Uitgegeven den
1 JUNI 1939

PATENT SPECIFICATION

504,910

Application Date: July 27, 1937. No. 19431/37.

Complete Specification Accepted: April 27, 1939.

(Under this application, which was originally made under Section 91 of the Patents and Designs Acts, 1907 to 1932, a Specification was laid open to public inspection on Jan. 28, 1938.)

COMPLETE SPECIFICATION

Process for the Catalytic Conversion of Mixtures of Carbon Monoxide and Hydrogen

(A Communication from Abroad from RUHRCHEMIE AKTIENGESELLSCHAFT, of Oberhausen-Holten, Germany, a Body Corporate organised and existing under the Laws of the German State.)

I, OWEN EVANS, M.A. (Cantab.), of 40-43, Chancery Lane, London, W.C.2, of British Nationality, 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:—

Hitherto the conversion of carbon monoxide and hydrogen at a slightly elevated pressure or at normal or slightly reduced pressure has been carried out in such a manner that the conversion products contain a very large proportion of liquid hydrocarbons that boil at a low temperature and that can be used as fuel.

When cobalt-catalysts are employed, the optimum temperatures for this reaction lie between approximately 185° and 200° Centigrade. Lower temperatures have hitherto not been employed in practice since the yield of low boiling hydrocarbons would be so small that there was no object in carrying out the hydrogenation of carbon monoxide at such low temperatures.

For the conversion of a large proportion of the initial gases into hydrocarbons that boil at a higher temperature, certain processes have been developed on a practical scale that operate at temperatures lying between 230° and 250° Centigrade while using suitable catalysts.

It is already known from Specification No. 255,818 that by lowering the temperature to below that at which the reduction of carbon monoxide produces methane, the higher members of the methane series, such as ethane and propane, are recovered when the same catalyst is employed.

It has now been found that the conversion of mixtures of carbon monoxide and hydrogen at ordinary pressure or at pressures differing very slightly from ordinary pressure and at elevated temperatures below 175° Centigrade in the presence of catalysts comprising cobalt can be carried out in an advantageous manner by taking the duration of the reaction so long that 50 per cent or over of the carbon monoxide entering into reaction is converted into paraffin wax. Preferably the temperatures lie between 165° and 170° Centigrade. These temperatures are below that at which liquid hydrocarbons are produced which for the most part boil at a lower temperature. The lowest temperature at which good results can be obtained is 160° Centigrade.

When working in accordance with the present invention a far reaching conversion of the carbon monoxide, amounting to 80 per cent or over, may take place, whereby 50 per cent or more of the carbon monoxide introduced is converted into paraffin wax.

The rate of flow of the gases should in accordance with the present invention be at most 20 litres per litre of catalyst per hour in order to obtain the desired result. This rate of flow corresponds to a duration of contact of 180 seconds. With higher durations of contact, better yields can be obtained but a limit to increasing the duration of contact is given by economic considerations, since with an increased conversion the reaction velocity diminishes.

It has been found to be very advantageous when carrying out the process according to the invention to use catalysts which contain no catalytic metals other than cobalt and that have been activated solely by the addition of thorium oxide or magnesium oxide.

The process according to the invention may be carried out in a number of stages whereby in the first stage principally paraffin wax is produced, and in the following stages the reaction conditions and in particular the temperature are selected in accordance with the character and composition of the residual gases of the first stage to produce hydrocarbons.

The paraffinic products obtained by the process according to the invention are characterised by exceptional purity and special physical and chemical properties; for example, they provide an excellent raw material for polishing wax, since by their

addition oil is bound better than by the addition of ordinary paraffin wax.

The following Example will further illustrate how the said invention may be carried out in practice but the invention is not limited to the Example.

EXAMPLE

10 litres of a gas mixture composed of one part of carbon monoxide and two parts of hydrogen are fed per hour per litre of catalyst at a temperature of 160° Centigrade and at ordinary pressure over a cobalt catalyst activated with 18 parts of thorium oxide per 100 parts of cobalt, which, supported by wire gauze, is located in a vertical tube opening at the bottom. The paraffin wax formed during the reaction, after the catalyst has become saturated, flows off from the catalyst mass. The benzines contained in the gas and vapours that are drawn off are recovered by condensation. From every cubic metre of synthesis gas there are recovered 95 gms. of solid hydrocarbons and about 25 gms. of benzines and oils.

It may here be observed that in the conversion of carbon monoxide and hydrogen at slightly elevated pressure or at normal or slightly reduced pressure, for the purpose of securing a large proportion of liquid hydrocarbons that boil at a low temperature and that can be used as fuel, it is usual to use throughputs of 100 litres of synthesis gas per hour per litre of reaction space.

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

1. A process for the catalytic conversion of mixtures of carbon monoxide and hydrogen at ordinary pressure or at pressures differing very little from ordinary pressure and with catalysts containing cobalt, wherein for the purpose of increasing the content of solid hydrocarbons that boil at a high temperature, the conversion is carried out at elevated temperatures ranging from 160° Centigrade to 175° Centigrade, the speed of flow of the gas over the catalyst being not more than 20 litres per litre of catalyst per hour, whereby 50% or over of the carbon monoxide entering into reaction is converted into paraffin wax.

2. In the process as claimed in claim 1, working at temperatures between 165° and 170° Centigrade.

3. In the process as claimed in claim 1 or claim 2, the use of a catalyst consisting of cobalt activated solely by the addition of thorium oxide or magnesium oxide.

4. In the process as claimed in any of claims 1 to 3, treating the residual gases in accordance with their character and composition to produce hydrocarbons.

5. The process for the production of paraffin wax by conversion of carbon monoxide and hydrogen substantially as described in the foregoing Example.

6. Paraffin wax when obtained by a process in accordance with any one of the preceding claiming clauses.

Dated this 13th day of July, 1937.

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Leamington Spa: Printed for His Majesty's Stationery Office, by the Courier Press.—1939