduits conveying the gas from the producer. In my present invention I have overcome both of these defects by feeding the raw material into the producer in the path of the gases passing from the furnace chamber, but in an opposite direction thereto, distilling out the more volatile gases during the process of so feeding in the material, so that the material, when it reaches the furnace chamber proper, is substantially in the form of coke. Thus it may be said that the coking chamber is arranged as separate and independent from the furnace chamber. The resultant gas is of a better quality, more economical, and richer in heat units, than is the gas generated in the ordinary gas producers. It will be understood that the gas finally delivered from a producer made in accordance with my invention, as so far described, while of a high calorific value and admirably adapted for such purposes as combustion in a regenerator furnace, is not particularly well adapted for certain other purposes, such for instance as employment as motive fluid in a gas engine, because the lighter hydro-carbon increment is liable to condensation. The gas could, of course, be washed, scrubbed or drained of its non-stable and deposited constituents and then used for any purposes desired.

It is a further object, however, of my present invention to provide means in a single producer for supplying gas not only to regenerator furnaces, but also to supply gas as motive fluid to gas engines, and that without necessitating the carrying on of washing, scrubbing or draining processes. In carrying out this part of my invention I provide a supplemental discharge communicating with the furnace chamber at a point below the normal upper level of the fuel therein, and because the volatile gases have all been evolved before the material reaches the furnace chamber, I am enabled to carry off only the stable gases through this supplemental discharge, such gases being admirably adapted for the purpose of motive fluid in gas engines.

My invention also consists in certain novel features of construction and combination of parts as will hereinafter be more fully described.

In order that my invention may be fully understood, I will now proceed to describe an embodiment thereof with reference to the accompanying drawings illustrating same, and will then point out the novel features in claims.

In the drawings: Figure 1 is a view in partial side elevation and partial vertical section through an apparatus embodying my invention. Fig. 2 is a view in transverse vertical section of the same along the plane of the line 2—2 of Fig. 1. Fig. 3 is a view in horizontal section substantially upon the plane of the line 3—3 of Fig. 2. Fig. 4 is a top view with certain parts removed. Fig. 5 is a view in transverse section through the coking chamber and conduit. Fig. 6 is a detail sectional view showing particularly the means for feeding in material to the coking chamber.

Reference character 10 designates a gas producer furnace chamber arranged for the reception of fuel to be burned at a high temperature. The fuel is fed in through the mouth 11 of the furnace chamber, and the solid residue after combustion is discharged through ash pits 12. Twyers 13 are provided for supplying the requisite quantity of oxygen in the form of air or otherwise, to support combustion in the furnace chamber, and also to supply steam, if necessary, as is common and well known.

Arranged above the furnace 10 at a slight angle from the horizontal, and with one end in open communication with the mouth 11 of the said furnace, is a closed conduit 14, the opposite end opening into a vertical down-take 15, which, in turn, leads to a discharge flue 16. Rotatably mounted in said conduit is an open-ended cylindrical shell 17 constituting a coking chamber. This shell is suitably mounted upon anti-friction rollers 18, and is rotated by means of a pinion 19 in mesh with a gear ring 20 upon the said shell. The pinion 19 is carried by a shaft 21 driven by any suitable means. The coking chamber 17 is arranged directly in the path of the gases which rise from the furnace 10, said gases 10 passing through the coking chamber in order to reach the down-take 15 and discharge

flue 16. The conduit 14, near its mouth, is preferably provided with a wall 22, which serves to prevent any but a very small quantity of gases from passing into the main part of the conduit 14, such portions of the gas which do pass into the conduit, however, having a direct path to the down-take 15, and no other path, so that there will be no undesirable escape of gases to the external atmosphere. The coking chamber 17 is preferably arranged at a slight angle to the horizontal, so that material fed at the upper end will gradually tend to work down toward the lower end to be finally delivered into the furnace chamber 10 through the open mouth 11.

The apparatus is provided with an automatic feed 23 for delivering material into the upper end of the coking chamber. This feed comprises a hopper 24, a stationary tube 25 secured to one of the end walls of the conduit 14 and arranged to project into the open end of the coking chamber 17, and a revoluble conveyer screw 26 mounted in the said tube. The feed screw 26 is driven from a shaft 27, itself rotated by any suitable means. Preferably the shafts 27 and 21 are connected through intermediate means, whereby the relationship of speed of one is correctly timed with the relationship of speed of the other. In the present example of my invention I have shown cone pulleys 28 and 29 upon the shafts 27 and 21, respectively, and a belt 30 connecting them. By shifting the belt 30 along the cone pulleys, a variation of relative speed between the feed screw and the rotating means for the coking chamber may be attained. This variation is sometimes desirable when different qualities of material are fed into the apparatus, and also to initially adjust the speeds to the required relationship.

In operation, material such as green coal is fed into the hopper 24, and is fed therefrom at the proper speed by means of the conveyer screw 26 into the upper end of the coking chamber 17. This coking chamber is revolved at the desired speed, the material therein gradually working itself away down to the lower end of the coking chamber into the furnace chamber. The gases rising from the furnace chamber pass through the coking chamber and impart a sufficient heat to the material therein to distil off the volatile hydro-carbons, which are then carried over with the other gases down through the down-take 15 to the discharge conduit 16. It will be noted also that, because of the arrangement above set forth in which the fresh coal is advancing in a contrary direction to the hot products of combustion, there will be a constant interchange of heat. Thus the incoming green coal will be submitted to a minimum of heat as it enters, and this heat will gradually increase as the material passes on. It will increase until the lightest of all the volatile hydro-carbons begin to go off, and will then gradually increase until the material reaches the discharge mouth of the coking chamber until all of the said hydro-carbons will have been evolved and substantially nothing but coke will be discharged into the furnace. It is not until the coke gets into the furnace that the temperature rises to a point which would be sufficient to decompose these volatile hydro-carbons, and as by this time they will all have been evolved, they are thus all available for use. Again, because all these unstable gases have been evolved before the material reaches the combustion chamber, it follows that the gases later evolved from the coke will be stable and can be used for purposes to which gases including an unstable increment would not be adapted. These stable gases may be drawn off through an auxiliary conduit 31 which I have especially provided for the purpose, said conduit communicating with the furnace below the level of the top of the fuel therein, so that, in a furnace constructed in accordance with my invention, I am enabled to draw off from one part a stable gas suitable for certain purposes, such as supplying motive power to a gas engine, and from another part of the apparatus I am enabled to take off a gas of an extremely high caloritic value, which includes all the unstable elements ordinarily destroyed by decomposition in the process of manufacturing producer gas. The apparatus will be substantially free from deposits of soot, soot being largely one of the products of the decomposition of the lighter hydro-carbons. If any soot were formed, it would form in the coking chamber, and would be fed down back into the furnace, there to be consumed as carbon, thereby tending to increase the carbon monoxid evolved.

If steam is employed in the twyers, the gases evolved from the decomposition thereof will further tend to enrich the final product.

What I claim is:

1. In a gas producer, the combination with a furnace chamber, of a substantially horizontal conduit in direct open communication therewith, and a coking chamber revolubly mounted in said conduit, said coking chamber in open communication at its upper end with said conduit and at the lower end with said furnace chamber.

2. In a gas producer, the combination with a furnace chamber, of a substantially horizontal conduit in direct open communication therewith, and an inclined coking chamber revolubly mounted in said conduit, said coking chamber in open communication at its upper end with said conduit and at the lower end with said furnace chamber.

3. In a gas producer, the combination with a furnace chamber, of a conduit in open communication therewith, a cylindrical coking chamber revolubly mounted at a slight angle from the horizontal in said conduit, the upper end of said coking chamber in open communication with the said conduit and the lower end thereof in communication with the said furnace chamber, and means for feeding fresh material to the upper end of said coking chamber.

4. In a gas producer, the combination with a furnace chamber, a conduit in open and direct communication therewith at one end, and a discharge from said conduit at the other end, of a rotatable coking chamber open at both ends into the conduit, revolubly mounted in said conduit, and a supplemental discharge from the furnace chamber communicating therewith at a point below the upper end thereof and below the normal level of the fuel contained therein, said supplemental discharge arranged to deliver gases evolved in the lower part of said furnace chamber substantially free from gases evolved at a point above the level of the fuel.

5. In a gas producer, the combination with a furnace chamber, a conduit in open and direct communication therewith at one end, and a discharge from the said conduit at the other end, of a rotatable coking chamber open at both ends into the conduit, revolubly mounted in said conduit.

6. In a gas producer, in combination with a furnace chamber, a conduit in open and direct communication therewith at one end, and a discharge from the said conduit at the other end, of a rotatable coking chamber open at both ends into the conduit, revolubly mounted in said conduit, and means for feeding material into the end of the coking chamber furthest away from the furnace chamber.

7. In a gas producer, the combination with a furnace chamber, and a conduit in open and direct communication therewith, of a revoluble coking chamber mounted in said conduit, feeding means for feeding material into the revoluble coking chamber, and means for operating the feeding means in timed relation with the speed of revolution of the coking chamber.

8. In a gas producer, the combination with a furnace chamber, and a conduit in open and direct communication therewith, of a revoluble coking chamber mounted in said conduit, feeding means for feeding material into the revoluble coking chamber, and means for operating the feeding relationship between the feeding means and the rotation of the coking chamber.

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