PATENT SPECIFICATION

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COMPLETE SPECIFICATION

An improved Process for carrying out the Fischer-Tropsch Synthesis

We, CHEMISCHE WERKE BERGKAMEN AKTIENGESELLSCHAFT, whose former name was "Chemische Werke Essener Steinkohle Aktiengesellschaft, of Bergkamen bei Kamen, Germany, a German Company, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The initial substance in the well known Fischer-Tropsch synthesis is a synthesis gas in the preparation of which bituminous-coal coke, low-temperature coke, coke-oven gas and lignite have proved to be suitable. It is of importance that such fuels or gases be used as may be converted into a gas containing CO and H_2 in a proportion of 1 : 1 or up to 1 : 2. The greatest economy in carrying out the process has been achieved with a combination of coke and coke-oven gas.

Moreover it is known to produce oxygen-containing compounds, more particularly alcohols, from carbon monoxide and hydrogen or by the action of these components on olefines. Thus by passing carbon monoxide and hydrogen at high temperatures and pressures over iron catalysts, methanol is obtained. Similarly it is possible, by the "Synthol" process of Franz Fischer and his associates, to produce mixtures of oxygen-containing compounds, more particularly alcohols.

It has now been found that the Fischer-Tropsch synthesis may be carried out most advantageously if, in a preliminary stage, the coke-oven gas employed is passed over cobalt contacts at temperatures ranging from 100° to 180°C. and at moderate pressures not exceeding 20 atmospheres, the pressure being, for instance, up to 284 lbs. per sq. in., as in the method of producing water-soluble straight-chain aliphatic alcohols containing at least three atoms of carbon per molecule from industrial gases containing carbon monoxide and a large excess of hydrogen described and claimed (for a temperature range between 100° and 160°C.) in our Specification No. 3184/51 (Serial No. 711,597). In this preliminary stage, part of the carbon monoxide contained in the coke-oven gas is changed into a mixture of water-soluble straight-chain aliphatic alcohols from ethyl alcohol up to amyl alcohol, and quite small quantities of still higher alcohols, at least 75 per cent of the mixture being *n*-propyl alcohol. The yield of these alcohols containing at least three atoms of carbon per molecule may be appreciably increased if olefinic hydrocarbons, such as ethylene, are added to the coke-oven gas before the conversion into the alcohols aimed at takes place.

Since the gases produced from high-boiling hydro-carbons by cracking, and also obtained in the Fischer-Tropsch synthesis, are rich in olefines, such cracked gases may likewise be utilised to advantage in the process by introducing them into the reaction chamber. The coke-oven gas, pre-treated as described above, is then treated in the well-known way in water-gas generators for the purpose of producing synthesis gas by means of decomposing methane. Or the pre-treated coke-oven gas is mixed with purified water-gas and directly introduced into the Fischer-Tropsch synthesis, and may thus, in the known way, be brought to conversion according to the Fischer-Tropsch synthesis in one or several stages. Considerable advantages are achieved by means of this new process, technical advantages, chiefly affecting the contacts, and considerable economical advantages.

Thus, the gas is introduced into the contact chamber at low temperatures so that starting operations are easier on the contacts, thereby assuring the higher efficiency thereof. Also unlike the products ordinarily resulting

[Price 3/-]

from the Fischer-Tropsch synthesis, the water-soluble straight-chain aliphatic alcohols obtained by the preliminary stage described above, containing three or more carbon atoms per molecule, constitute valuable materials, considerably lowering the expenses for the raw materials required for the production of synthesis gas and, hence, enhancing the economy of the process. The new process takes on added significance when a greater amount of residual gas is to be produced at the cost of the yield of products obtained by the Fischer-Tropsch synthesis, in order to meet peak demands for town gas during the winter months.

What we claim is :—

1. A process for carrying out the Fischer-Tropsch synthesis using coke-oven gas as the initial substance for the production of synthesis gas, characterised by the fact that in a preliminary stage the coke-oven gas, at temperatures ranging from 100° to 180°C. and at ordinary or slightly raised pressures not exceeding 20 atmospheres, for instance up to a pressure of 284 pounds per square inch, is passed over cobalt contacts, that water-soluble straight-chain aliphatic alcohols containing three or more carbon atoms per molecule are thus obtained, and that the remaining gas is then used for synthesis gas, for instance by running it into water-gas generators, or by mixing it with purified water-gas and then directly introducing it for conversion into the Fischer-Tropsch synthesis.

2. A process as claimed in Claim 1, wherein olefinic hydrocarbons, such as ethylene, are added to the coke-oven gas prior to the preliminary treatment in order to raise the yield of water-soluble straight-chain aliphatic alcohols containing three or more carbon atoms per molecule.

3. A process as claimed in Claim 1 or 2, wherein gases which are obtained by cracking hydrocarbons of high boiling point and which are rich in olefines are introduced into the reaction chamber.

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