FORM 1

SPRUSON & FERGUSON

APPLICATION ACCEPTED AND AMENDMENTS ALLOWED 7-1-91

608411

COMMONWEALTH OF AUSTRALIA

PATENTS ACT 1952

APPLICATION FOR A STANDARD PATENT

Shell Internationale Research Maatschappij B.V., a Netherlands Company, of Carel van Bylandtlaan 30, 2596 HR, The Hague, THE NETHERLANDS, hereby apply for the grant of a standard patent for an invention entitled:

Process for Preparing Normally Liquid Hydrocarbonaceous Products from a Hydrocarbon Feed Containing Linear- and Branched Olefins

which is described in the accompanying complete specification.

Details of basic application(s):-

Basic Applic. No:	Country:	Application Date:
8804033	GB	22 February 1988

The address for service is:-

Spruson & Ferguson
Patent Attorneys
Level 33 St Martins Tower
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Sydney New South Wales Australia

DATED this SEVENTEENTH day of FEBRUARY 1989

Shell Internationale Research Maatschappij B.V.

By: M.J. Anderson

Registered Patent Attorney

TO: THE COMMISSIONER OF PATENTS
OUR REF: 85206
S&F CODE: 61750

5003573 20/02/89

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SPRUSON & FERGUSON

COMMONWEALTH OF AUSTRALIA
PATENTS ACT 1952

DECLARATION IN SUPPORT OF A CONVENTION APPLICATION FOR A PATENT

In support of the Convention Application made for a patent for an invention entitled:

Process for preparing normally liquid hydrocarbonaceous products from a hydrocarbon feed containing linear-and branched olefins.

I, Onno Aalbers, of Carel van Bylandtlaan 30, 2596 HR The Hague, the Netherlands, do solemnly and sincerely declare as follows:-

1. I am authorised by SHELL INTERNATIONALE RESEARCH MAATSCHAPPIJ B.V., the applicant for the patent to make this declaration on its behalf.

2. The basic application(~~s~~) as defined by Section 141 of the Act was/~~were~~ made in Great Britain
on 22nd February, 1988
by Shell Internationale Research Maatschappij B.V.

3. Pierre GRANDVALLET, a French citizen, Andras Guus Theodorus George KORTBEEK, a Netherlands citizen, Johannes Petrus VAN DEN BERG, a Netherlands citizen and Karl Heinz RÖBSCHLÄGER, a W.-German citizen, all of Badhuisweg 3, 1031 CM Amsterdam, the Netherlands

(~~respectively~~), ~~is~~/are the actual inventor(s) of the invention and the facts upon which the applicant is entitled to make the application are as follows:

The Applicant is the assignee of the actual inventor(s).

4. The basic application(~~s~~) referred to in paragraph 2 of this Declaration was/~~were~~ the first application(~~s~~) made in a Convention country in respect of the invention the subject of the application.

DECLARED at The Hague this 4th day of January 1989

Onno Aalbers

TO: THE COMMISSIONER OF PATENTS
AUSTRALIA

(12) PATENT ABRIDGMENT (11) Document No. **AU-B-30103/89**
(19) AUSTRALIAN PATENT OFFICE (10) Acceptance No. **608411**

(54) Title
PROCESS FOR PREPARING NORMALLY LIQUID HYDROCARBONACEOUS PRODUCTS FROM A HYDROCARBON FEED CONTAINING LINEAR-AND BRANCHED OLEFINS

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(56) Prior Art Documents
US 3402217
AU 12535/88 C07C 2/12

(57) Claim

1. A process for preparing normally liquid hydrocarbonaceous products from a hydrocarbon feed comprising linear- and branched olefins which comprises the following steps:

(i) selectively converting branched olefins in the feed in the presence of a catalyst into a normally liquid hydrocarbonaceous product while leaving the linear olefins substantially unconverted;

(ii) separating linear olefins from hydrocarbon mixture obtained in step (i), and

(iii) oligomerizing linear olefins obtained from step (ii) in the presence of a solid catalyst into liquid hydrocarbons.

8. Process according to any one of claims 5 to 7 wherein in a step (iv) linear paraffins obtained from at least one of the steps (ii) and (iii) are catalytically hydroisomerized in the presence of hydrogen to branched paraffins.

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14. Process according to any one of claims 5 to 9 wherein in an additional step (d) paraffins obtained from at least one of the steps (ii), (iii), and, if included, (iv) and (a) are catalytically and/or thermally dehydrogenated to olefins.

S & F Ref: 85206

FORM 10

COMMONWEALTH OF AUSTRALIA

PATENTS ACT 1952

608411

COMPLETE SPECIFICATION

(ORIGINAL)

This document contains the amendments made under Section 49 and is correct for printing

FOR OFFICE USE:

Class Int Class

Complete Specification Lodged:
Accepted:
Published:

Priority:

Related Art:

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Complete Specification for the invention entitled:

Process for Preparing Normally Liquid Hydrocarbonaceous Products from a Hydrocarbon Feed Containing Linear- and Branched Olefins

The following statement is a full description of this invention, including the best method of performing it known to me/us

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ABSTRACT

PROCESS FOR PREPARING NORMALLY LIQUID HYDROCARBONACEOUS PRODUCTS FROM A HYDROCARBON FEED CONTAINING LINEAR- AND BRANCHED OLEFINS

The invention relates to a process for preparing normally liquid hydrocarbon products, such as middle distillates and methyl-t-butylether, from a hydrocarbon feed containing linear and branched olefins (e.g. propane and butenes in light ends) comprising at least the following steps:

i) selectively converting branched olefins in the feed in the presence of a catalyst into a normally liquid hydrocarbonaceous product (e.g. MTBE);

ii) separating linear olefins from product obtained in step (i), and

iii) catalytically oligomerizing linear olefins obtained from step (ii) into liquid hydrocarbons such as middle distillates.

PROCESS FOR PREPARING NORMALLY LIQUID HYDROCARBONACEOUS PRODUCTS FROM A HYDROCARBON FEED CONTAINING LINEAR- AND BRANCHED OLEFINS

The invention relates to a process for preparing normally liquid hydrocarbonaceous products from a hydrocarbon feed containing linear- and branched olefins.

A variety of one - and multistep - processes are known for the preparation of hydrocarbonaceous products such as oxygenates, middle distillates, alkylates and gasoline from an olefinic feed containing e.g. propene and/or butenes. These known processes have a number of draw-backs, however. One-step processes do not provide the flexibility to prepare a number of different products starting from a multi-component feed, whereas multi-step processes in many cases require splitting-up of such a feed in order to convert each component under optimal conditions.

In particular with the oligomerization of olefinic feed mixtures in the presence of solid catalysts it has been observed that the quality of the liquid hydrocarbon products (e.g. the cetane number of the gas oil fraction) is lower than when an olefinic feed substantially comprising linear olefins is processed.

Surprisingly, it has now been found that by first selectively converting branched olefins present in a feed mixture, followed by product separation and oligomerization of the linear olefins, excellent liquid hydrocarbon oligomerization products can be obtained in addition to valuable conversion products from the branched olefins.

The invention therefore relates to a process for preparing normally liquid hydrocarbonaceous products from a hydrocarbon feed comprising linear- and branched olefins which comprises the following steps:

(i) selectively converting branched olefins in the feed in the presence of a catalyst into a normally liquid hydrocarbonaceous product while leaving the linear olefins substantially unconverted;

(ii) separating linear olefins from hydrocarbon mixture obtained in step (i), and

(iii) oligomerizing linear olefins obtained from step (ii) in the presence of a solid catalyst into liquid hydrocarbons.

Monoolefins are preferably used as feed (components). The olefins preferably have at most six carbon atoms per molecule (C_6^- olefins); preferably, the olefins employed as feed for at least one of the steps (i) and (iii) contain compounds having 3 and 4 carbon atoms i.e. propene and in addition 1-butene and/or 2-butene as linear olefin, and 2-methyl propene as branched olefin.

In addition, the hydrocarbon feed to step (i) suitably comprises (cyclic) paraffins, in particular from 10 to 70% by weight.

Furthermore, the hydrocarbon feed may contain di-olefins and mono-olefins having more than six carbon atoms per molecule and/or aromatic compounds.

The hydrocarbon feed is suitably obtained as by-product from (fluid) catalytic cracking processes, thermal cracking processes (e.g. for the preparation of ethene), coking- and/or pyrolysis processes.

Suitable feeds for the present process can also be prepared starting from synthesis gas which is first converted into methanol and subsequently into a product substantially consisting of C_6^- olefins. Alternatively, the synthesis gas can be converted in the presence of a

Fischer-Tropsch type of catalyst into a product which in addition to paraffinic hydrocarbons contains a considerable amount of C_6^- olefins.

In a preferred embodiment of the process according to the invention in step (i) the branched feed olefin 2-methyl propene is converted with methanol (which may have been prepared starting from synthesis gas as described hereinbefore) in the presence of an acid-type catalyst into 2-methoxy-, 2-methyl propane (commonly described as methyl-t-butylether i.e. MTBE). It appears that by means of such an etherification process branched olefins are selectively removed from a hydrocarbon feed mixture which also contains linear olefins and, optionally, paraffins. Even when a complete light ends fraction containing olefins and paraffins having 3-6 carbon atoms per molecule is employed as feed for MTBE preparation in step (i) of the present process, the resulting product stream is well suited for the next steps of the process due to the selective removal of branched olefins from said stream.

The conversion of branched olefins in step (i) is suitably performed in the presence of a catalyst having acid properties such as an inorganic acid (e.g. phosphoric acid or sulphuric acid) on a refractory oxide carrier (e.g. silica and/or alumina), a crystalline (alumina) silicate in the hydrogen form or a strongly acidic microporous organic ion exchange resin. Suitable temperatures for carrying out the conversion in step (i) are from 0 to 200 °C, and in particular from 10 to 100 °C. Suitable pressures are from 1 to 100 bar, in particular from 1-20 bar. The space velocity in the conversion zone(s) employed in step (i) is suitably from 0.1 to 10 kg hydrocarbon feed/kg catalyst.hour, and in particular from 0.2 to 5 kg feed/kg catalyst.hour.

For the preparation of MTBE, methanol and 2-methyl propene are suitably reacted in step (i) in a molar ratio of 1.5:1 to 5:1, and preferably from 2:1 to 4:1.

In an alternative embodiment of the process according to the invention, branched olefins are removed in step (i) by means of polymerization in the presence of an acid-type catalyst which may be similar to those described hereinbefore for the preparation of MTBE under similar reaction conditions without addition of methanol to the conversion zone of step (i).

Whereas MTBE is a well known octane booster for motor gasoline, the gasoline fraction of a polymerization product alternatively, or even simultaneously, prepared in step (i) of the present process has itself a high octane rating and can be a useful blending component for the gasoline pool in a refinery.

Furthermore, it is envisaged to prepare 2-hydroxy, 2-methyl propane (t-butyl alcohol) in step (i) of the present process, again employing an acid-type catalyst (preferably immobilized on a carrier) in the presence of water.

Provided that paraffinic hydrocarbons are present in the feed to step (i), it is preferred to separate at least part of the paraffins in step (ii) from the linear olefins and from the conversion product(s) of branched olefins obtained from step (i) e.g. by means of distillation or molecular sieves, in order to avoid the presence of large quantities of paraffins in the feed stream to the oligomerization step (iii) of the present process. Moreover, the paraffins thus obtained can be suitably used as feed for additional process steps which will be discussed hereinafter.

The solid catalyst employed in step (iii) of the process according to the invention preferably comprises at least one metal (Z) selected from the group consisting of metals from Groups 1b, 2a, 2b, 3a, 4b, 5b, 6b and 8 of the Periodic Table of the Elements and a crystalline trivalent metal (Q) silicate.

Reference is made to the Periodic Table of the Elements as published in the "Handbook of Chemistry and Physics", 55th addition (1975), CRC Press, Ohio, USA.

Preferably, at least part of the amount, and most preferably the total amount, of metal(s) Z has(have) been incorporated into the catalyst by means of ion exchange. Preferably, the catalyst applied in step (iii) of the process according to the invention is prepared by using a mordenite-type of carrier material, which comprises exchangeable cations such as alkali metal-, hydrogen- and/or preferably ammonium ions. The carrier material is suitably treated one or more times with a solution of at least one metal salt such as an aqueous solution of a metal nitrate or -acetate. The ion exchange treatment is suitably carried out at a temperature from 0 °C up to the boiling temperature of the solution, and preferably at a temperature from 20-100 °C.

The valency n of the metals Z can vary from +1 to +6. Preferably, however, at least one of the metals Z in the second stage catalyst is bivalent or trivalent, in which case the molar ratio Z:Q is preferably greater than 0.5. Z is preferably selected from the group consisting of the bivalent metals copper, zinc, cadmium, magnesium, calcium, strontium, barium, titanium, vanadium, chromium, manganese, iron, cobalt and nickel. A particularly preferred metal Z is nickel.

The trivalent metal Q which is present in the crystal structure of the mordenite-type of metal silicate catalyst carrier used at least in step (iii) preferably comprises at least one metal selected from the group consisting of aluminium, iron, gallium, rhodium, chromium and scandium. Most preferably Q consists substantially of aluminium; the resulting crystalline aluminium silicate preferably comprises a major part of mordenite and most preferably consists substantially completely of mordenite.

The molar ratio silicon:Q in the catalyst is suitably in the range from 5:1 to 100:1 and preferably in the range from 7:1 to 30:1. This ratio is in most cases substantially identical to the molar ratio Si:Q in the crystalline metal silicate employed as carrier material, except when some of the metal Q has been removed from the crystal structure during the catalyst preparation e.g. by means of acid leaching.

If desired (e.g. in order to increase the crushing strength of the catalyst particles), the carrier material and/or the ready catalyst for either one of the steps of the present process can be combined with a binder material such as (a combination of) refractory oxide(s), clay and/or carbon. Suitable refractory oxides comprise alumina, silica, magnesia, zirconia, titania and combinations thereof.

The molar ratio Z:Q in the ready catalyst is preferably from 0.6-1.5 and most preferably from 0.2-1.2. A molar ratio Z:Q of 0.5 or less for bivalent metals Z results in a catalyst which is in some cases less stable than a catalyst for which said ratio is greater than 0.5. A very high molar ratio Z:Q of e.g. more than 2 could lead to difficulties in the catalyst preparation and result in a relatively inactive catalyst with a relatively low surface are a and pore volume due to the very high degree of loading with metal(s) Z.

In an alternative preferred embodiment of the process according to the invention the metal Z is identical with the metal Q and is incorporated in the crystal structure of the silicate; most preferably gallium is the metal Q in the case where no additional metal Z is present in the catalyst because it appears that the selectivity such a catalyst shows for the preparation of lubricating base oils is surprisingly high.

After loading of the carrier material with the metal(s) Z, the catalytically active composition thus obtained is preferably dried and calcined before being employed as catalyst in the process according to the present invention. Drying is suitably carried out at a temperature from 100-400 °C, and preferably from 110-300 °C, for a period of 1-24 hours; the calcination temperature is suitably from 400-800 °C and preferably from 450-650 °C. The calcination treatment is suitably carried out at (sub-)atmospheric or elevated pressure for a period of 0.1-24 hours, and preferably of 0.5-5 hours in air or in an inert (e.g. nitrogen) atmosphere.

The process according to the invention can be carried out in one or more fixed-, moving- and/or fluidized beds or in a slurry-type of reactor; preferably, the process is carried out in a fixed bed of catalyst particles such as extrudates, pellets or spheres passing sieve openings having a width from 0.05-5 mm, and preferably from 0.1-1 mm.

Step (iii) of the present process is suitably operated at a temperature which is at least 100 °C above the operating temperature in step (i), in particular when the latter temperature is from 10-100 °C as discussed hereinbefore.

Step (iii) is preferably carried out at a temperature from 150-330 °C, a pressure from 1-100 bar and a space velocity from 0.1-10 kg olefins feed/kg catalyst.hour. Most preferably, step (iii) is carried out at a temperature from 180-300 °C, a pressure from 10-50 bar and a space velocity from 0.2-5 kg olefin feed/kg catalyst.hour.

Various preferred embodiments of the process according to the invention will be discussed with the use of Figures 1 and 2, which are flow schemes in which similar process steps and streams have been indicated with the same reference numerals.

Common to both Figures 1 and 2 are essential process steps (i), (ii) and (iii), which are schematically represented by units (1), (2) and (3), respectively.

In Figure 1 a feed stream (10), containing at least a quantity of linear- and branched olefins, in particular linear butene(s) and 2-methylpropene, and in addition paraffins, and methanol stream (11) are converted in MTBE unit (1) into MTBE. Product stream 12 contains, in addition to MTBE, substantially unconverted paraffins and linear olefins.

From separation unit (2) (e.g. one or more distillation columns) MTBE is obtained through line (13), in some cases together with unconverted methanol and methoxy methane as byproduct. Stream (14) containing linear olefins (such as 1-butene, 2-butene, optionally propene) and linear and branched paraffins (such as n-butane and 2-methyl butane, and optionally propane) is directed to oligomerization unit (3).

In case a C_3/C_4 feed for the process according to the invention is available as separate C_3- and C_4-fractions, it is preferred to introduce the C_4-fraction (which may also contain small amounts of C_3) through line (10) and the C_3-fraction through line (15) in order to keep the dimensions of unit (1) as small as possible and avoid undesired side reactions with the C_3-fraction.

Optionally, paraffins are obtained as a separate stream (16) from unit (2) which is directed to hydroisomerization unit (4) (step (iv) of the present process) wherein linear paraffins (e.g. n-butane) are catalytically hydroisomerized in the presence of hydrogen (supplied through line (17)). It is furthermore possible to employ in unit (4) a paraffin stream (18) (e.g. containing propane and/or n-butane) obtained from unit (3). The hydroisomerization step (iv) is suitably carried out in the presence of a catalyst comprising at least one hydrogenating metal and a moderately acidic carrier; a preferred catalyst comprises a Group 8 metal (in particular platinum and/or palladium) on a microporous crystalline silicate (in particular mordenite with a surface area from 100 to 800 m^2/g).

Suitable hydroisomerization conditions include a temperature from 100 to 400 °C, a pressure from 1-100 bar and a space velocity from 0.1 to 10 kg hydrocarbon feed/kg catalyst.hour. Preferred conditions are a temperature from 150 to 300 °C, a pressure from 10 to 40 bar and a space velocity from 0.5 to 5 kg feed/kg catalyst.hour.

In a preferred embodiment of the process according to the invention, in unit (8) at least one of the paraffin containing streams (19) (containing 2-methyl propane obtained from step (iv)), (20) (obtained from step (iii)) and (21) (Fig. 2) (obtained from step (ii) and which may be fed directly to unit (8)) are converted in the presence of olefins having at least 3 carbon atoms per molecule (C_3^+) (supplied separately through line (22) if not already present in streams (19), (20) and (21). The C_3^+ olefins-containing stream

(22) is suitably obtained from the same source as stream (15); alternatively, C_3^+ olefins obtained from the Shell Middle Distillate Synthesis (SMDS) process or from catalytic conversions of oxygenated hydrocarbons (such as methanol) can be used as feed for unit (8).

Said conversion (step (a)) is carried out in the presence of an acid-type catalyst, resulting in alkylated (i.e branched) hydrocarbons (stream 29) having at least 7 carbon atoms per molecule which are excellent for use as motor gasoline (component). The alkylation catalyst is suitably hydrofluoric acid or sulphuric acid.

Suitable alkylation conditions are a temperature from 0 °C to 65 °C, a pressure from 2 to 15 bar and a space velocity from 0.05 to 1 vol. hydrocarbon feed/vol. acid catalyst.hour. Preferred conditions are a temperature from 5 °C to 40 °C, a pressure from 5 to 10 bar and a space velocity from 0.1 to 0.6 vol feed/vol.acid catalyst.hour.

According to a further preferred embodiment of the present process paraffins obtained from at least one of the steps (ii), (iii) and (a) (i.e. obtained from units (2), (3) and (8), respectively) are converted in step (b) into aromatic-rich gasoline (stream 28) in the presence of a catalyst containing at least one of the metals zinc, gallium and thorium, and a crystalline silicate. Step (b) is carried out in unit (5) as schematically depicted in Figures 1 and 2 which unit is supplied through lines (23), (24) and/or (25) with paraffins comprising at least propane, n-butane and/or 2-methyl propane.

A preferred catalyst for step (b) comprises a crystalline gallium silicate (in particular with a MFI-type of structure) which may optionally be combined with zinc; suitable temperatures for carrying out step

(b) with such a catalyst are from 400 to 600 °C, in particular from 500 to 600 °C. Suitable reaction conditions for step (b) using a catalyst without gallium in the crystal structure are a temperature from 200-600 °C, a pressure from 1-100 bar and a space velocity from 0.1-10 kg paraffin feed/kg catalyst.hour.

Said crystalline gallium silicate catalyst can also advantageously be applied in essential step (iii) of the process according to the invention to produce middle distillates (i.e. kerosine and gas oil) and/or lubricating base oil fractions (stream 27) with excellent properties and having a high added value compared with a gasoline fraction which can also be prepared in unit (3); a gasoline stream is suitably recycled via line (26) (see Figure 2) in order to maximize the production of higher-boiling fractions.

When a crystalline gallium silicate is used in unit (3), a moderate reaction temperature from 180-240 °C is preferably maintained in order to minimize aromatics formation and enhance the production of lubricating base oil fractions.

Hydrogen obtained as by-product from unit (5) during the preparation of aromatic-rich gasoline can be suitably employed for a selective pre-hydrogenation of dienes (not shown in the Figures) which may be present in feed stream (10) or, as shown in Fig. 2, for hydrofinishing oligomerized product stream (27) in hydrogenation unit (9) (from which hydrofinished products are obtained via line (40)).

In yet another preferred embodiment of the process according to the invention unconverted paraffins such as propane, n-butane and/or 2-methyl propane are catalytically and/or thermally dehydrogenated in unit (6). The paraffins can be obtained either directly from separation unit (2) via lines (30) and (31) (Fig. 2), from aromatic gasoline unit (8) through line (32), and/or from oligomerization unit (3) directly via line (33) (Fig. 1).

The olefins obtained from unit (6) through line (34) are suitably recycled (not depicted in the Figures) to unit (1) and/or unit (3).

The hydrogen produced in unit (6) is suitably directed via line (17) to hydroisomerization unit (4) or via line (35) to hydrogenation unit (9).

Thermal dehydrogenation is suitably carried out at a temperature from 1000 to 1600 °C, and preferably from 1100-1400 °C. Catalytic dehydrogenation is suitably carried out at a temperature from 300 to 1000 °C, and preferably from 400 to 700 °C in the presence of a catalyst comprising a metal or metal compound(s) (e.g. Cr_2O_3/ZnO) having dehydrogenation capability on a refractory carrier material such as nickel on silica, alumina or a combination thereof as carrier.

Dehydrogenation in unit (6) is suitably carried out at a pressure from 0.1 to 10 bar, and preferably from 0.2 to 5 bar. The space velocity in unit (6) is suitably from 0.1 to 10 kg paraffin feed/kg catalyst.hour and preferably from 0.2 to 5 kg paraffins feed/kg catalyst.hour.

Paraffins obtained from at least one of the steps (ii), (iii), (iv) and (a) (carried out in units (2), (3), (4) and (8)) are dehydrogenated in unit (7) in the presence of steam supplied through line (36) in an alternative preferred embodiment of the process according to the invention. Paraffins such as propane, n-butane and/or 2-methyl propane are supplied via line (37) or (38) to unit (7) and products are removed via line (39).

Steam cracking conditions in unit (7) are suitably a temperature from 600 to 1400 °C, a pressure from 1 to

10 bar, a residence time from 0.5 to 1.5 s, and a steam/paraffin weight ratio of 0.1 to 1.0.

Preferred stream cracking conditions are a temperature from 700 to 900 °C, a pressure from 1.5 to 5 bar, a residence time from 0.1 to 1 s and a steam paraffin weight ratio of 0.2 to 0.7.

Olefins obtained from unit (7) through line (39) are suitably recycled (after separation from steam; not depicted in the Figures) to unit (1) and/or unit (3), or used as feedstock for manufacturing chemicals.

The invention furthermore relates to normally liquid hydrocarbons and oxygenates prepared by a process as described hereinbefore. Such normally liquid hydrocarbons include products boiling in the gasoline range (40-150 °C), the middle distillate range (kerosene- and gas oil fractions boiling from 150-370 °C) and in the lubricating base oil range (boiling above 370 °C); the oxygenates include ethers, in particular MTBE (methyl-t.butylether) and alcohols, in particular 2-hydroxy, 2-methyl propane.

The claims defining the invention are as follows:

1. A process for preparing normally liquid hydrocarbonaceous products from a hydrocarbon feed comprising linear- and branched olefins which comprises the following steps:

(i) selectively converting branched olefins in the feed in the presence of a catalyst into a normally liquid hydrocarbonaceous product while leaving the linear olefins substantially unconverted;

(ii) separating linear olefins from hydrocarbon mixture obtained in step (i), and

(iii) oligomerizing linear olefins obtained from step (ii) in the presence of a solid catalyst into liquid hydrocarbons.

2. Process according to claim 1 wherein the olefins employed as feed for at least one of the steps (i) and (iii) contain compounds having 3 and 4 carbon atoms.

3. Process according to claim 1 or 2 wherein in step (i) the branched feed olefin 2-methyl propene is converted with methanol in the presence of an acid-type catalyst into 2-methoxy, 2-methyl propane.

4. Process according to any one of the preceding claims wherein the solid catalyst employed in step (iii) comprises at least one metal (Z) selected from the group consisting of metals from Groups 1b, 2a, 2b, 3a, 4b, 5b, 6b and 8, and a crystalline trivalent metal (Q) silicate.

5. Process according to any one of the preceding claims wherein the hydrocarbon feed to step (i) further comprises paraffins.

6. Process according to claim 5 wherein the paraffins are contained in an amount of from 10 to 70% by weight.

7. Process according to claim 5 or 6 wherein, in step (ii), paraffins are separated from the hydrocarbon mixture obtained from step (i).

8. Process according to any one of claims 5 to 7 wherein in a step (iv) linear paraffins obtained from at least one of the steps (ii) and (iii) are catalytically hydroisomerized in the presence of hydrogen to branched paraffins.

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9. Process according to any one of claims 5 to 8 wherein, in an additional step (a), paraffins obtained from at least one of the steps (ii), (iii) and, if included, (iv) are converted in the presence of olefins having at least 3 carbon atoms per molecule and an acid-type catalyst into alkylated hydrocarbons.

10. Process according to any one of claims 5 to 9 wherein in an additional step (b) paraffins obtained from at least one of the steps (ii), (iii) and, if included, (a) are converted into aromatic gasoline in the presence of a catalyst containing at least one of the metals zinc, gallium and thorium, and a crystalline silicate.

11. Process according to claim 10 wherein a catalyst comprising a crystalline gallium silicate is employed.

12. Process according to claim 11 wherein the catalyst is employed at a temperature from 400 to 600°C.

13. Process according to any one of claims 5 to 9 wherein in an additional step (c) paraffins obtained from at least one of the steps (ii), (iii), and, if included, (iv) and (a) are dehydrogenated in the presence of steam under steam cracking conditions.

14. Process according to any one of claims 5 to 9 wherein in an additional step (d) paraffins obtained from at least one of the steps (ii), (iii), and, if included, (iv) and (a) are catalytically and/or thermally dehydrogenated to olefins.

15. Process substantially as described hereinbefore with reference to Figures 1 or 2.

16. Normally liquid hydrocarbonaceous products whenever prepared by a process according to any one of the preceding claims.

DATED this NINETEENTH day of DECEMBER 1990

Shell Internationale Maatschappij B.V.

Patent Attorneys for the Applicant
SPRUSON & FERGUSON

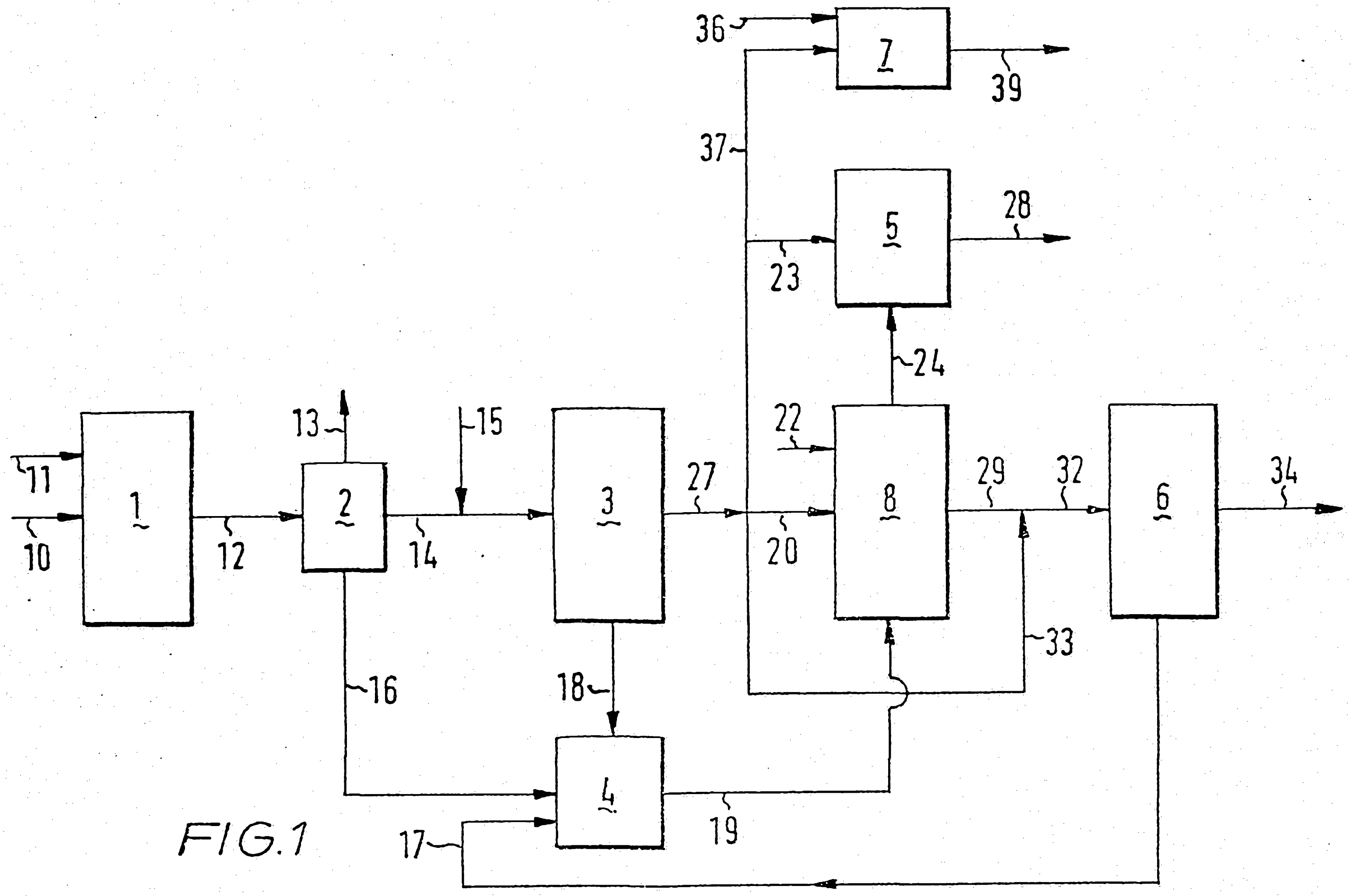

FIG.1

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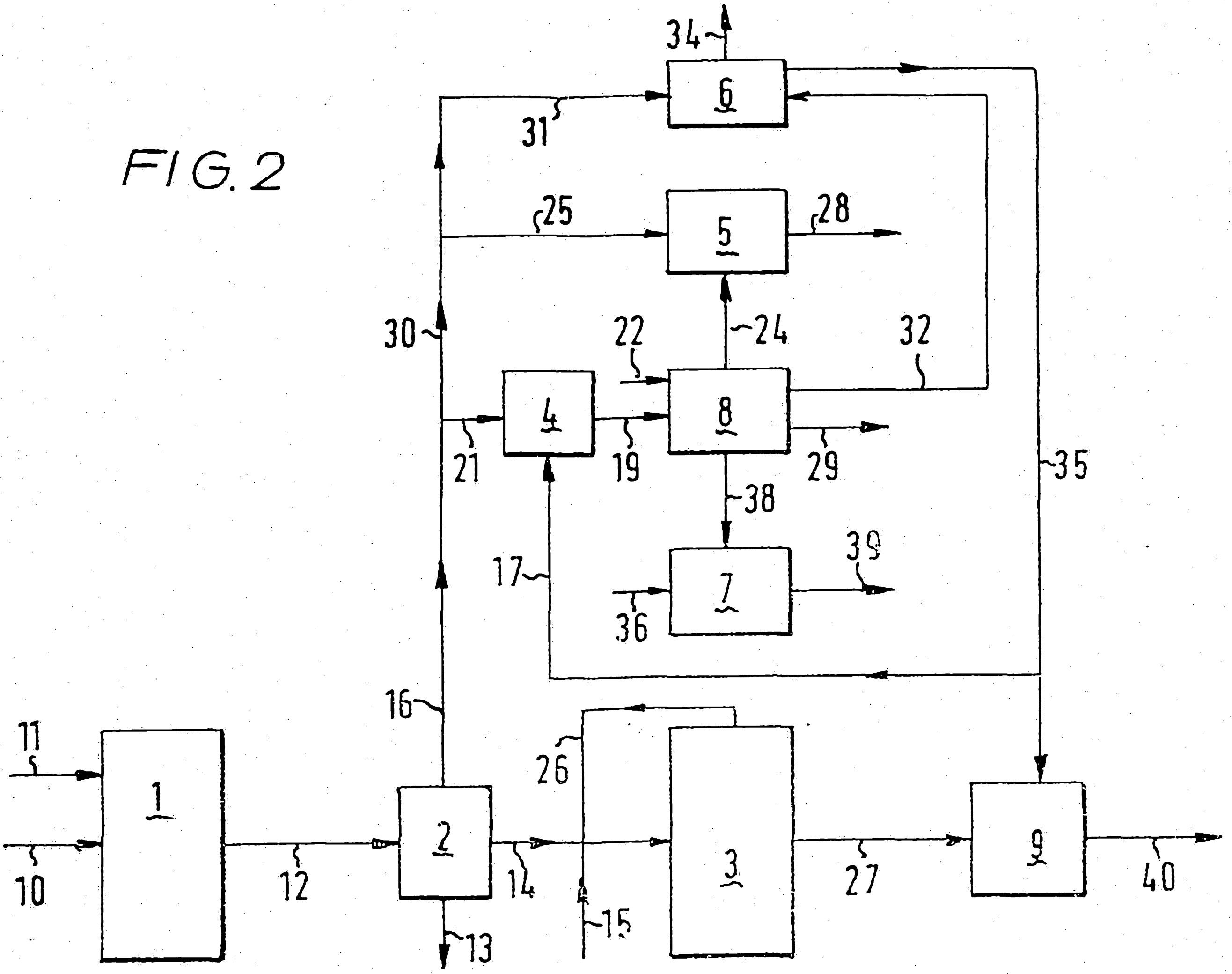
FIG. 2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