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(12) Patent:

(54) PROCESS OF MANUFACTURING CARBON MONOXIDE

(54) FABRICATION DE PROTOXYDE DE CARBONE

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- Disclosures Image
- Drawings Image

307776

This invention relates to the manufacture of carbon monoxide and more particularly refers to improvements in its processes of manufacture whereby high efficiency and economy of operation result.

5 As is well known, carbon monoxide gas constitutes the main ingredient in the commercial manufacture of formic acid, acetic anhydride and phosgene.

10 Furthermore, the purity of the carbon monoxide gas is an all important factor in assuring the economical production of these substances, since the purer the carbon monoxide gas, the quicker and more complete the reaction, so that fewer intermediate compounds will be formed.

15 The cost of production of these substances is, of course, also affected to a considerable extent by the cost of production of the carbon monoxide gas, to that any improvement in the process of manufacture of the latter will result both directly and indirectly in improving the character and the yield of the substances  
20 derived therefrom.

Carbon monoxide gas is generally produced by admitting pure oxygen within a mass of coke brought up to white heat, said coke being placed in a suitable generator equipped with means for insuring a continuous supply of coke without admitting air to the generator and without stopping the operation of the furnace.

However, the very high reaction temperatures used, give occurrence to a number of difficulties in the operation of these generators and also entail heavy maintenance costs due to the necessity of consequently renewing linings, nozzles, etc.

The heavy formation of slag in the furnace also entails the necessity of frequent removals, so that the operation of the furnace must be interrupted from time to time and a diminished output results.

I have also found that the carbon monoxide gas obtained by the processes heretofore in use does not have a high degree of purity and this causes a material increase in the time required by the subsequent reactions especially when formates are produced as a preliminary  
5 step towards the manufacture of formic acid.

The primary object of this invention is to provide a novel and improved process of manufacture of carbon monoxide gas, whereby a gas having a high degree  
10 of purity is produced and a relatively high rate of production can be maintained.

Another object is to provide a novel and improved process of manufacture of carbon monoxide gas permitting at all times an uninterrupted production of gas  
15 having a high degree of purity, at relatively low cost.

A further object is to provide an improved process of manufacture of carbon monoxide gas, whereby the high temperatures of reaction are localized, so that a relatively low temperature is maintained within the furnace as a whole, with consequent material reduction of maintenance costs.

A still further object is to provide, in a process of manufacture of carbon monoxide gas where pure oxygen is caused to react with previously ignited coke contained in a wrought iron generator, a novel and improved manner of supplying the oxygen to the coke, whereby temperatures localized at the point of reaction are produced, sufficiently high to sublime the ash contents of the coke, the gas being produced at a pressure sufficient to carry away the sublimed ash in its entirety; an important resultant advantage being the possibility of an uninterrupted operation of the furnace for long period of time.

Other objects and advantages of the present invention will more fully appear as the description proceeds and will be set forth and claimed in the appended claims.

5 My process is carried out in a wrought iron generator which is maintained at a relatively low temperature by water cooling.

The generator is first charged with a small amount of charcoal on top of which coke is added.  
10 The fuel is then ignited and the generator manhole is closed, after which pure oxygen is supplied through a nozzle, so that it will react with the carbon content in the coke producing carbon monoxide gas.

The charging of the generator is done  
15 from the top by a special charging apparatus which makes it possible to supply additional coke from time to time without stopping the process.

The oxygen supply should be well regulated because if the supply is too abundant, carbon dioxide might be produced together with carbon monoxide.

My improved process consists, essentially,  
5 in supplying oxygen to the generator through a narrow nozzle, at a relatively high velocity and under a pressure of one-half atmosphere or more.

The ensuing reaction, which may be compared to that taking place in a welding or cutting burner,  
10 occurs very energetically producing a very high temperature of reaction which is however, localized, and therefore does not affect the furnace linings.

At the same time, the reaction temperature is such that with a normal composition of the coke  
15 the entire ash becomes sublimed and is carried away with the gas, no sintered or molten slag remaining in the generator.

This entirely does away with the necessity of removing slag so that an essential advantage is gained over the methods and apparatus heretofore in use.

5                   The amount of the filling charge depends  
on the gas temperature. With a generator burned low, the  
gas temperature should not exceed 130° Celsius but under  
normal conditions of operation the temperature should be  
about 60 to 70° Celsius. The oxygen pressure can be reg-  
10                   ulated automatically as will be understood.

The dimensions of the generator may be very small in comparison with the output, therefore the cost of the apparatus is proportionately low.

15                   The main advantage resulting from this  
process is that almost pure carbon monoxide gas is produced,  
its purity being as high as 98-99% and at any rate never  
lower than 96%, according to the kind of coke used, as  
against a purity of 90-92% obtained by other processes.



Other advantages are the small cost of the apparatus due to its simplicity, a small power consumption and a high efficiency through possibility of automatic regulation of the oxygen supply.

5                   The carbon monoxide gas thus produced contains about 30 to 40 grams of dust per cubic meter, and the same is therefore subjected to a purification process in order to render it suitable for use in the manufacture of other substances such as those previously mentioned.

10                   Leaving the generator, the gas is conveyed to one of the units of a specially constructed two unit filter in which the ash and flue dust admixed with the gas are retained. As soon as one of the filter units is filled with ash and flue dust, the gas supply is  
15 switched over to the other filter unit. In this manner, the operation is not interrupted and the first filter unit may be cleaned at once and made ready for the next step.

After the gas has passed the filter,  
it enters the pre-purifier. This apparatus consists of a  
tower provided with several compartments; the carbon mon-  
oxide gas enters this tower at the bottom, travels through  
5 the different compartments and leaves it at the top after  
having been freed of the greater part of the impurities,  
such as the small amount of dust which may have been  
carried past the filter and the sulphur and other consti-  
tuents of the gas.

10 As soon as the operation of the pre-  
purifier becomes impaired by impurities collected therein,  
the gas supply is switched over to a similar apparatus  
held in reserve so that the operation can be continued  
without interruption.

15 The carbon monoxide gas is then sub-  
jected to a final purification process, and when it has  
thus been entirely purified and absolutely freed of dust,  
it is dried in a suitable dry cleaner.

13

307778

After this is done, the gas may be directly used for the production of formates in autoclaves with caustic soda or potash and the formates thus formed may be decomposed with sulphuric acid and formic acid may  
5 be obtained; otherwise, the gas may be stored in a gas storage tank to be later used for the manufacture of formic acid, acetic anhydride or phosgene.

The advantages deriving from the state of purity in which the carbon monoxide gas is produced may  
10 be more fully realized when one considers that in the production of formates in which the time of reaction is generally between twenty and twenty-four hours, no more than twelve to fourteen hours are required by the use of the pure carbon monoxide gas obtained by this process.

15 I claim:

307776

1. - In a process of manufacture of carbon monoxide gas where coke or a like material is used as a source of carbon supply, the step which consists in supplying oxygen to said coke through a nozzle having a relatively small diameter, at a relatively high velocity.

2. - In a process of manufacture of carbon monoxide gas where coke or a like material is used as a source of carbon supply, the step which consists in supplying oxygen to said coke through a nozzle having a relatively small diameter, under a pressure of not less than one half atmosphere.

3. - The process of manufacturing carbon monoxide gas in a generator charged with coke or a like material used as a source of carbon supply, which consists in supplying oxygen to said coke, and in localizing the reaction between the oxygen and the carbon so as to produce relatively high temperatures without materially raising the temperature of the mass of coke as a whole.

4. - The process of manufacturing carbon monoxide gas in a generator charged with coke or a like material used as a source of carbon supply, which consists in supplying oxygen to said coke, in a quantity sufficient to locally produce temperatures sufficiently high to sublime the ash constituents of the coke, and at a velocity high enough to cause the ash particles to be carried away from the generator by the gas resulting from the reaction.

5. - In a process of manufacturing carbon monoxide gas where coke or a like material is used as a source of carbon supply, the step which consists in supplying oxygen to said coke at a velocity high enough to cause the ash constituents of the coke to be carried away from the generator by the gas resulting from the reaction.

6. - The process of manufacturing carbon monoxide gas in a generator charged with coke or a like material used as a source of carbon supply, which consists in supplying oxygen to said coke, in a quantity sufficient to locally produce temperatures sufficiently high to sublime the ash constituents of the coke, and at a velocity high enough to cause the ash particles to be carried away from the generator by the gas resulting from the reaction, and in subsequently subjecting said gas to operations of filtration and purification.

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307778

7. - The process of manufacturing carbon monoxide gas in a generator charged with coke or a like material used as a source of carbon supply, which consists in supplying oxygen to said coke, through a nozzle having a relatively small diameter, at a relatively high velocity, causing local reaction temperatures to be produced sufficiently high to sublime the ash constituents of the coke, and causing said ash constituents to be carried away from the generator by the generated gas.

8. - The process of manufacturing carbon monoxide gas in a generator charged with coke or a like material used as a source of carbon supply, which consists in supplying oxygen to said coke, through a nozzle having a relatively small diameter, at a relatively high velocity, causing local reaction temperatures to be produced sufficiently high to sublime the ash constituents of the coke, and causing said ash constituents to be carried away from the generator by the generated gas, and in subsequently subjecting said gas to operations of filtration and purification.

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July 1<sup>st</sup> 1929.