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UNITED STATES PATENT OFFICE.

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PROCESS OF MAKING GAS.

SPECIFICATION forming part of Letters Patent No. 764,320, dated July 5, 1904.

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To all whom it may concern:

Be it known that I, DESIDERIUS TURK, engineer, a subject of the Emperor of Austria-Hungary, and a resident of Riesa, in the Kingdom of Saxony, Germany, have invented new and useful Improvements in the Production of Gases of High Caloric Value, of which the following is a specification.

The invention relates to improvements in the production of gas, and has especial relation to the production of gases of high caloric value from fuel material which is of an inferior quality.

The invention consists in the process of forming gas of a comparatively high caloric value, the said process consisting in blasting a body of inferior fuel or material to obtain producer-gas and at the same time blasting a superior body of better fuel to a state of incandescence, after which the air-blast is shut off from the superior body-fuel, and the producer-gas generated by blasting the body of inferior fuel is passed through the incandescent superior fuel, the end product containing only the result produced by passing the inferior gas through the superior body of incandescent fuel.

According to the present process it is possible to employ fuel material of inferior caloric value—such as brown coal, lignite, or peat—for producing the highest heat effects required for industrial purposes. The gases obtained from such fuel material by the process carried out in the customary manner contain, besides the heating-gases proper, a quantity of carbonic-acid gas (CO_2) and a large percentage of steam.

It is the presence of steam which proves to be an insuperable obstacle when high effects of temperature are attempted. Attempts have been made to meet this drawback by getting rid of the steam by condensing the latter; but this involves the loss of a considerable amount of heat, since the heat required for transforming the water into steam is lost, while the generating heat is lost to a great extent.

According to the present invention such gases of low caloric value are made to pass through a layer of incandescent coal or coke. During such passage of the low-caloric gases through the incandescent fuel the following important chemical changes take place, besides some minor transformations of heavy carbureted-hydrogen combinations into light carbureted-hydrogen combinations. First, the carbonic-acid gas (CO_2) present in such gases is to a great extent reduced to carbon monoxid, (CO,) and, second, the steam is, as in the known water-gas process, decomposed, its oxygen forming carbon monoxid with the carbon taken up in its passage, while the hydrogen is disengaged, ($2H_2O+C_2=2CO+2H_2$.) In this manner it is possible to transform, by means of a very simple apparatus, a gas of low caloric value, containing, for example, among other constituents, ten per cent. of carbonic acid, fifteen per cent. of carbon monoxid, and fully twenty-five per cent. of steam, into a gas of high caloric power, which, while containing only four per cent. of carbonic-acid gas, (CO_2,) contains as much as thirty per cent. of carbon monoxid (CO) and twenty-five per cent. of hydrogen.

This process may be used in combination with any gas-generator of ordinary construction by transforming in the known manner the fuel of low caloric power into generator-gas. This generator-gas, commonly called "producer-gas," is made by igniting a body of cheap low-grade fuel—such as lignite, peat, or waste material containing carbon—in a gas-furnace and blasting it with air. The gas thus obtained, forming a gas of low caloric value, containing often as much as twenty-five per cent. and more of steam, is passed through an apparatus known as "water-gas" apparatus—*i. e.*, an apparatus containing coal rendered incandescent by an air-blast. The gas of low caloric power is kept passing through the second apparatus as long as the coal in it has sufficient heat to decompose the steam present in the passing gas into free hydrogen and oxygen, which with the carbon present forms carbon monoxid. When this no longer takes place, the gas is cut off and the contents of the water-gas apparatus are again raised to white heat by a fresh air-blast.

The exhaust-gases from the blast used in raising the contents of the water-gas apparatus to incandescence contain both carbon monoxid and carbon dioxid, and these gases may be mixed with the raw gas from the generator. This mixture may then be led into a second water-gas apparatus, (used alternately with the first,) where the carbon dioxid is reduced to the monoxid, thus further enriching the final gas.

Of course it is possible so to combine the generator-gas apparatus and the water-gas apparatus as to form a single apparatus.

There can be no doubt that the present invention will meet a pressing want, especially in view of the present scarcity in the supply of high-class coal, since it offers a ready means of employing cheap low-quality brown coal, such as is found in great quantities, lignite, peat, and even waste material containing carbon for all industrial purposes requiring very high temperatures, and thereby the use of high-price fuel may be avoided. Moreover, the gases thus obtained offer in addition the great advantage that owing to their high caloric value as regards the production of high temperatures the preliminary heating of air and gas hitherto necessary may henceforward be restricted to such preliminary heating of the air alone, in consequence of which the construction of furnaces and foundries will be considerably simplified. Then, again, the gases thus obtained may be conducted any distance without deteriorating in value, and, finally, it may be remarked that since steam can also be added to such low-caloric gases in quantities which can be regulated with great exactness a means is thereby secured of increasing the amount of carbon monoxid and hydrogen in the final gas, the caloric value of which can thus be brought very near to that of water-gas itself.

The application of this process to foundries enables their heating power to be increased, which power is apt to suffer, especially in wet weather, owing to the increase of steam caused by the charges being wet, in consequence of which it is often necessary to supplement with direct coal-firing in those places which are heated by foundry-gases. It may also be observed here that a great part of the carbonic acid contained in the foundry-gases is reduced to carbon monoxid, whereby the caloric value of the foundry-gas is considerably augmented.

I am aware that in the manufacture of water-gas the gaseous products arising from passing steam through a body of incandescent fuel, also the mixed gases produced by passing steam through incandescent fuel and the resulting products through a body of bituminous coal, have been passed through a second body of incandescent fuel for combining and fixing the gases. I am also aware that in a continuous process for the production of gas the mixed gaseous products arising from continuously blasting a body of bituminous coal with air and containing the "distillation products of the coal—namely, hydrocarbons, tars, and ammonia"—have been "forced through an incandescent body of coke into which air is at the same time forced." I am also aware that it has been proposed to make water-gas continuously by passing a "continuous supply of intensely-superheated steam at a temperature of nearly 2,500° through and in contact with a body of incandescent fuel." I do not employ or claim any of these methods of making gas. My process of making gas of high calorific value is distinguised from the processes heretofore known by the operations of first producing gas of low calorific value by blasting cheap low-grade fuel with air, at the same time heating a separate body of fuel to incandescence by blasting it with air, then shutting off the air and passing the said gas of low calorific value through the body of incandescent fuel. The air-blast is always shut off while passing gases of low calorific value through the separate body of incandescent fuel, so as to obtain gas of high calorific value containing the minimum per cent. of nitrogen and the maximum percentages of carbonic oxid and hydrogen. After the body of incandescent fuel for treating the gas of low calorific value has been reduced to too low a temperature for effecting the desired reactions the gas is shut off and the fuel is again heated to incandescence by blasting it with air, after which the air is shut off and the gas again passed through the incandescent fuel. I obtain economical and advantageous results by reason of the fact that cheap fuel is used for first producing gas of low calorific value containing carbonic oxid, carbonic acid, and steam. The gas while still hot and before the contained steam has opportunity to condense is passed into the body of incandescent fuel, where the carbonic acid is converted into carbonic oxid and the steam decomposed to produce hydrogen and carbonic oxid. These reactions can only take place in a body of fuel at a high temperature. Consequently the poor gas must be periodically shut off and the fuel again heated to incandescence by blasting with air. The air is excluded during the admission of the poor gas to the incandescent fuel in order to avoid the introduction of an excess of nitrogen into the gas.

Having now described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. The herein-described process of forming gas of high caloric value which consists in blasting a body of inferior fuel, and also blasting a superior body of a better fuel after which the air-blast is shut off from the second body of fuel and the producer-gas generated by blasting the first body of inferior fuel is

then passed through the incandescent body of superior fuel previously blasted, the end product containing only the result produced by passing the producer-gas through the second body of incandescent fuel.

2. The herein-described process of forming gas of high caloric value which consists in blasting fuel containing a large percentage of carbonic acid and steam or water vapor to form producer-gas, and at the same time blasting a second body of fuel of higher grade to an incandescent state after which the air-blast is shut off from the second body of the incandescent fuel and the producer-gas obtained from blasting the inferior fuel is then passed through the incandescent fuel for converting the carbonic acid into combustible carbonic oxid and decomposing the steam or water vapor into hydrogen and carbonic oxid until the time when the incandescent fuel is reduced in temperature below an effective degree for causing such reactions, then shutting off the gas and again blasting the better fuel to an incandescent state, after which the air is again shut off and the gas of low caloric value is again passed through the incandescent fuel, the operation being continued intermittently.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

DESIDERIUS TURK.

Witnesses:

HERNANDO DE SOTO,

PAUL ARRAS.