PATENT SPECIFICATION

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COMPLETE SPECIFICATION

Improvements relating to the Manufacture of Gas

We, SURFACE COMBUSTION CORPORATION, of Toledo, Ohio, United States of America, a Corporation organised and existing according to the laws of the State of New York, United States of America, assignees of JOHN ALDRICH COMSTOCK, a citizen of the United States of America, of 1433, South Cove, Toledo, Ohio, United States of America, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to the manufacture of gas and involves a method of and apparatus for utilising carbonaceous material such as charcoal or coke in the production of a gas which shall have a high carbon monoxide content and which shall be substantially devoid of the volatile impurities given off by the carbonaceous material when it is initially heated.

Hitherto in using carbonaceous material in the production of a gas having the characteristics mentioned it has been the practice first to degasify a full charge of said material in a heated retort and then to utilize that charge as long as it lasts in making the desired gas.

The present invention, on the other hand, aims to provide for the continuous feeding of the carbonaceous material into the retort and for the continuous degasification of the incoming material.

In the manufacture of gas according to this invention a method of utilising carbon in the form of charcoal or coke to produce a gas of high carbon monoxide content and of controlled hydrogen content is employed, which method comprises feeding the carbon into one end of an externally heated retort to continuously maintain in the retort a column of incandescent carbon, continuously flowing a stream of gas out of the retort countercurrent to the incoming carbon whereby to expel from the retort those volatiles that are given off by the carbon when it is first heated, flowing an oxidizing gas into the retort at a point where the carbon is substantially devoid of said volatiles and withdrawing the resulting reaction products from the retort at another point where the carbon is substantially devoid of said volatiles, and controlling the hydrogen content of said reaction products by controlling the composition of the oxidizing gas.

A gas producer made according to this invention for carrying out the before described method comprises in combination, an externally heated retort, means for feeding carbonaceous material to the retort, means including means for delivering a base gas under pressure to said retort for causing volatiles and vapors given off by the incoming material as it becomes heated to flow out of rather than into the retort, a passage through which the desired gas is withdrawn from the retort, the intake end of said passage and the point where the base gas is discharged into the retort being remote from each other and both being sufficiently remote from the place where said material enters the retort to insure that said material will be completely out-gassed when it reaches said end and said point, said base gas containing a constituent that will react with the out-gassed material to produce the gas flowing out of the retort through said passage.

Referring to the drawings filed herewith:—

Fig. 1 illustrates a preferred form of gas producer, and

Fig. 2 illustrates a modified form thereof.

The gas producer comprises a retort 20 and a furnace 14 for heating the same, the means for firing the furnace comprising burners 27 and temperature control apparatus of which a portion is indicated at 28. The lower end of the retort is closed as by a valve 21 through which ashes may be removed from the retort. The carbon or carbonaceous material C to be fed to the retort is contained in a magazine or hopper 15 having a removable cover 16 and a valve-controlled vent 17 and will ordinarily consist of wood charcoal, it

[Price 1/-]

being noted that the lower end of the magazine is in open communication with the upper end of the retort and, therefore, that the material moves into the retort under the influence of gravity. 29 indicates a sand seal or the like between the magazine and the retort.

Projecting down into the retort from the magazine for some distance is a tube 25^{11} through which the desired gas produced in the retort is withdrawn from the latter for use, the tube being coupled to a pipe 30 shown as leading out of the side of the magazine at 31. 32 and 33 indicate normally closed clean-out pipes which also serve as means for holding the tube 25^{11} in predetermined position.

The base gas, which is to react with the out-gassed carbon in the retort to produce the carbon monoxide is delivered under pressure to the retort by a valve-controlled supply pipe 22 shown as delivering into the lower end of the retort whereby to insure that the oxygen-containing constituent in the base gas shall be converted into carbon monoxide by the time it reaches the intake end of the tube 25^{11}. The pressure of the base gas need not be great but it should be great enough to cause the volatile impurities given off by the incoming carbonaceous material as it becomes heated to flow out through the vent 17 rather than into the retort and additionally to prevent products of combustion in the furnace 14 from seeping into the retort. The degree to which the tube 25^{11} projects into the retort should, of course, be such as to insure that by the time the incoming carbon reaches the intake end of the tube it has not only been sufficiently out-gassed for the purposes in view but has also attained the prevailing temperature as determined by the settling of the temperature control apparatus previously mentioned.

The primary constructional difference between the gas producers of Figs. 1 and 2 is that whereas in Fig. 1 the reaction products flow out of the retort through the tube 25^{11}, in Fig. 2 they flow out through a side port 25 in the wall of the retort. However, the mode of operating the producer of Fig. 1 is the same as that of Fig. 2 and therefore need not be further described.

The side port 25 constitutes the intake end of a conduit 30^{1} which delivers the withdrawn gases in a heated condition to an enclosure 34. In order to assist in keeping said gases hot while flowing through the conduit 30^{1}, the hot waste gases from the furnace 14 are caused to flow upwardly around said conduit through an upright duct 35 from which they pass to the atmosphere through a side opening 36 in the duct.

37 indicates a portion of the floor or base of the enclosure 34 and 38 a portion of a hood or cover which cooperates with the base to form the enclosure. The conduit 30^{1} is shown as comprising a tube having at its upper end an annular flange 39 removably seated in an annular seal and having at its lower end a bell mouth 40 which dips into an annular seal, thereby facilitating assemblage of the parts.

The gases withdrawn from the retort through the tube 25^{11} or the side port 25 are well adapted for use as a protective atmosphere for heated steel and the enclosure 34 shown in Fig. 2 may therefore be used for heating steel articles for various processes such as annealing, normalizing, hardening, tempering, forging, etc.

The choice of base gas hereinbefore referred to will be determined largely by its relatively low content of hydrogen or hydrogen-containing constituents and by its nitrogen content. Thus the base gas may be air, dehydrated flue gas, dried ammonia combustion products or producer gas or various mixtures of these gases depending on the amount of nitrogen that is desired in the reaction products.

The relative proportions of CO and CO_2 in the reaction products is a function of the temperature to which the carbonaceous material in the retort is heated and by maintaining the retort at the same or substantially the same temperature as the temperature of the enclosure 34 the ratio

$$\frac{(CO)^2}{CO_2}$$

expressed in partial pressures in atmospheres will be such as to be neutral or slightly carburizing to the steel in the enclosure.

In order that the retort may withstand temperatures in excess of 1850° F., it will ordinarily be made of silicon carbide.

As an indication of the difference in the composition of the vented gases, that is, the gases flowing out of the magazine through the vent 17 and the retort gases, that is the gases flowing out of the retort through the tube 25^{11} or side port 25, when using wood charcoal as the carbonaceous material and air as the base gas, the following examples are given for two different temperatures.

EXAMPLE No. 1.—Retort at 1550° F.

Vented Gases		Retort Gases
%		%
3.6	CO_2	0.7
0.0	O_2	0.0
28.7	CO	33.1
7.4	H_2	2.1
0.0	CH_4	0.0
balance	N_2	balance

EXAMPLE No. 2.—Retort at 2200° F.

Vented Gases		Retort Gases
%		%
3.8	CO_2	0.1
0.0	O_2	0.0
30.6	CO	34.5
7.7	H_2	1.2
0.0	CH_4	0.0
balance	N_2	balance

The method herein described of making a metal protecting gas of controlled hydrogen content regardless of the initial content of hydrogen or hydrogen compounds in the carbonaceous material (e.g. carbon, coke, charcoal) is an important feature of the invention.

Having now particularly described and ascertained the nature of our said invention, and in what manner the same is to be performed, we declare that what we claim is:—

1. The manufacture of gas involving the method of utilizing carbon in the form of charcoal or coke to produce a gas of high carbon monoxide content and of controlled hydrogen content, which method comprises feeding the carbon into one end of an externally heated retort to continuously maintain in the retort a column of incandescent carbon, continuously flowing a stream of gas out of the retort countercurrent to the in-coming carbon whereby to expel from the retort those volatiles that are given off by the carbon when it is first heated, flowing an oxidizing gas into the retort at a point where the carbon is substantially devoid of said volatiles and withdrawing the resulting reaction products from the retort at another point where the carbon is substantially devoid of said volatiles, and controlling the hydrogen content of said reaction products by controlling the composition of the oxidizing gas.

2. A gas producer for carrying out the method of claim 1 comprising in combination, an externally heated retort, means for feeding carbonaceous material to the retort, means for delivering a base gas under pressure to said retort for causing volatiles and vapors given off by the incoming material as it becomes heated to flow out of rather than into the retort, a passage through which the desired gas is withdrawn from the retort, the intake end of said passage and the point where the base gas is discharged into the retort being remote from each other and both being sufficiently remote from the place where said material enters the retort to insure that said material will be completely out-gassed when it reaches said end and said point, said base gas containing a constituent that will react with the out-gassed material to produce the gas flowing out of the retort through said passage.

3. A gas producer according to claim 2 characterised in that the retort is surrounded by a furnace for heating the said retort.

4. A gas producer according to claims 2 and 3 wherein the retort is fed with carbonaceous material through a hopper discharging into the upper end of the retort, the said hopper being located exteriorly of the furnace.

5. A gas producer according to claim 2 wherein the intake end of said passage is intermediate the ends of said retort and the point of discharge of the base gas into the retort is adjacent that end of the latter most remote from the incoming carbonaceous material.

6. The method of manufacturing gas substantially as hereinbefore described.

7. A gas producer constructed substantially as described with reference to and as illustrated in Figure 1 or Figure 2 of the accompanying drawings.

Dated this 3rd day of February, 1941.

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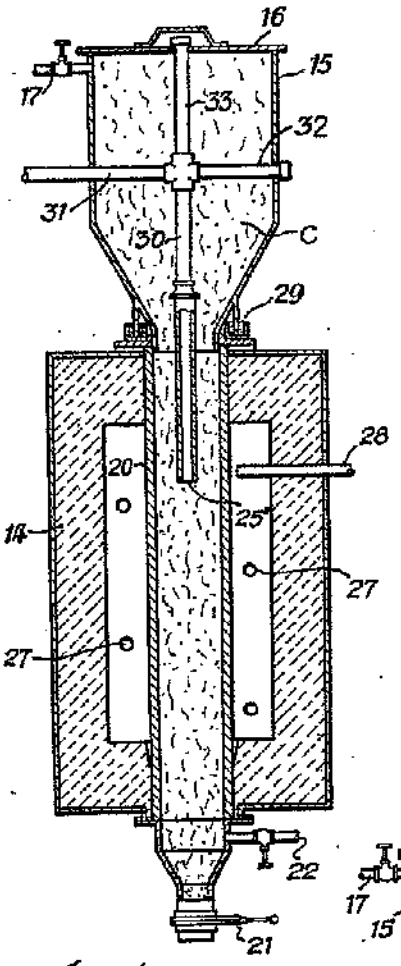

Fig. 1

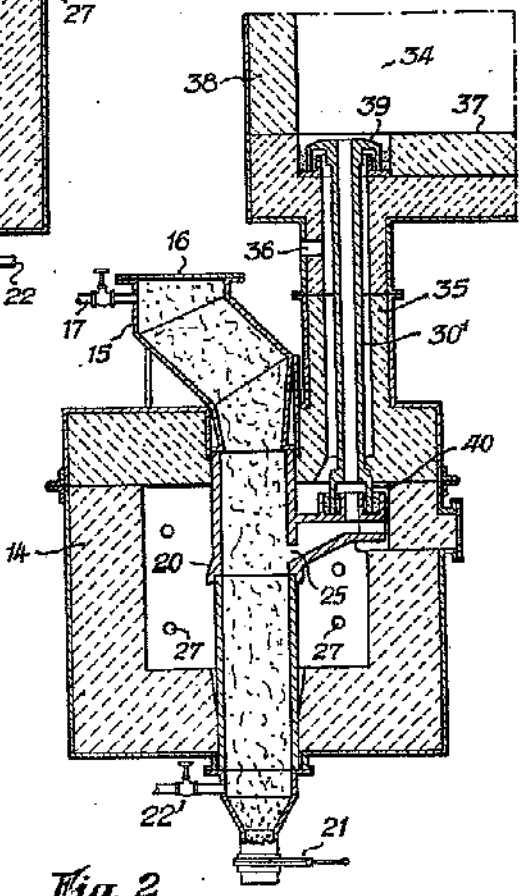

Fig. 2

Malby & Sons, Photo-Lith.