[Second Edition.]

PATENT SPECIFICATION

Convention Date (Germany): Aug. 24, 1935.

470,534

Application Date (in United Kingdom): Aug. 1, 1936. No. 21393/36.

Complete Specification Accepted: Aug. 17, 1937.

COMPLETE SPECIFICATION

Process for Producing Lubricating Oils.

We, RUHRCHEMIE AKTIENGESELLSCHAFT, Oberhausen-Holten, Germany, a body corporate organised and existing according to the laws of the German State, 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 has already been proposed to condense petroleum distillates having a high content of unsaturated hydrocarbons at ordinary or raised temperatures in the presence of a catalyst, such as aluminium chloride, for the purpose of producing lubricating oils. After removing the unconverted constituents, and after the usual treatment, lubricating oils having a low solidification point are obtained. It has further been proposed to use cracked products as raw materials; thus, for example, the hydrocarbons obtained by cracking petroleum oils and other hydrocarbon mixtures may be used for this purpose.

In order to obtain in sufficient quantity lubricating oils that will satisfy all practical requirements and which have a low solidification point and display a small change of viscosity on change of temperature, it was believed that it would be necessary to make use of a hydrocarbon mixture which consisted wholly or predominantly of aliphatic hydrocarbons which are solid at ordinary temperature.

It has now been found that, if the products of the hydrogenation of carbon monoxide be used as raw material for producing lubricating oils, it is not necessary to be restricted to hydrocarbon mixtures which consist wholly or principally of aliphatic hydrocarbons which are solid at ordinary temperature. On the contrary it is possible to make use of hydrocarbon mixtures that boil at a lower temperature, and to include all the constituents that boil at over 150° C. According to the invention those fractions which boil at over 150° C., of the hydrocarbon mixtures obtained on the catalytic conversion of mixtures of carbon monoxide and hydrogen are employed as raw materials for the production of lubricating oils by cracking and the subsequent polymerisation of the mixtures obtained by the cracking. The condensation of the hydrocarbon mixtures obtained, which are rich in unsaturated compounds, is carried out in the usual manner. In this way a considerably larger yield of valuable lubricating oils with respect to the quantity of cracked products introduced is obtained. Furthermore the lubricating oils produced have not only a low solidification point but also the highly desirable property of small change in viscosity on change of temperature. For the rest the process according to the invention enables the aluminium chloride to be used repeatedly, with a continually recommenced conversion of freshly introduced charges of the cracked products, so that there is obtained a considerable saving in condensation agents and at the same time greater economy in the production of lubricating oils.

The process is carried out by converting in known manner a mixture of carbon monoxide and hydrogen into liquid hydrocarbons by the use of suitable catalysts, at ordinary pressure and at a moderately raised temperature. Thereupon the fractions of the conversion products which boil at over 150° C. are subjected to cracking of from 12 to 15 atmospheres and at temperatures lying between 450 and 550° C. The cracked products which have a high content of unsaturated hydrocarbons are in known manner treated either wholly or in part (for example, after the distilling-off of particular fractions) with anhydrous aluminium chloride or similar condensing agents, viscous oils being obtained by condensation and polymerisation which display remarkably good lubricating qualities. The products show very little relation between viscosity and temperature, that is to say, they have an exceptionally good viscosity index, and on the other hand such a low solidification point that the synthetically produced lubricating oil can still be used as a lubricant even at low atmospheric or working temperatures.

[Price 1/-]

Particularly useful lubricating oils are obtained by using those constituents of the cracked products which boil at up to 200° C. Such lubricating oils are principally characterised by a remarkably low solidification point. For example lubricating oils are obtained which have a viscosity index of $1,_{75}$ to $1,_{9}$, an absolute viscosity of 12 to 22° Engler at 55° C. and a solidification point of —32° C. to —20° C. Of particular importance is the exceptionally great tenacity of the oil film in heavily loaded bearings. By reason of this property and particularly because of its low solidification point, the lubricating oil can be used for many purposes. Furthermore the tendency to form resins as well as the tendency to form carbon during the coking of the lubricating oils obtained by the process of the invention are by no means inferior to the equivalent tendencies in the very best lubricating oils.

The quantity of condensation agents needed for the polymerisation and condensation of the cracked products obtained in the manner described lies within the usual limits. It has been found, however, that the raw material employed according to the invention enables the condensation agent to be repeatedly used for the condensation of fresh charges of the raw hydrocarbons. In accordance therefore with the further knowledge obtained the layer remaining after the removal of the conversion products and containing the condensation agent may be repeatedly used for similar condensation reactions. In the repeated use of the already used condensation agent the condensation temperature is advantageously raised correspondingly. This step however involves a considerable saving in the condensation agent needed for carrying out the process. There is no reduction in quality of the lubricating oils even after the condensation agent has been used repeatedly. The catalyst employed with the first charge was, for example, used again eight times for the condensation reaction with new charges without being exhausted. Whereas according to the known processes for producing synthetic lubricating oils it is necessary to employ one part of aluminium chloride to from 6 to 10 parts of the lubricating oil obtained, for producing lubricating oils according to the process of the invention the necessary quantity is reduced to at least one-tenth, with repeated use of the same catalyst.

Furthermore the saving in condensation agent secured according to the process of the invention by the repeated use of the aluminium chloride employed with new charges of the raw products to be condensed was in no way to be anticipated; in fact it was to be expected that the hydrocarbon mixtures obtained by cracking would in a very short time render the catalyst useless by reason of its content of resinifying substances. Actually however the opposite was observed.

Those constituents of the hydrocarbons which are not converted during the condensation of the liquid cracked products can be again subjected to cracking and further treatment after the removal of the lubricating oils.

The invention is illustrated by means of the following examples:—

EXAMPLE 1.

A gas consisting of one part by volume of carbon monoxide and two parts by volume of hydrogen, from which any sulphur compounds have been removed, is led over a cobalt catalyst at about 180° C. and at ordinary pressure. A reaction gas is obtained from which, after cooling, liquid hydrocarbon separate out. The reaction gas is then passed over active carbon for the purpose of removing from it the benzines which boil at a lower temperature and which are still gaseous. Of the liquid hydrocarbons obtained those constituents which boil at above 150° C. are cracked at a pressure of 8 atmospheres and at a temperature of 493° C. From the cracked products obtained a fraction is removed which distils up to 200° C. and which at 20° C. has a density of 0.702. This distillate is caused to react for 48 hours with 5% of aluminium chloride in a stirred vessel, with cooling at —20° C. The reaction product, from which the contact substance has been removed by washing with water, is distilled in vacuo after drying and bleaching treatment. To 100 parts of cracked product introduced there are obtained 53 parts of oil from which, after the removal of refrigerating machine oil, 43 parts of an exceptionally valuable lubricating oil having the properties hereinbefore described are obtained.

EXAMPLE 2.

A cracked benzine produced according to Example 1 is distilled off up to 230° C. This benzine has a density of 0.715 at 20° C. and a content of unsaturated hydrocarbons of 39.2% by volume. This fraction serves as raw material for the condensation process. At 20° C. 100 parts of this cracked product are polymerised for 24 hours in a stirred vessel with 5 parts of fresh aluminium chloride. The reaction product is separated from the layer of liquid containing the catalyst, which is again used for converting a similar quantity of

freshly introduced cracked product. For 24 hours the substances are left to react at a temperature of 55° C., whereupon the oils obtained are separated from the layer of liquid containing the catalyst in the same way. The layer of contact substances produced by this process is then for 24 hours brought into reaction at 90° C. with fresh cracked product. The process is repeated in like manner at 120° C., at 145° C. and at 170° C., using the same condensation agent. The whole process produces from the 600 parts of cracked product introduced, a yield of 52% of lubricating oils composed of the following amounts from the several charges:

First charge - - - -	42 parts
Second charge - - -	52 parts
Third charge - - - -	55 parts
Fourth charge - - - -	58 parts
Fifth charge - - - -	57 parts
Sixth charge - - - -	50 parts

The oils have the same excellent properties as those hereinbefore described.

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 producing lubricating oils from conversion products of the catalytic hydrogenation of carbon monoxide at ordinary or slightly changed pressure and at a moderately raised temperature, characterized in that of these hydrogenation products fractions boiling at over 150° are cracked at temperatures lying between about 450° and 550° C., and at a pressure of about 8 to 15 atmospheres, and the resulting hydrocarbon mixtures rich in unsaturated compounds following on the treatment described are condensed, either in their entirety or as regards fractions, in known manner with condensation agents such as aluminium chloride into lubricating oils.

2. A process according to claim 1, characterized in that the constituents boiling up to 200° of the hydrocarbon mixtures rich in unsaturated compounds and produced during cracking are subjected to condensation to produce lubricating oils.

3. A process according to claim 1 or claim 2, characterized in that the condensation agents employed for condensing the liquid products of cracking are repeatedly used advantageously while increasing the condensation temperature each time for a further condensation reaction.

4. A process for producing lubricating oils substantially as hereinbefore described, and as indicated in Examples Nos. 1 and 2.

5. New products of manufacture, being lubricating oils produced by the process specified in claim 1, 2 or 3.

Dated the 1st day of August, 1936.
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Abingdon: Printed for His Majesty's Stationery Office, by Burgess & Son.
[Wt. 8030.—50/4/1938.]