May 10, 1938. W. REPPEKUS 2,116,641

RECOVERY OF VALUABLE BY-PRODUCTS DURING THE PRODUCTION OF GAS AND COKE

Filed April 8, 1936 2 Sheets-Sheet 1

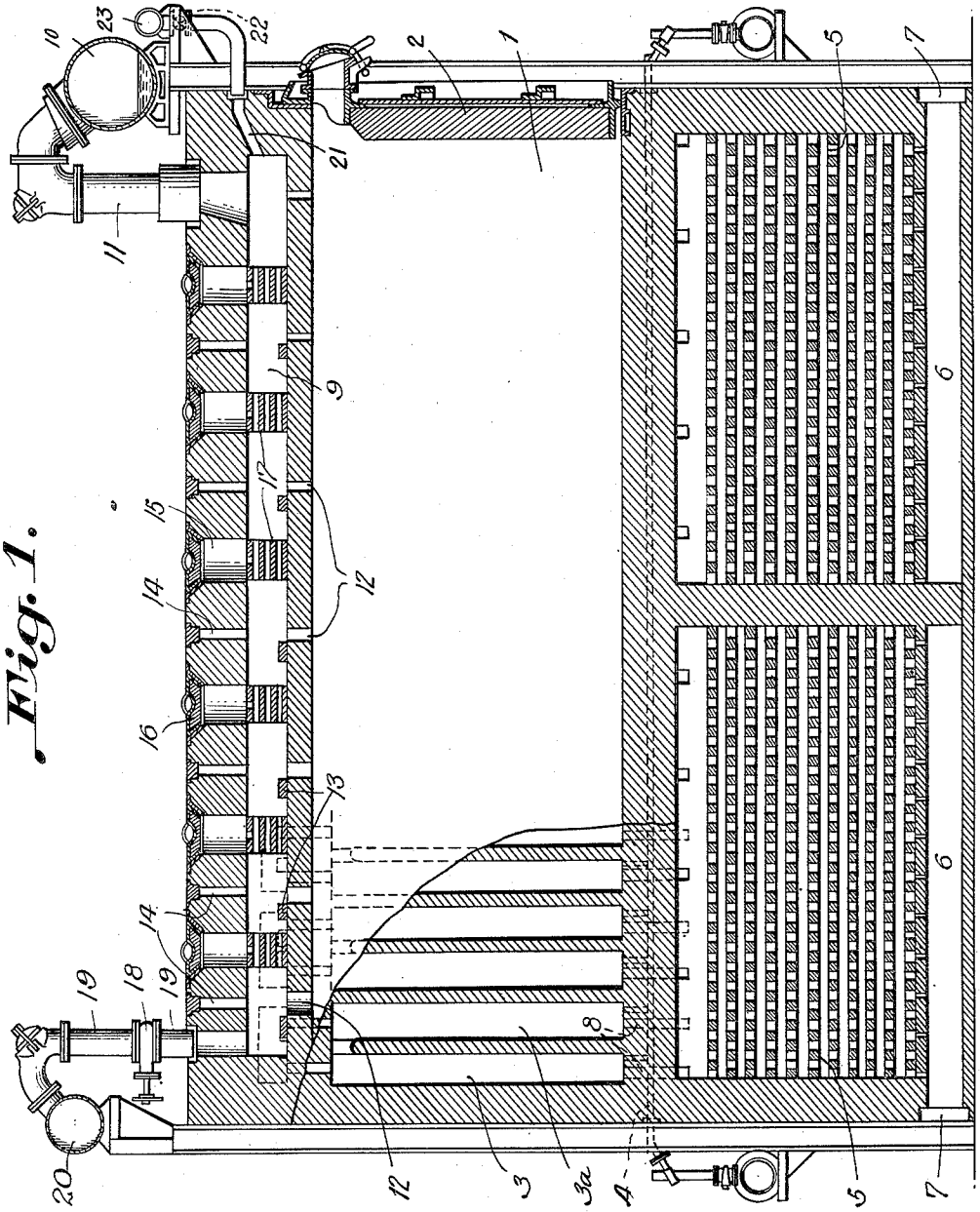


Fig. 1.

Inventor.

Walter Reppekus

By Henry Love Clarke
his Atty.

May 10, 1938. W. REPPEKUS 2,116,641

RECOVERY OF VALUABLE BY-PRODUCTS DURING THE PRODUCTION OF GAS AND COKE

Filed April 8, 1936 2 Sheets-Sheet 2

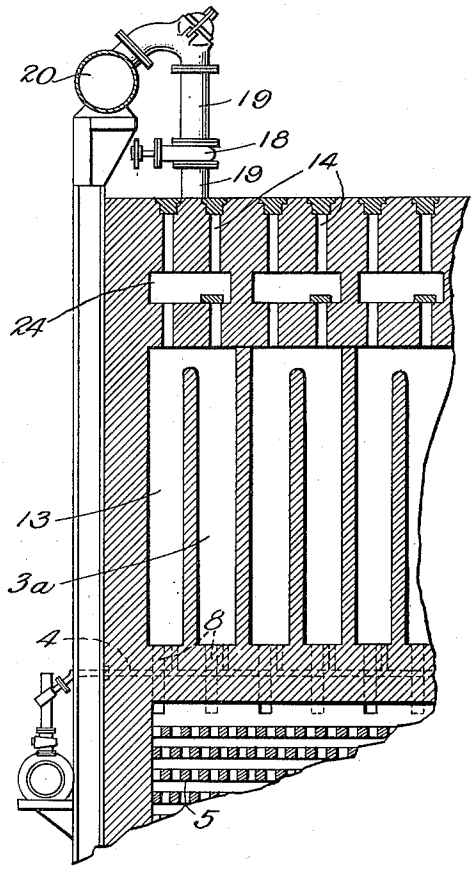


Fig. 2.

Inventor.
Walter Reppekus

By Henry Low Clarke
his Atty.

Patented May 10, 1938 2,116,641

UNITED STATES PATENT OFFICE

2,116,641

RECOVERY OF VALUABLE BY-PRODUCTS DURING THE PRODUCTION OF GAS AND COKE

Walter Reppekus, Essen, Germany, assignor, by mesne assignments, to Koppers Company, Pittsburgh, Pa., a corporation of Delaware

Application April 8, 1936, Serial No. 73,231
In Germany January 29, 1935

4 Claims. (Cl. 202—139)

The invention relates to the recovery of valuable by-products during the production of gas and coke in chamber- or retort-ovens, especially in horizontal chamber ovens, which are nowadays generally adopted for producing gas and coke.

The observation has been made, that the formation of valuable by-products in coke ovens, for instance of benzol and its homologues, can be considerably favourably influenced in that the distillation gases rising upwards in the coking chamber are allowed to enter a channel, which is suitably kept at a certain temperature. The channel is in connection with the coking chamber itself as well as also with the ascension pipe. If the gases entering this channel are prevented from being decomposed or should the hydrocarbons contained in the coal distillation gas be converted as a result from the heating up or due to the fact, that a definite temperature is reached, resp. maintained, whereby benzol hydrocarbons are formed, or should it happen that both reactions are performed simultaneously or in series, it cannot be denied that actually the yield of valuable hydrocarbons is increased by providing a channel in the roof above the coking chamber instead of the gas collecting space, generally in use.

The basic idea of the present invention provides such improvements at coke ovens, having a distillation gas channel, arranged in the roof of the coking chambers or coking retorts, so that the yield of valuable hydrocarbons will be further increased.

To solve this problem, the main feature of my present invention is to provide catalysts within said distillation gas channel of the oven roof, preferably on carrying bodies, which can be taken out of the channel, by which it would be possible to accelerate or to make more complete the conversion of the hydrocarbons in the desired direction.

Furthermore, the invention relates to the peculiar arrangement and design of the carrying bodies to be used for the catalysts and to the design of the channel in the roof receiving the carrying bodies.

Still further objects of my present invention may be taken from the following description of a preferred embodiment of my invention on the lines of the accompanying drawings.

The drawings show in Fig. 1 a vertical cross section through a horizontal chamber oven, which is especially suitable for the production of gas and coke, according to the present invention, and in Fig. 2 a similar view but illustrating in full lines the additional heating flues above the main heating flues.

The chamber of the oven has been marked with 1 on the drawings. Chamber 1 is charged with the fuel to be carbonized. The fuel is top-charged into the chamber through customary openings in the oven roof, which have, however, not been shown on the drawings for simplicity's sake.

The coking chamber is equipped with door openings at both ends which can be closed by means of removable doors, 2. A number of vertical heating flues 3, 3a have been provided for in the walls of the coking chamber 1, which are interconnected in pairs at the upper end by forming hair-pin flues. Fuel gas and pre-heated air are admitted from below into the flues. Horizontal channels 4 supply the fuel gas, two channels for each chamber wall. One channel 4 is connected to the heating flues 3 and the other channel 4 is in connection with the heating flues 3a. Thereby it is rendered possible to supply the channels 3 and then in the next heating period to supply the channels 3a with fuel gas. The combustion air is preheated in regenerators 5 which are arranged underneath the coking chamber or the heating walls respectively. Each regenerator has one sole channel 6, the inlet 7 of which being provided with a knee piece, not shown however on the drawings. Said knee piece connects alternatively the regenerator with the atmosphere and with the waste gas channel. During one working period, the opening 7 of the regenerator sole channels is in connection with the atmosphere. The cold air is distributed over the chequerwork, which, as usual, fills the regenerators and which has been heated during the previous working period by the hot waste gases. Thereby, the air has become warm and then flows through the connecting flues 8 into the heating flues 3 of the heating wall placed above.

Hot air and fuel gas meet at this point and the combustion takes place. The hot combustion gases go upwards in the heating flues 3 and pass the upper connecting opening in the heating flues 3a in which the heating gases descend. Similar to the heating flues 3, there have been arranged connecting flues on the bottom of the heating flues 3a. The latter connecting flues lead to another regenerator, which is placed beside the regenerator 5, all regenerators being constructed as cross regenerators. Said other regenerator is connected during this working period with the waste gas channel. The hot waste gases from the

heating flues 3a pass through and thereby they heat the chequerwork, whereupon they escape into the waste gas channel. If the chequerwork in the regenerators 5 has been sufficiently cooled down by heating the cold combustion air, the direction of flow of the heating media (gas and air) is reversed so that hot waste gases again pass the regenerator 5 and heat it up.

In the roof of the coking chamber 1 there has been arranged a channel 9, extending over the whole length of the oven, said channel being connected at one end to the ascension pipe 11 which leads into the gas collecting main 10. A number of openings 12 are provided, leading from the coking chamber up to the channel 9 into the oven roof.

The free section of the openings is gradually increased from one end of the coking chamber 1, being situated underneath the ascension pipe 11 to the other end, as illustrated on the drawings. By calibrating the connecting openings 12 in the described manner, the distillation gases formed in the chamber can be uniformly drawn from the gas collecting space immediately into the channel of the chamber roof, and the gases do not flow along the roof inside the chamber. Dampers 13, which can be operated from smaller openings 14 in the roof, serve to change the free section of the connecting openings, if necessary.

Additional openings 15 have been provided between the roof openings 14 in the oven roof, which likewise lead to the roof channel 9. These openings 15 have the shape of a slot. They can be closed by means of covers 16, being provided suitably on the lower side with removable insulation.

The openings 15 serve to put perforated bricks 17 from above into the channel 9 of the roof in such a way, that the section of the roof channel underneath the openings 15 is essentially filled up by the perforated bricks. The channels provided inside the perforated bricks 17, as shown on the drawings, run in longitudinal direction of the roof channel so that the gases passing through the channel have to flow through the channels of the perforated bricks.

The perforated bricks 17 serve as a carrying body for the catalysts, which shall be provided according to my invention within the roof channel. The arrangement of bricks 17 underneath the openings 15 enables an exchange of the carrying body for the catalysts even during the operation, so that any worn-out or worthless catalysts can easily be replaced.

The catalysts can be put upon the perforated bricks in a different way. Thus it is possible to submerge the perforated bricks before they are laid in the roof channel, in a solution, of the catalysts used, for instance a nickel salt solution. After the evaporation of the solvent, there has been formed a thin layer of the catalyst substance on the surface of the carrying brick, the catalyst being present in said skin in a finely divided state, advantageous for the catalyst. Instead of this, it is also possible to deposit on the perforated bricks the catalyst substance by the precipitation from a suitable solution in the well-known manner.

Since the further conversion of the hydrocarbons to be attained by the present invention is, under certain circumstances, dependent on the fact that sufficient quantity of hydrogen is present in the gases, it may be of advantage to lead the distillation gases with a lower contents of hydrogen, which are mainly formed in the first part of the carbonization of the chamber charge, simultaneously with the gases having a higher contents of hydrogen, through the roof channel. To enable this, there has been connected to one end of the roof channel a pipe line 19, which is governed by a regulating and shut-off valve 18. Pipe line 19 leads to a connecting line 20, extending over the oven battery, which is similarly connected with all coking chambers or only with a part of the coking chambers of the oven battery. The distillation gases escaping from an oven charged before, having a higher hydrogen contents, can now be led through the pipe lines 20, 19, into the roof channel 9, as long as there are formed gases with a lower contents of hydrogen during the charging time of chamber 1.

The invention further provides the possibility to lead through the roof channel 9 the other gases, if necessary, for instance to regenerate the catalyst substance on the perforated bricks. For this purpose, the roof channel is connected at point 21 with a pipe line 23, which is governed by a regulating- and shut-off valve 22. Under certain circumstances, it may be possible to use air as regenerating gas. The air passes through the roof channel upon opening of the valve 22, which is suitably done if the valve 13 and the ascention pipe 11 are closed. It can then escape at the other end of the channel through one of the holes 14. Other regenerating gases can eventually also be permanently led through the roof channel, in which case the connection 21 for the regenerating pipe line is suitably arranged at the other end of the roof channel.

In most cases, it will be advisable to adjust the temperature of the roof channel quite independently of the temperature of the coking chamber. According to the present invention, this possibility can be carried into effect in that additional heating flues, shown in dotted lines on Fig. 1 and in full lines in Fig. 2 of the drawings and marked with 24, are provided in the chamber walls above the main heating flues 3, 3a, by means of which the coking space of the chamber 1 is heated. One heating flue 24 has been arranged for each pair of the heating flues 3, 3a. The connecting openings between the flue 24 and the heating flues 3, 3a are governed by valves so that hot gases from the lower heating flues 3, 3a can be led through the upper flues 24, as required. The regulation of the quantity of hot gases passing through the heating flues 24, renders it possible to adjust the temperature in the walls of the roof channel 9 in any desired manner.

The present invention is in no way limited to the mode of carrying out as described and shown, but many other modifications of the embodiment shown are rendered possible. It should be pointed out especially, that it may also be of advantage not to provide the catalysts on special carrying bodies, but to use the walls of the roof channel, as carrying bodies for the catalysts. Furthermore, irregularly shaped bricks can also be taken as a carrying body, for the catalysts and finally the carrying bodies for the catalysts may show a different form from that of the perforated bricks, illustrated on the drawings.

The invention may be varied within the scope of the following claims. The right to make subsequent claims is expressly reserved.

I claim:—

1. A horizontal coking retort oven comprising: a horizontal coking chamber indirectly heated by side wall heating flues therefor along the length of the coking chamber; a catalytic gas treatment chamber arranged in the roof of the oven length-

wise immediately over the gas collecting crown-space of the coking chamber; gas-ports distributed along the length of the top of the coking chamber for flow of coke oven gas from the gas collecting space into the catalytic-treatment chamber and distillate offtake means for off-flow of the coke oven gas from the catalytic-treatment chamber; means for heating the gas treatment chamber, and catalytic material adapted to favor the thermal conversion of coke oven gas into benzene and its homologues disposed inside said catalytic-treatment chamber, the catalytic material being contained in carrying bodies therefor removably mounted inside said treatment chamber in such manner that the coke oven gas passes in contact with the catalyst material and is catalytically converted to benzene and its homologues in the course of its normal evolution from the coking coal and rapid off-flow from the coking coal on its way to the distillate offtake means from the ports from the gas collecting space.

2. A horizontal coking retort oven comprising: a horizontal coking chamber indirectly heated by side wall heating flues therefor along the length of the coking chamber; a catalytic gas treatment chamber arranged in the roof of the oven lengthwise immediately over the gas collecting crown-space of the coking chamber; gas-ports distributed along the length of the top of the coking chamber for flow of coke over gas from the gas collecting space into the catalytic-treatment chamber and distillate offtake means for off-flow of the coke oven gas from the catalytic-treatment chamber; means for heating the gas treatment chamber, and catalytic material adapted to favor the thermal conversion of coke oven gas into benzene and its homologues disposed inside said catalytic-treatment chamber, the catalytic material being contained in carrying bodies therefor removably mounted inside said treatment chamber in such manner that the coke oven gas passes in contact with the catalyst material and is catalytically converted to benzene and its homologues in the course of its normal evolution from the coking coal and rapid off-flow from the coking coal on its way to the distillate offtake means from the ports from the gas collecting space; and means for introducing gases adapted for regenerating the catalytic material from outside the oven into and through the catalytic gas-treatment chamber to regenerate the catalytic material while in place in the catalytic gas-treatment chamber.

3. A horizontal coking retort oven comprising: a horizontal coking chamber indirectly heated by side wall heating flues therefor along the length of the coking chamber; a catalytic gas-treatment chamber arranged in the roof of the oven lengthwise immediately over the gas collecting crown-space of the coking chamber; gas-ports distributed along the length of the top of the coking chamber for flow of coke oven gas from the gas collecting space into the catalytic-treatment chamber and distillate offtake means for off-flow of the coke oven gas from the catalytic-treatment chamber; means for heating the gas treatment chamber comprising gas-flow heating flues in the oven roof and arranged alongside the gas-treatment chamber at substantially the same elevation thereof, and catalytic material adapted to favor the thermal conversion of coke oven gas into benzene and its homologues disposed inside said catalytic-treatment chamber, the catalytic material being in bodies placed inside the catalytic gas-treatment chamber between each two of the gas-ports leading thereto from the gas collecting space and adapted for passage of the coke oven gas freely from one side to the other of the bodies along the length of the catalytic gas-treatment chamber in such nanner that the coke oven gas passes in contact with the catalyst material and is catalytically converted to benzene and its homologues in the course of its normal evolution from the coking coal and rapid off-flow from the coking coal on its way to the distillate offtake means from the ports from the gas collecting space.

4. A coking retort oven as claimed in claim 3 and in which conduit means are provided for communicably connecting the catalytic gas-treatment chamber with another coking chamber in such way that distillation gas formed during later stage of coking in the other coking chamber may be passed through the first aforesaid catalytic treatment chamber during off-flow therethrough of coke oven gas from a coal charge in an early stage of coking in its coking chamber.

WALTER REPPEKUS.