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**Procedure for Catalytic Conversion of
Materials Containing Carbon.**

It is known that carbonaceous materials especially hydrocarbons or their mixtures may be cracked at elevated temperatures in the gaseous or vapor phase in the presence of a powdered catalyst. In this process, high molecular coke-like deposits settle on the catalyst due to decomposition and render it ineffective after a time. The catalyst has to be reactivated before further use; this is done, as is known, by burning off the coke-like deposits with the aid of gases containing oxygen, especially air. The cracking of carbonaceous materials in the presence of powdered catalysts can also be carried out continuously. In this case the procedure for example, may be as follows: Two reaction chambers are used, one of which serves for cracking of the initial materials and the other for reactivation of the spent catalyst. The reactivated or spent catalyst moves continuously through both chambers, whereby the reactivation is carried out in parallel flow or preferably in counterflow. The spent catalyst is continuously transferred from the reaction chamber by conveyors into the reactivation chamber, while from the latter the reactivated catalyst is continuously transferred back into the reaction chamber. In this process, besides the two chambers, there has to be also a scrubbing zone at the end of each chamber. These zones serve to displace the hydrocarbon vapors or oxygen-bearing gases still present in the powdered catalyst with an inert gas, such as nitrogen, prior to its transfer into the reactivating or cracking chamber by means of conveying devices such as screw conveyors, bucket elevators, etc. This is necessary in order to avoid loss of hydrocarbons at the exit from the cracking chamber or to avoid admixture of combustible gases or vapors with oxygen in the cracking chamber. In order to avoid one of the cumbersome and technically difficult transfers of the highly heated catalyst from one reaction chamber to the other, for instance from the cracking chamber into the reactivation chamber, it is feasible to combine the cracking chamber and the reactivation chamber into a single chamber, as has already been proposed for the use of lumpy or granular catalysts. In such an arrangement a sharp separation of the reaction-, scrubbing-, and reactivation zones from each other must be provided since otherwise the vapors to be converted would be either diluted with an inert gas or else ignited by the reactivating gases.

It was found that, with the different zones arranged in a single reactor and ~~the powdered catalysts moving downwardly therein, the individual zones may be sealed~~ from each other by providing above or below each zone a permeable partition on which the powdered catalyst accumulates to form a seal. These partitions may be of the tiltable or retractible type, e.g. in the form of metal plates rotatable about an axis, or gate valves or rocking screens. The powdered catalyst falling on such a partition from the zone above, is pressed against the partition by the inert gas or by the reactivating gas or by the vaporized conversion material entering via a gas passage arranged above the partition, and thus prevents the vapors or the inert gas from breaking through to the next lower zone. Simultaneously, the resistance

offered by the layer of catalyst on the partitions is greater than the resistance encountered by the inert gases or reactivation gases at their exit at the upper end of the scrubbing zone or reactivation zone, so that the powder lying on the partition is not stirred up and thus prevents the passage of the scrubbing gases or reactivation gases to the next higher zone. The main requirement in this type of seal is the even distribution of the catalyst powder on the partition. According to the behavior of dry powder at ordinary temperatures this could not be expected, since dry powder tends to "bridging" at ordinary temperatures and when the partition is tipped or opened it will descend and pile up at the natural angle of repose on the succeeding partition. Surprisingly it was found that highly heated powder charged with vapor or gas bubbles behaves like a liquid and spreads uniformly over the support.

The process is further illustrated by the attached diagram. This shows a cracking and reactivating plant arranged in a single vertical reactor, 1. Being the cracking chamber and 2. being the reactivation chamber. The plant is supported by frame 3. It contains two purging zones 4 and 5. The first one of these is located between the cracking zone and the regeneration zone, and the second one is located at the exit of the regeneration chamber. The purging zone 4 is limited by two sealing zones 6 and 7 located above and below the purging zone and separated by partitions, whereas the purging zone 5 has only one sealing zone 8 located above the purging zone and separated by partitions. The catalyst moves through the apparatus from top to bottom over the various partitions 9 which according to patent No..... (Appl.No.I 74,507:IVb/12g) are tiltable or retractible or according to patent No.... (Appl.No.I 74,797:IVb/12g) may be in the form of a rocking screen. The oil to be cracked enters at 10 into the cracking chamber. The cracked products leave the cracking chamber at 11.

In the regeneration chamber 2 the reactivation of the catalyst is effected according to patent No..... (Appl.I 74,936:IVa/23b) with removal of surplus heat. Air enters the regeneration chamber at 12 at about 450°C. whereas the waste gases leave at 13. Air of ordinary temperature is admitted through pipes 14, whereby the temperature of the regenerating gas is kept within permissible limits so that overheating of the catalyst will not take place.

The catalyst after traversing the entire reactor is carried away at its lower end by a conveyor device, e.g. a paddle wheel 15, and returned again by further conveyor 16 to the upper part of the reactor 17.

An inert gas, preferably nitrogen, is piped to the purging zones 4 and 5 at 18 and 20, respectively. The gas leaves the purging zones at 19 and 21, respectively. A slightly elevated pressure is maintained in the purging zones relative to the rest of the apparatus.

The two partitions located immediately above and below the purging zones 4 and 5 and, like the other partitions 9, covered with catalyst are entirely sufficient in order to safeguard complete separation of both purging zones from adjacent parts of the apparatus. Since every chamber consists of two spaced partitions, one above the other, the passage of the catalyst in the direction from top to bottom may pro-

ceed also over the partitions of the sealing zones without any interference. The reason is that when one of the two partitions forming the seal is actuated for passage of the catalyst, the other partition remains inactive at this time and provides in itself a complete seal between adjacent zones to an extent such a small difference in pressure, if any, will not cause leakage of gases or vapors from one zone into the other.

Claims

1. Process for conducting catalytic conversions of carbonaceous materials, especially for the cracking of hydrocarbons in the gaseous or vapor phase in the presence of a powdered catalyst which is continuously regenerated by the passage of oxygen-bearing gases, especially air, and is moved through the reaction, regeneration and purging zones from top to bottom, has as its significant feature the fact that the reaction zone and the regeneration zone together with the necessary purging zones are arranged in a known fashion in a single integral reactor and the individual zones are sealed off from each other, especially the purging zones from the adjacent zones, by the powdered catalyst collected on permeable partitions between the zones.

2. Process according to Claim 1, in which the permeable partitions between the zones are in the form of tiltable or retractible devices or rocking screens.

(1 diagram)

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