

UNITED STATES PATENT OFFICE

2,518,529

PROCESS FOR PRODUCING SYNTHETIC LUBRICANTS

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No Drawing. Application January 18, 1949, Serial No. 71,562. In France September 12, 1947

1 Claim. (Cl. 260—671)

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The present invention relates to alkylated and polymerized hydrocarbons, and particularly to synthetic lubricating oils produced by alkylating and polymerizing low molecular weight hydrocarbons to increase their molecular weight. The invention relates also to an improved process of making such synthetic oils.

It is known that products of high molecular weight and having a high viscosity suitable for use in the lubrication of various mechanisms including steam engines, or internal combustion engines, can be obtained by the polymerization of various olefinic hydrocarbons in the presence of catalysts of the Friedel-Crafts type, such as aluminum chloride, iron chloride, zinc chloride, and boron fluoride.

In the application for French Patent 522,546, filed on the 24th of September, 1946, in the name of the applicants, it has been suggested that olefins such as those obtained by cracking commercial paraffins in the vapor phase and, more particularly, the cracking of paraffins of melting points greater than 50° C. be polymerized and also that there be added during the polymerization a certain proportion of a light aromatic hydrocarbon, such as benzene or its homologues.

This method of operation produces synthetic oils of good quality, possessing remarkable characteristics, with particular respect to the slope of the viscosity temperature curve, the pour point and the Conradson carbon and the iodine number. The stability and the lubricating properties of these oils, even at high temperatures, justify their use in all types of internal combustion engines including aviation engines.

The synthesis process described above, is called "alkylation polymerization" without these terms being in any way limiting. As by-products of this process, in addition to lubricating oils, lighter synthesis products, comparable to gasoline, gas oil and spindle oil, are also obtained. These products are formed from the aromatic components and the cracking distillate in such large proportions that they cannot be utilized for the manufacture of lubricating oil. The applicants have found further that it is very difficult to obtain oils having an iodine number lower than 10 (of the order of about 5) successfully by the simple process of "alkylation polymerization," without too great a sacrifice in the viscosity index of the oils obtained in conversion into viscous oil. The applicants have now discovered, and it is the object of the present invention

(1) That all or part of these light products can be advantageously reused in a subsequent

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"alkylation polymerization" and that if one uses them integrally, there is no apparent accumulation of any fraction.

(2) That by the process of total recycle, the production can be adjusted so as to produce as a total product an oil of the desired viscosity, for example, of the viscosity of a light motor oil, of a heavy motor oil or of a bright stock.

(3) That the iodine number of the oils obtained by the process is always distinctly lower than that obtained without recycling.

The reaction of the "alkylation-polymerization" according to the present invention is carried out in the following manner:

Into a suitable mixture of benzene and recycled products (obtained from a previous operation), there is introduced with agitation the necessary quantity of anhydrous aluminum chloride. Then, little by little, the paraffin cracking distillate (boiling up to 285° C. at atmospheric pressure) is added. The reaction liberates heat and it is necessary to cool the mixture extensively to keep the temperature below 50° C. The lowered temperature is maintained for a substantial period of time, 2 to 8 hours, preferably about 5 hours and then is increased to about 90° to 120° C., preferably 100–110° C. for 1 to 4 hours, preferably about 2 hours to complete the reaction.

The product is then decanted. The aluminum chloride sludge formed is separated and the upper layer is neutralized if desired and is treated with a decolorizing clay in the presence of steam. Finally, it is distilled under vacuum to concentrate the oil and obtain a product of the desired viscosity and flash point characteristics. Thereafter, the light products, not utilizable directly for the manufacture of lubricating oils, are reused in a new operation.

It is noted that in the above description the range of distillation of the recycled fraction has not been defined as it is possible in applying the previously indicated method to recycle, for example, only the fraction boiling below 125° C. at atmospheric pressure, or the fraction boiling below 300° C. at atmospheric pressure, or even the fractions boiling up to 400° C. at atmospheric pressure (such fractions contain light oils of the transformer oil type). Also only part of these fractions can be used, for example, the fraction boiling between 125° C. and 300° C. at atmospheric pressure or the fraction boiling between 125° C. and 400° C. at atmospheric pressure. The method of recycling employed does not modify the characteristics of the finished oil in any way.

The process according to the present invention

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thus allows the complete transformation of the light products into quality oils and thus reduces appreciably the total initial material used for a given quantity of oil produced. Particularly, only a minimum quantity of aluminum chloride is employed, which leads to formation of a minimum of aluminum chloride sludge.

The following examples show methods of carrying out the invention and are not limitative in any way.

Example 1

For comparison, a first operation was carried out without recycling. The starting materials were:

	Kilograms
Benzene	500
Cracking distillate.....	2000
Aluminum chloride.....	80

After reaction under the conditions indicated above (below 50° C. for 5 hours then at 100 to 110° C. for 2 hours) and clay treatment and distillation of the products obtained, the following yields were obtained:

	Kilograms
Sludge (without aluminum chloride)	290
Products to be recycled.....	1010
Aviation type oil.....	1000

The oil obtained had the following characteristics:

Density at 15° C.....	0.879
Flash point, open cup.....	258° C.
Viscosity, Saybolt Universal at 98.8° C.....	110
Viscosity index, Dean and Davis.....	110
Solidifying point.....	-30° C.
Conradson carbon (residue).....	0.24
Iodine number.....	10.8

Example 2

In recycling all the products boiling below the aviation oil fraction the reaction tends to an equilibrium in the following proportions

Charge:	Kilograms
Fresh benzene.....	40
Recycled products.....	1440
Cracking distillate.....	1000
Aluminum chloride.....	40

Products obtained:	
Sludge (without aluminum chloride) ..	80
Recycled products (boiling below 220° C. under 3 mm. of mercury pressure) ..	1440
Aviation oil (boiling above 220° C. under 3 mm. mercury pressure) ..	740

The consumption of the products per ton of aviation oil are, therefore, as follows:

Consumption:	Kilograms
Benzene	54
Cracking distillate.....	1350
Aluminum chloride.....	54

Products obtained:	
Aviation oil.....	1000
Sludge (without aluminum chloride) ..	108

The characteristics of the oil obtained were as follows:

Density at 15° C.....	0.878
Flash point.....	260° C.
Viscosity, Saybolt at 98.8° C.....	110
Viscosity index, Dean and Davis.....	109
Solidifying point.....	-30° C.
Conradson carbon.....	0.24
Iodine number.....	5

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Comparison of the Examples 1 and 2 clearly shows the remarkable advantages of recycling.

The improvement of the iodine number which seems to be due to the decantation of the aluminum chloride sludge is improved in the presence of recycled products and is particularly remarkable.

Example 3

In this example (carried on the semi-industrial scale) the overhead products boiling in the range of light gasolines up to 150° C. were rejected and the products boiling between 150° C., at atmospheric pressure, and 210° C., under the pressure of 3 mm. of mercury, were recycled.

Charge:	Kilograms
Benzene	310
Recycled products.....	1400
Cracking distillate.....	1000
Aluminum chloride.....	40

Products obtained:	
Sludge	53
Overhead products	218
Recycled products	1400
Oil (boiling at about 210° C. under 3 mm. of mercury pressure)	650

The consumption and products were as follows:

Consumption:	Kilograms
Benzene	460
Cracking distillate	1540
Aluminum chloride	60

Products:	
Sludge	81
Overhead products	335
Oil	1000

Characteristics of the oil:	
Density at 15° C.	0.887
Flash point	262° C.
Viscosity, Saybolt at 98.8° C.	121.8
Viscosity index, Dean and Davis	108
Solidifying point	-30° C.
Iodine number	4

The invention has been described by giving specific examples without being limited, necessarily to such examples. It is intended to cover obvious equivalents and variants conforming to the spirit of the invention without necessarily being restricted to the particular products or conditions given above. The proportions of aromatic hydrocarbon to olefin containing fraction may vary from about 1 to 30 to as much as 1 to 3. The type and quantity of catalyst, and the reaction conditions also can be varied within reasonable limits.

What is claimed is:

1. An improved process for the production of a synthetic lubricant which comprises simultaneously alkylating and polymerizing about 50 parts by weight of benzene with about 200 parts by weight of a cracked distillate in the presence of about 8 parts by weight of aluminum chloride at a temperature of about 50° C. for about 5 hours in a reaction zone, allowing the temperature to raise to one within a range of from 100° C. to about 110° C. for about 2 hours to obtain an alkylated-polymerized reaction product, treating said reaction product with a decolorizing clay in the presence of steam, distilling said treated reaction product to separate it into a synthetic lubricating oil fraction having an iodine number of less than 10 and a light lower boiling

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fraction, recycling said light fraction to said reaction zone, charging to said reaction zone fresh benzene cracking distillate and aluminum chloride until there exists in said reaction zone a mixture comprising approximately 4 parts by weight of benzene, 144 parts by weight of recycled fraction, 100 parts by weight of cracking distillate and 4 parts by weight of aluminum chloride, and reacting said charged materials to obtain a second synthetic lube fraction having an iodine number of less than 10.

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