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R. S. CRAIG.

GAS PRODUCING APPARATUS.

APPLICATION FILED JUNE 18, 1902. RENEWED JULY 12, 1904.

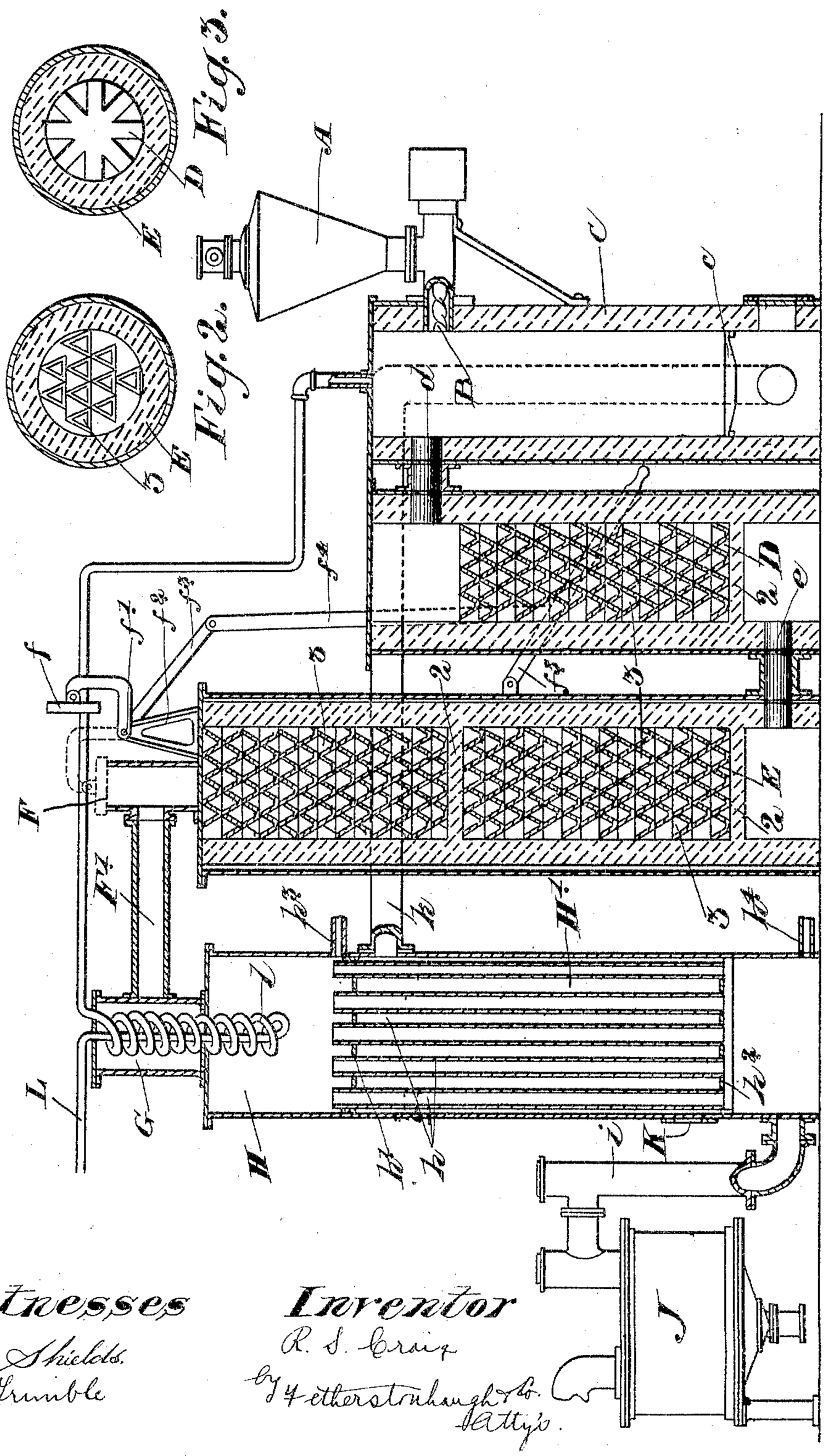

Fig. 1.

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UNITED STATES PATENT OFFICE.

ROBERT STEELE CRAIG, OF CHICAGO, ILLINOIS.

GAS-PRODUCING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 780,026, dated January 17, 1905.

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To all whom it may concern:

Be it known that I, ROBERT STEELE CRAIG, of the city of Chicago, in the county of Cook, in the State of Illinois, have invented certain new and useful Improvements in Gas-Producing Apparatus, of which the following is the specification.

My invention relates to improvements in gas-producing apparatus; and the object of the invention is to devise a simple and cheap apparatus for producing gas of a superior quality for illuminating and fuel purposes in which air under forced draft will be used continuously and in which also the utilization of all electrolytic action will be avoided.

The present invention relates to an apparatus which I use in connection with my method which forms the subject-matter of a separate application, filed July 8, 1901, Serial No. 67,541.

The apparatus I shall now describe in detail.

Figure 1 is an elevation, mostly in section, showing the apparatus adapted to carry out my improved process. Fig. 2 is a sectional plan showing the form of the crucibles in the fixing-chamber. Fig. 3 is a sectional plan showing the form of arch in the fixing-chamber.

In the drawings like characters of reference indicate corresponding parts in each figure.

A is the feed-box for the coal or carbonaceous material. Soft or bituminous coal is the kind I prefer.

B is the screw-feed leading from the hopper to the combustion-chamber C, which is provided with the grate-bars *c* and upon which the fuel is continuously fed, but in such a manner as not to prevent the state of incandesence being preserved in the fire-bed.

D and E are the fixing-chambers. The combustion-chamber C is connected at the top by the flue *d* with the fixing-chamber D and the fixing-chamber D is connected at the bottom by the flue *e* with a fixing-chamber E. The fixing-chambers D and E are provided with arches 2 in a spider-like form, as shown in Fig. 3, upon which is supported the silica crucibles 3, filled, preferably, with a material of a great heat absorbing, retaining, and radiating quality, preferably copper. I preferably fill the silica crucibles 3 with copper alone, as I do not wish to produce any electrolytic action, but merely to cook or fix the gas.

I employ silica crucibles to contain the heat absorbing, retaining, and radiating material in order to enable me to use slack-coal in the combustion-chamber. This slack-coal gives off a great amount of lampblack, which readily adheres to fire-brick and retards the fixing operation; but I find that this is not the case with silica. Hence I place the copper in silica crucibles, to which the lampblack will not adhere to any appreciable degree.

At the top of the fixing-chamber E, I provide a flue F, which when the process is in operation is closed by a cap *f*, as indicated by dotted lines, such cap being pivoted at *f'* on the top of a suitable standard f^2 and operated through an arm f^3 and connecting-rod f^4 by a lever f^5. F' is a continuation of the flue F, such flue extending to a flue G at the top of a receptacle provided with a vaporizing-chamber H, communicating with the flue G, a condensing-chamber H' below said vaporizing-chamber, and a collecting-chamber arranged below said condensing-chamber. The condensing-chamber H' contains a plurality of tubes *h*, such tubes being supported on diaphragms *h'* and h^2, which form the upper and lower walls of the chamber H'. The tops of the tubes *h* extend above the diaphragms *h'*, and a water-supply h^3 enters the condensing-chamber below the level of the top of the tubes. A water-drain pipe h^4 is provided at the bottom of the collecting-chamber, as indicated. The collecting-chamber is connected by the pipe *i* to the wash-box J.

K is the pipe leading into the condensing-chamber H' and provided at the end thereof with any suitable fan or other device for producing a forced draft of air, such forced draft passing through the chamber H' into the pipe *k* at the upper end of the chamber, thence to the combustion-chamber, which it enters underneath the grate-bar *c*. By this arrangement it will be seen that the air entering the condenser through pipe K is first employed to cool the condenser; but in its passage therethrough and before leaving the same it

becomes heated to a degree and in this heated condition it is delivered to the combustion-chamber beneath the grate-bar, and thus aids the primary combustion. This utilization of the air to first cool the condenser and then aid primary combustion is important and greatly improves and simplifies the apparatus, as will be obvious.

h^4 is the drain-pipe for the water.

I preferably use crude petroleum.

The pipe L extends downward into the condenser H in the form of a coil 1 and passes outwardly again through the flue G to a point at the top of the combustion-chamber C.

In starting my apparatus the cap *f* is removed from the flue F and the soft coal or other carbonaceous material is placed upon the grate-bar *c* and a fire made, the draft being directly through the combustion-chamber C, flue *d* and fixing-chamber D, flue *e*, fixing-chamber E, and out through the flue F. As soon as the bed of carbonaceous material is brought to a point of incandescence and the copper in the silica crucibles 3 has been brought up to the desired heat I close the cap *f*, so that the gas now produced in the combustion-chamber will pass through the flue F′ down through a flue G into the vaporizing-chamber H, whence it passes out through the flues *h* of the condensing-chamber H′, into the collecting-chamber, thence to the wash-box. The water-pipe h^3 serves to keep the water to about a level with top of the tubes *h*, and any overflow will pass down such tubes. As the gas is at a great heat when it strikes the top of the tubes, it will be seen that the water surrounding the same will protect the tubes. There is a constant supply of the water, so as to keep the water up to the top of the level of the tubes, as it is of course constantly evaporating. The overflow passes out through the pipe h^4 after having passed down the sides of the tubes, which I find in practice keeps them clean.

By employing a condenser intermediate the fixing-chambers and the wash-box it is found that the resultant gas is considerably improved in quality, for the reason that the condenser acts to gradually cool the gas after leaving the fixing-chambers and before reaching the wash-box. In fact, by the arrangement herein shown and described the gas enters the wash-box at about the same temperature as the water therein, and hence a great percentage of the "marsh-gas" series is preserved, which would not be the case if the gas entered the wash-box directly from the fixing-chambers and when it is in a highly-heated state. I consider the particular arrangement of condenser as being a most valuable improvement in the apparatus.

It will consequently be seen that as the pipe L passes into the flue G and vaporizing-chamber H such pipe is kept at a high temperature, and consequently the crude petroleum that passes therethrough will be vaporized before it reaches the top of the combustion-chamber. Immediately the cap *f* has been placed in position so as to cause the passing of the gas through the whole apparatus a suitable cock is turned on in the pipe L and hydrocarbon vapor passes into the top of the combustion-chamber, the forced draft of air forcing the gas through the flue *d* and thence through the apparatus.

What I claim as my invention is—

1. In a gas-producing apparatus, a combustion-chamber, a carbonaceous-material supply communicating therewith, a fixing-chamber communicating at its top with said combustion-chamber, a second fixing-chamber communicating at its bottom with the bottom of the first-mentioned fixing-chamber, a receptacle having a pair of compartments, one of which forms a vaporizing-chamber and the other of which a condensing-chamber, said vaporizing-chamber provided with a water-inlet and said condensing-chamber with an air inlet and outlet, said receptacle further provided with a water-outlet, means for establishing communication between the top of said second-mentioned fixing-chamber and top of said receptacle, a vaporizing-coil extending in said vaporizing-chamber and communicating with a hydrocarbon-supply, said coil further communicating with the top of said combustion-chamber, a wash-box communicating with said receptacle, and an air-pipe communicating at one end with the air-outlet of said condensing-chamber and at its other end with the combustion-chamber below the fuel therein.

2. In a gas-producing apparatus, a combustion-chamber, a fixing-chamber communicating therewith, a receptacle provided with a vaporizing and a condensing chamber, said receptacle having air and water inlets and outlets, and having its vaporizing-chamber communicating with said fixing-chamber, a hydrocarbon-supply pipe extending in said vaporizing-chamber and opening into the top of said combustion-chamber for supplying vapor thereto, and an air-conducting pipe communicating at one end with the air-outlet of said receptacle and opening at its other end into the bottom of said combustion-chamber below the grate-bars thereof.

3. In combination, a receptacle provided with a vaporizing, a condensing and a collecting chamber, said condensing-chamber having air and water inlets and an air-outlet, said collecting-chamber having water and gas outlets, and said vaporizing-chamber having a gas-inlet, a fixing-chamber communicating with said gas-inlet, a combustion-chamber communicating with said fixing-chamber, an air-pipe communicating with said air-outlet and with said combustion-chamber below the grate-bars thereof, and means for supplying vapor from said vaporizing-chamber to said combustion-chamber.

4. In combination, a receptacle provided with a vaporizing, a condensing and a collecting chamber, said vaporizing-chamber having a gas-inlet, said condensing-chamber having an air and water inlet and said collecting-chamber having water and gas outlets, a fixing-chamber communicating with said gas-inlet, a combustion-chamber communicating with said fixing-chamber, a hydrocarbon-supply pipe extending in said vaporizing-chamber and opening into the top of said combustion-chamber for supplying vapor thereto, and an air-pipe communicating with said air-inlet and opening into the bottom of said combustion-chamber below the grate-bars thereof.

5. In a gas-producing apparatus, a collecting-chamber, a wash-box communicating therewith, a condensing-chamber arranged above said collecting-chamber and provided with an air inlet and outlet, a vaporizing-chamber arranged above said condensing-chamber, a fixing-chamber arranged parallel to said collecting, condensing and vaporing chambers, and communicating with said vaporizing-chamber, a combustion-chamber arranged parallel to said fixing-chamber and communicating therewith, means extending in said vaporizing-chamber for supplying vapor to said combustion-chamber, and an air-pipe for supplying air from said condensing-chamber to said combustion-chamber below the grate-bars thereof.

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