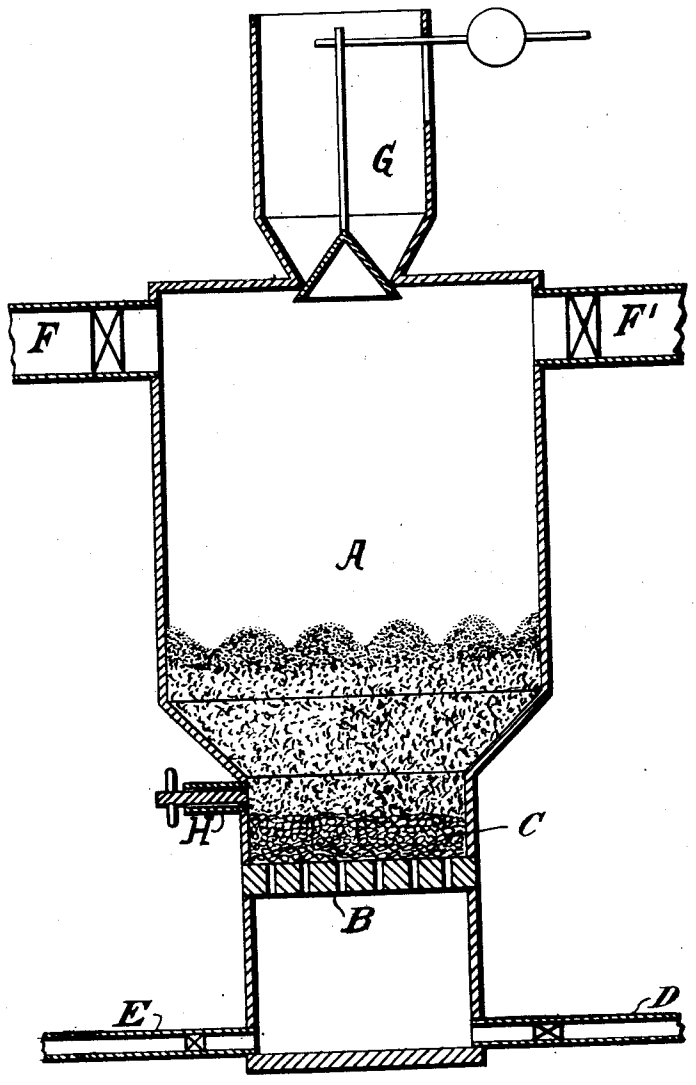
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MANUFACTURING FUEL GAS

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MANUFACTURING FUEL GAS.

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Fuel gas, such as producer gas or blue water gas or mixed coal and water gas has hitherto usually been made from coke in coarse lumps by allowing steam and air, either alternately or jointly, to react with the said coke, which is in an incandescent state. Pulverulent coal has also been used for producing combustible gases, either in the form of a shower falling down in a current of air or by means of injection with the air. According to the usual methods of operation it has not been possible to use small-sized carbonaceous material, such as refuse coke, coke breeze, coke from lignite, and the like, in the form of grits and small pieces of pea size for making fuel gas.

My invention relates to an improved process whereby small-sized coal or other carbonaceous material can be utilized for making fuel gas and consists in charging the small coal material onto a suitable grate or support in a shaft generator, and blowing a gasifying medium, such as air or air and steam through the said coal material either alternately or jointly according to the kind of fuel gas desired with sufficient pressure to bring about a strong agitation in the form of a so-to-say boiling motion of the material. On the other hand the blast of gas should not be so strong as to carry away the solid fuel and blow it out of the generator. A free passage of the gases is secured and when the layer, or bed, of fuel is not too low the material is thoroughly mixed while its combustion is not concentrated locally but well distributed throughout the whole mass, a uniform temperature being thereby established. The ashes do not melt together. In many cases, particularly when using lignite, the ashes are carried along with the gases and can be deposited in an adjacent dust chamber.

When the gas generator is to be set into operation, about one cubic metre of incandescent coke made from lignite, for example, coke the grains of which have a size of between ¼ and 10 millimetres, is introduced by means of the hopper G onto the fire-clay layer C resting on the grate B of about one square metre area. 1000 cubic metres of air are then blown in per hour through the pipe D. The glowing coke is at once agitated throughout so that the charge assumes an appearance similar to that of a boiling liquid. The temperature of the coke rapidly increases and fresh coke made from lignite is supplied by the hopper G until the bed of fuel in the generator A has a height of 150 centimetres. By the introduction of the fresh coke the temperature of the fuel bed falls, but uniform temperature throughout the whole mass of fuel is very soon established, as can be determined by a number of suitable thermostats or the like arranged above the grate and within the body of the generator A. This is due to the strong agitation of the mass and is also promoted by the higher weight per unit of volume of the cold coke made from lignite in comparison with the glowing coke. While one litre of the glowing coke has a weight of about 500 grams, one litre of the cold coke made from lignite has a weight of about 700 grams. This assists the cold coke in sinking down in, and mixing with the mass of glowing fuel which is continuously maintained in the strongly agitated state above compared with a boiling liquid by the gases continuously flowing through the charge of the fuel. The similarity of the charge of glowing fuel with a boiling liquid is in fact a very striking one. It may be demonstrated as follows:

The body of the generator A is provided in its upper part with an observation window and with an opening about 20 centimetres in diameter which is arranged about 50 centimetres above the upper level of the incandescent mass. The amount of air blown in at D is now reduced to about 300 cubic metres per hour. By means of the observation window it is now seen that the entire charge of coke is in a slightly undulating movement which can be observed especially at the surface of the fuel bed. When a stone or a lump of iron is thrown into the generator, such stone or lump rapidly sinks down in the charge of coal, down to the grate C. When a lump of wet wood is thrown into the generator, it first sinks down within the charge of the incandescent fuel and the water vapor escaping from the moist wood throws up a number of small coal particles similar to a fountain. After some minutes the wood has become charred and now is carried upwards to the surface of the fuel

bed where the lump or lumps of charcoal now swim on the surface of the coke bed, just as wood swims on water. When through the said opening above the charge of coke a current of air is blown in an oblique direction onto the surface of the charge, the air current throws up waves just as would be the case with water. It will be obvious from these explanations that the charge of fuel in my generator has a very striking behaviour. Though it is continuously in motion and the single particles of fuel are continuously whirled up and down, the whole mass is rather compact, much more than would be the case for example, when allowing a fine powdery material to fall down in a stagnant or streaming mass of gas. Accordingly each particle of fuel is brought into intimate contact with the gas blown in from below, but not with so much gas that an undue removal of heat and dilution of the reaction product between the gas and the fuel would be caused. Owing to the intense agitation of the fuel particles, the entire charge of fuel has a very uniform temperature. The slags formed sink down onto the grate similar to the lump of iron in the above described experiments. The fine ashes of the lignite coke are for the most part carried away by the gas current and may be separated from the gases in any suitable manner after they have left the generator. It is characteristic of my invention that the entire bed of fuel is kept in continuous agitation by means of the gas current blown through the charge from below, whether this is air or steam or other gasifying medium, and that this state of continuous agitation is maintained merely by the gas current and without any mechanical means.

My invention will be more fully explained with reference to the annexed diagrammatical drawing showing a vertical section which explains the manufacture of blue water gas from lignite coke but the invention is not restricted to this example.

Lignite coke is placed in a cylindrical shaft generator A, which is conically reduced at its bottom and there contains, as a grate, a perforated plate of fireclay B carrying a layer C of pieces of about two inches thickness of fireclay of about nut size. The coke is ignited and air blown in from below through the inlet pipe D first at a moderate pressure, which gradually is raised until the particles of coke commence to execute a vigorous whirling movement so that the mass assumes an appearance of boiling. The gases of combustion or air blast gases containing finally up to 30 per cent, by volume, of carbon monoxid and 2 per cent of carbon dioxid, take the light ashes along, removing the greater part of the ashes from the gas generating chamber, and then are conveyed through a dust chamber where the ashes are caused to deposit. This dust chamber may be of the usual form and requires no detailed description, and has also been omitted from the drawing. When a temperature of about 1100 degrees centigrade is reached, the supply of air is cut off and steam which is admitted through pipe E is blown through the incandescent coke at a similar pressure, or speed, to maintain the strong agitation of the fine coke material. Blue water gas is thereby formed approximately composed, by volume, of 43 per cent of carbon monoxid, 45 per cent of hydrogen, 2.5 per cent of carbon dioxid and 9.5 per cent of nitrogen, and which is free from oxygen and methane. After the temperature has fallen in the steaming period, the coke is reheated by again blowing air through and the operations are alternately repeated, the gases produced in the two periods being withdrawn separately through the outlet pipes F and F′ shown in the drawing. Fresh coke is supplied when necessary in a convenient manner from the hopper G. H is a discharge opening through which ashes may be removed if necessary. Small sized lignite itself may be used instead of lignite coke, or small-sized coke or hard or soft coal.

I claim:

1. The process of manufacturing fuel gas in a generator having a bed of small-sized, incandescent solid carbonaceous material supported by a grate, consisting in blowing a gas adapted to produce fuel gas through said material with sufficient speed to establish a boiling action in the material, thereby causing gasification thereof by reaction between the incandescent material and the gas.

2. The process of manufacturing fuel gas in a generator having a bed of small-sized, incandescent solid carbonaceous material supported by a grate, consisting in blowing air and steam through said material with sufficient speed to establish a boiling action in the material, thereby causing gasification thereof by reaction between the incandescent material and the air and steam.

In testimony whereof I have hereunto set my hand.

FRITZ WINKLER.