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APPLICATION VOID.

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PATENT SPECIFICATION

Convention Date (Germany): Jan. 9, 1936.

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Specification not Accepted

COMPLETE SPECIFICATION

An improved Process for Making Carbon Black, which is Poor in Impurities, and Hydrogen or Hydrogen-containing Gases

We, BAYERISCHE STICKSTOFFWERKE AKTIENGESELLSCHAFT, of Schadowstrasse 4—5, Berlin, N.W.7, Germany, a German Company, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

It is known in the production of carbon black by burning hydrocarbons, such as for example acetylene, to chill the flame on a cool surface in order to prevent combustion of the soot. Up to now, however, a chilling or temperature lowering of the splitting products has not been provided in the thermal splitting of hydrocarbons; on the contrary it was considered to be fitting to lead acetylene carbon again, after it had been formed, through a hydrogen flame formed by combustion of the hydrogen resulting from the cracking.

In contradistinction thereto, it has now been found, surprisingly enough, that particular advantages are obtained if the cracking products undergo a chilling or temperature lowering directly after their formation. In this way not only is the hydrogen from the cracking obtained for other purposes, e.g. for inorganic or organic syntheses, but the quality of the carbon black formed is improved since on the one hand the graphite formation which sets in at elevated temperatures is avoided and at the same time the fineness and structure of the black is improved. According to the new process, therefore, unsaturated or saturated gases or vapours containing hydrocarbons, e.g. waste gases, of carbon hydrogenation or benzine synthesis according to Franz Fischer, are thermally cracked with or without additional substances, e.g. small quantities of iron pentacarbonyl, and the cracking products chilled or lowered in temperature directly after their formation. The chilling must be effected at least to such temperatures that the size and atom arrangement of the small carbon particles remain practically maintained, or experience no further substantial changes. Accordingly the chilling may be effected both to low temperatures as well as so carefully that the chilled cracking products have in addition a sufficiently high temperature for possible other purposes, e.g. a further treatment. What is essential is only that the cracking products directly after their formation undergo a chilling or temperature lowering.

The new process affords particular advantages in the case of those gases or gas mixtures the cracking of which is accompanied by heat evolution, for example in the case of the splitting of acetylene or acetylene-containing gas mixtures, for which 54 Calories are liberated per mol of C_2H_2. Other such hydrocarbons cracking with evolution of heat are for example allylene, dimethyldiacetylene, also ethylene, propylene, and other homologues of the olefine series, furthermore for example cyclopropane, benzene vapour, dihydrobenzene, and others or mixtures thereof with one another or with exothermic compounds. From this is apparent more particularly the manner of working heretofore never employed of subjecting to a chilling cooling merely splitting products formed by cracking heat.

The chilling or temperature lowering can be effected with the aid of known means, e.g. by means of a cooling device acting from the exterior or installed in the gas path, which operates with any cooling liquids or fluids. In the case of exterior cooling, cooling ribs may also be used made of metal of good thermal conductivity. It is particularly advantageous to effect the cooling by boil-

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ing liquids and to adapt the cooling device for steam or vapour production. In this case the cooling appliance may be constructed for example after the fashion of a tube steam boiler connected immediately behind the cracking zone; the cracked products then stream through the nest of tubes and, owing to the narrowing of the free cross section, acquire an increased velocity which is particularly advantageous for the cooling since the cracked products are rapidly removed from the vicinity of the reaction zone. The cooling at raised velocity of the cracked products may also be produced otherwise by narrowing of the chamber attached to the cracking space, for example by a narrower tube cooled from the exterior by air or liquid (technical capillary). The elevation of the velocity of the split products affords the further advantage of effectively preventing deposition of the carbon black, stopping up of the tubes, etc.

A raising of the velocity of the cracked products can also advantageously be effected by admixing gases or vapours behind the cracking zone, gases of good thermal conductivity for example hydrogen, or of high thermal capacity, for example polyatomic molecules like steam or the like, being preferably used; in the last-named case the steam may be produced in the described manner by the process itself. A particularly advantageous chilling or temperature lowering of the cracked products is obtained when the cracking hydrogen is wholly or partially sent back in circulation into the reaction space behind the cracking zone; for this purpose also hydrogen-containing reaction mixture, which may or may not yet be completely freed from soot, may be used. Both possibilities, return of the cracking hydrogen and introduction of steam produced by the process itself behind the cracking zone, may also be combined.

The chilling or temperature lowering of the cracked products may also advantageously be effected so that the splitting process is coupled with heat-consuming processes, for example by introducing dissociating gases or vaporising liquids at the rear of the cracking zone. In the former case the heat of dissociation of the gas or of the vapour is rendered utilisable for the temperature lowering, and in the latter case the heat of vaporisation of the liquid, for example water, which in liquid form, finely divided through one or several nozzles or through a large number of fine openings, is introduced behind the cracking zone in the path of the splitting products.

The possibilities set forth are all merely by way of example and the new invention embraces also all other forms of procedure in which the cracked products experience a chilling or temperature lowering immediately after their formation.

The new process possesses particular advantages for example in the case of the thermal splitting of acetylene or gas mixtures containing the same more particularly when the acetylene is continuously supplied to the cracking space after starting the ignition in very large quantities, preferably in quantities of more than 10 kg/hr, at ordinary pressure or pressure which is raised a little, without further heat supply or special heat source.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:—

1. A process for preparing carbon black, which is poor in impurities, and hydrogen or hydrogen-containing gases by thermally splitting hydrocarbons, characterised by the feature that directly after their formation the splitting products undergo a chilling or temperature lowering.

2. A process as claimed in claim 1, characterised by the feature that the splitting products formed with evolution of heat, for example those from acetylene or acetylene-containing gas mixtures, are subjected to a chilling or temperature lowering directly after their formation.

3. A process as claimed in claim 1 or 2, characterised by the feature that the chilling or temperature lowering is effected by means of a cooling device acting from the exterior or installed in the gas path.

4. A process as claimed in any one of the preceding claims, characterised by the feature that the cooling device is adapted for producing steam or vapour.

5. A process as claimed in any one of the preceding claims, characterised by the feature that the chilling or temperature lowering is produced by cooling at elevated gas velocities of the splitting products.

6. A process as claimed in any one of the preceding claims, characterised by the feature that gases or vapours are admixed with the splitting products behind the splitting zone, more particularly gases or vapours of good thermal conductivity or of somewhat high heat capacity.

7. A process as claimed in any one of the preceding claims, characterised by the feature that the chilling or tempera-

ture lowering of the reaction products is effected by supplying hydrogen from the splitting or hydrogen-containing reaction mixture back to the space behind the splitting zone.

8. A process as claimed in any one of the preceding claims, characterised by the feature that the splitting process is coupled with heat-consuming processes by introduction of vaporising and/or dissociating substances behind the splitting zone.

9. The use of the process claimed in any one of the preceding claims for the thermal splitting of acetylene or gas mixtures containing the same, which are supplied continuously to the splitting space without further heat supply and after initiation of the ignition in quantities of at least 10 kg per hour at ordinary or slightly raised pressure.

10. The improved process for preparing carbon black, which is poor in impurities, and also hydrogen or hydrogen-containing gases, substantially as hereinbefore described.

11. Carbon black and/or hydrogen or hydrogen-containing gases prepared by the process hereinbefore described and claimed.

Dated this 11th day of January, 1937.

MARKS & CLERK.

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