PATENT SPECIFICATION

783,061

Date of Application and filing Complete Specification: March 8, 1956.

No. 7314/56.

Application made in Germany on March 15, 1955.

Complete Specification Published: Sept. 18, 1957.

Index at Acceptance:—Class 2(3), B1G.
International Classification:—C07c.

COMPLETE SPECIFICATION

Process for the production of Hydrocarbons

We, HEINRICH KOPPERS Gesellschaft mit beschränkter Haftung, of Moltkestrasse 29, Essen, Germany, a Joint Stock Company organised and existing under the laws of the German Federal Republic, 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 present invention relates generally to a process for the production of hydrocarbons by reacting carbon monoxide and hydrogen (synthesis gas) or gas mixtures containing the same, in the presence of catalysts, more especially catalysts containing iron.

The invention is specifically concerned with such a process in which the reaction chamber is filled by a hydrocarbon oil (catalyst oil) in which the catalyst is suspended or fixedly arranged, the catalyst oil being constantly withdrawn at the top end of the reaction chamber and returned in circulation to the said chamber again at the bottom end thereof.

This process, which is designated as liquid phase synthesis, has certain advantages as compared with the so-called gaseous phase synthesis, these advantages having been frequently described in detail in the pertinent literature. When this process is carried out on a practical basis, however, it has been shown that under certain circumstances, the activity of the catalyst drops more rapidly from a high initial value to a lower value than was to be expected *per se*. Investigations have now shown that the cause of the unexpected fall in the catalyst activity is to be sought, *inter alia*, in the presence of too great an amount of carbon dioxide in the reaction chamber, more especially at the start of the catalytic reaction. At the pressure which is used, the carbon dioxide being formed in the synthesis at iron-containing catalysts is in fact partially dissolved in the hydrocarbon oil and is returned to the bottom of the reaction chamber again with the oil which is conducted in circulation. In the said chamber, the carbon dioxide can have an oxidising action on the catalyst and can in this way or in some other way lower the activity thereof. Moreover, the presence of too large an amount of carbon dioxide also has a reducing action on the partial pressure of the synthesis gas.

The invention overcomes this disadvantage by the fact that prior to the extracted catalyst oil being reintroduced into the reaction chamber, it is liberated from the major part of the carbon dioxide dissolved therein by expansion to pressure lower than the pressure used in the a synthesis and only thereafter is it forced into the reaction chamber again with the pressure necessary for the synthesis.

The result achieved by means of the invention is that the carbon dioxide content at the bottom end of the reaction chamber is kept within tolerable limits. The pressure to which the catalyst oil is to be expanded is dependent both on the dissolving power of the oil for carbon dioxide and also on the amount of carbon dioxide which is actually dissolved. Generally speaking, it has been found sufficient to expand to normal pressure or to a pressure only slightly above normal pressure.

The complete or partial expansion of the circulating catalyst oil has yet another advantageous effect, in that in this way certain unsaturated hydrocarbons of low molecular weight are separated from the oil, which hydrocarbons, on being reintroduced into the reaction chamber, would be hydrogenated to form saturated hydrocarbons, such as methane, ethane or the like, which are undesirable *per se*.

We wish it to be noted that the performance of the invention the subject of the present application involves the use of the invention described and claimed in our prior Patent No. 728543.

What we claim is:—

Process for the production of hydrocarbons by reacting carbon monoxide and hydrogen (synthesis gas) at elevated pressure and temperature in the presence of iron-containing

[Price 3s. 6d.]

catalysts which are suspended or fixedly arranged in a hydrocarbon oil (catalyst oil), the latter being constantly withdrawn at the upper end of the reaction chamber and introduced in circulation into the bottom end of the said chamber, characterised in that prior to the extracted catalyst oil being reintroduced into the reaction chamber, the said oil is freed from the major part of the carbon dioxide dissolved therein and if necessary other dissolved substances by being expanded to a pressure lower than the pressure used in the synthesis and only then is it forced into the reaction chamber again at the necessary pressure.

HERON ROGERS & CO.,
Agents for Applicants,
Bridge House, 181, Queen Victoria Street
London, E.C.4.

Printed for Her Majesty's Stationery Office by J. Looker Ltd., Poole, Dorset. 1957.
Published at The Patent Office, 25, Southampton Buildings, London, W.C.2, from which copies may be obtained.