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PROCESS OF PRODUCING HYDROGEN OR ILLUMINATING AND HEATING GAS.

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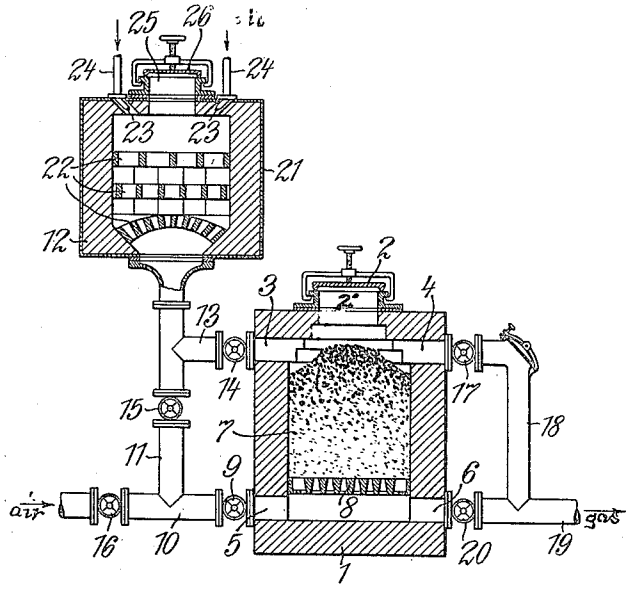

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PROCESS OF PRODUCING HYDROGEN OR ILLUMINATING AND HEATING GAS.

1,172,925. Specification of Letters Patent. Patented Feb. 22, 1916.

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To all whom it may concern:

Be it known that I, KURT EMIL BARTH, a citizen of the Empire of Germany, residing at Charlottenburg, Germany, have invented certain new and useful Improvements in the Process of Producing Hydrogen or Illuminating and Heating Gas by the Decomposition of Hydrocarbons, of which the following is a full, clear, and exact description.

My invention relates to improvements in the process of producing hydrogen, or an illuminating and heating gas by the decomposition of the vapors of oils, tar, or liquid hydrocarbons. In known processes of this class hydrogen, or an illuminating and heating gas is produced from oil, tar, or liquid hydrocarbons by spraying the liquid fuel from above on a glowing charge of coke inclosed within a generator, which coke is intermittently raised to high temperature by forcing a current of air therethrough. Thereby the oil is first vaporized within the generator and passed through the charge of coke. While thus passing through the glowing coke the vapors of oil are decomposed in such a way, that carbon is split off and either hydrogen is produced, or a gas which is suitable for illuminating and heating purposes. If the temperature employed is about 1000° centigrade, an illuminating and heating gas is obtained; if the temperature is higher, hydrogen is produced. An improvement of this process consists in preheating the liquid fuel by the waste heat from the generator, for which purpose the supply conduit for the oil is provided within the masonry of the generator. These processes are objectionable for various reasons. The major part of the liquid fuel which is sprayed from above on the glowing coke is decomposed within the uppermost parts of the charge of carbon while splitting off oil coke and carbon which resembles graphite and is but difficultly combustible. Furthermore the uppermost parts of the glowing charge of coke are rapidly cooled by the vaporization of the liquid fuel. Thereby the resistance offered by the said parts to the air forced through the charge of coke during the blowing or reheating period is increased, and the blowing or reheating period must be extended in order to raise the upper layers of the charge of coke to the desired incandescent temperature, and to remove the graphite which has been deposited in the coke. However, by the extended blowing operation the lower layers of the charge of coke are rapidly consumed, so that the consumption of coke is increased. Furthermore, by the extended blowing operation the temperature of the lower layers of the charge of coke is unduly increased. Thereby the lower parts of the inner wall of the generator are liable to be partly burnt, so that the generator must frequently be repaired.

Frequently so much oil coke and graphite are deposited in the upper layers of the charge, that the coke cakes rigidly together, and must be broken up by mechanical means, in order that the air may have a free passage therethrough as is necessary for uniformly blowing through the coke. As the breaking and stirring of the coke must frequently be repeated, the coke is disintegrated to such a degree, that the resistance of the air is unduly increased, so that in many cases the only way of establishing a correct operation consists in removing the whole charge of coke from the generator and refilling the same. Thereby the operation of the apparatus is interrupted for a considerable time, and much fuel is wasted. Apart from these objections which render the operation of the apparatus difficult, a further objection consists in the fact, that for admitting the oil or the like to the surface of the charge of coke by means of a spraying nozzle much room is required in the upper part of the generator, because the area of the spraying cone of the nozzle must be nearly equal to the cross-sectional area of the generator. This requires a considerable height of the spraying cone, so that above the charge of coke a large waste space is necessary. Furthermore in the old processes the heat which is necessary for vaporizing the oil or other liquid fuel is taken from the charge of the generator. Thereby the heat within the generator which is available for decomposing the vapors of the fuel is considerably reduced.

The object of the improvements is to provide a process whereby the aforesaid objections are avoided.

With this object in view my invention consists in separating the vaporization from

the gasification and decomposition of the oil or other liquid fuel and effecting the vaporization within a vaporization chamber which is bodily independent of the generator. In some cases a preliminary decomposition can take place in the vaporization chamber.

In carrying out the improved process I prefer to construct the vaporization chamber of an iron jacket which has a lining of refractory bricks, and which is filled with a refractory grating or with coarse pieces of refractory material. The gases of combustion which escape from the generator during the blowing or reheating period are passed through the refractory grating of the vaporization chamber. Near the end of the blowing period the said gases contain a certain amount of carbonic oxid which is burnt within the vaporization chamber by admitting air thereto. By this operation the grating of refractory material within the vaporization chamber accumulates the heat which is necessary for vaporizing the liquid fuel and in some cases for partly decomposing the same. Finally the air supply is shut off, and the vaporized oil or other fuel is passed into the vaporization chamber through several nozzles and vaporized within the said chamber. The vapors are passed through the glowing charge of coke within the generator, where they are decomposed in such a way as to split off carbon and to produce either an illuminating and heating gas (if the process is carried out at a temperature of about 1000° centigrade), or hydrogen (if the process is carried out at a higher temperature). Preferably the vapors of oil or other fuel are alternately passed through the generator in opposite directions, that is alternately from above downward and from below upward. Thereby the heat which has been accumulated within the generator is uniformly consumed, and the lower part of the generator which during the blowing period is subject to the highest strain is not brought to an excessive temperature.

If it is desired to start the decomposition of the vapor of oil within the vaporization chamber, the refractory charge of the said chamber must be heated to a higher temperature. The carbon which is split off by the decomposition of the vapor of oil or the like is burnt when the gases of combustion from the generator are being passed through the vaporization chamber, so that they are made use of for heating the refractory charge of the vaporization chamber. Preferably the vaporization of the oil and the combustion of the carbon which has been deposited within the vaporization chamber is made more easy by so arranging the refractory charge within the vaporization chamber, that its permeability is increased from the bottom part to the top thereof, so that the vaporization of the liquid fuel takes place in the lower parts of the refractory charge which have been heated to a higher temperature.

In order that my invention be more clearly understood an apparatus which is suitable for putting the improved process into effect has been illustrated in the accompanying drawing, in which a vertical section of the apparatus is shown.

Referring to the example illustrated in the drawing, the apparatus consists of a generator 1 which at its top is provided with an intake 2′ for the charge of coke, which intake is normally closed by a cover 2. With the said generator a vaporization chamber 12 is connected which will be described hereafter. Near the top end of the generator two conduits 3 and 4 and from the bottom part two conduits 5 and 6 are branched off. The conduits 3 and 4 are located with their inner ends at or near the surface of the charge of coke 7, and the conduits 5 and 6 are located with their inner ends below the grate 8 supporting the charge 7. To the conduit 5 an air supply pipe 10 is connected, and between the conduit 5 and the pipe 10 a valve 9 or the like is interposed. From the supply pipe 10 a pipe 11 is branched off which is directed upward and is connected with the vaporization chamber 12. The upper part of the pipe 11 communicates through a branch pipe 13 and a valve 14 with the conduit 3. Below the branch pipe 13 the pipe 11 is provided with a valve 15 or the like. In advance of the inlet to the pipe 11 the air supply pipe 10 is equipped with a valve 16. To the conduit 4 connected with the upper part of the generator a pipe 18 provided with a valve 17 is connected, which communicates with a pipe 19 for removing the gas produced in the generator. The pipe 19 communicates with the lower conduit 6 of the generator through a valve 20.

The vaporization chamber 12 is constructed of bricks of refractory material and it is preferably inclosed within an iron jacket 21. Within the chamber 12 there is a refractory grating 22 which is preferably erected in such a way, that the spaces provided between the bricks are increased in the successive layers from the bottom of the chamber to the top thereof. Thereby the resistance found by the gases when passing through the refractory grating is gradually reduced, and the passage of the oil which is admitted at the top of the vaporization chamber and moves from the upper layers of the grating to the lower layers which have been heated to higher temperature is facilitated. The liquid fuel is admitted to the chamber 12 through nozzles 23 which in the example illustrated are disposed in the top wall of the chamber and are connected to an oil supply by pipes 24. The top wall is

provided with a tube or opening 25 which is adapted to be closed by a removable cover 26.

In carrying out my improved process in the apparatus I proceed as follows: The valves 15, 17, and 20 are closed and the cover 2 of the generator is placed on the opening 2', while the valves 16, 9, and 14, are opened and the cover 26 of the vaporization chamber 12 is removed from the tube 25. Air is forced through the air supply pipe 10 and into the bottom part of the generator below the grate 8, so that the charge of coke 7 within the generator is heated to high temperature. The gases of combustion escape through the pipes 3, 13, and 11 and pass through the vaporization chamber 12, where they heat the refractory charge 22, and from which they escape through the open tube 25. Near the end of the blowing or reheating period the valve 15 is slightly opened, so that so much air as is necessary for burning the carbonic oxid carried along by the gases of combustion is admitted to the chamber 12 through the air supply pipe 10 and the pipe 11. At the end of the blowing period the cover 26 of the vaporization chamber is placed on the tube 25, and the liquid fuel such as oil, is admitted to the vaporization chamber, through the pipes 24 and nozzles 23, and after vaporization and in some cases after partial decomposition the vapor is passed through the hot charge of coke contained within the generator 1. Preferably the flow of the vapor or gas is alternately from the top part of the generator downward to the bottom part thereof, and vice versa from the bottom part upward to the top part. For passing the vapor from the top part of the generator downward the valves 15, 16, 9 and 17 are closed. In this case the vapors pass through the pipes 11 and 13, the conduit 3 and the charge of coke 7 from which they escape through the valve 20 which has before been opened. If it is desired to conduct the vapors through the generator from the bottom part upward, the valves 14, 16, and 20 are closed, while the valves 15, 9 and 17 are opened. In this case the vapors of oil pass through the pipes 11 and 10, the conduit 5 and into the bottom part of the generator below the grate 8, whence they flow upward through the charge of coke 7 and escape through the upper conduit 4, the open valve 17 and the pipe 18 into the pipe 19. At the end of the gasification period the generator 1 is again reheated, for which purpose the valves are set as has been described above, and the cover 26 is removed from the vaporization chamber 12.

By conducting the vaporized fuel through the charge of coke 7 within the generator 12 alternately from the top thereof downward and from the bottom upward the advantages are obtained which have been explained above. Apart from this a layer of graphite is deposited on the lower part of the inner wall of the generator, whereby this part of the wall is protected against the injurious influence of the high temperature of the charge.

I claim:

1. The herein described process of producing hydrogen or an illuminating and heating gas from liquid fuel, which consists in burning solid fuel, passing the combustion gases from said solid fuel through a heat-absorbing refractory material, then discontinuing the passage of the combustion gases through said material and admitting liquid fuel into contact with said previously heated material which has been in contact with the combustion gases, to vaporize such liquid fuel, and then passing the vaporized fuel through the incandescent body of solid fuel to produce the desired gas.

2. The herein described process of producing hydrogen or an illuminating and heating gas from liquid fuel, which consists in burning solid fuel, passing the combustion gases from said solid fuel through a heat-absorbing refractory material, then discontinuing the passage of the combustion gases through said material and admitting liquid fuel into contact with the previously heated heat-absorbing material which has been in contact with the combustion gases, to vaporize such liquid fuel, and then passing the vaporized fuel alternately in opposite directions through the incandescent body of solid fuel to produce the desired gas.

3. The herein described process of producing hydrogen or an illuminating and heating gas from liquid fuel, which consists in burning solid fuel, passing the combustion gases from said solid fuel through a heat-absorbing, refractory material, then discontinuing the passage of the combustion gases through said material and admitting liquid fuel into contact with said previously heated material which has been in contact with the combustion gases, to vaporize such liquid fuel, then passing the vaporized fuel through the incandescent body of solid fuel to produce the desired gas, then interrupting the admission of liquid fuel to said heat-absorbing refractory material, admitting air to the solid fuel and also to the combustion gases coming from said solid fuel, and passing said combustion gases and air through said heat-absorbing refractory material.

4. The herein described process of producing hydrogen or an illuminating and heating gas from liquid fuel, which consists in first vaporizing said liquid fuel and then passing the resulting product alternately in opposite directions through a body of incandescent solid fuel.

5. The herein described process of producing hydrogen or an illuminating and heating gas from liquid fuel, which consists in first vaporizing said liquid fuel and then passing the resulting product alternately upward and downward through a body of incandescent solid fuel.

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

DR. KURT EMIL BARTH.

Witnesses:

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HENRY HASPER.