



(51) International Patent Classification:

C10G 45/58 (2006.01) *C10G 65/12* (2006.01)
C10G 45/62 (2006.01) *C10G 65/16* (2006.01)
C10G 45/64 (2006.01) *C10G 73/02* (2006.01)
C10G 47/00 (2006.01) *C10M 101/00* (2006.01)
C10G 47/18 (2006.01)

(21) International Application Number:

PCT/EP2014/065052

(22) International Filing Date:

15 July 2014 (15.07.2014)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

13176468.0 15 July 2013 (15.07.2013) EP

(71) Applicant (for all designated States except US): **SHELL INTERNATIONAL RESEARCH MAATSCHAPPIJ B.V.** [NL/NL]; Carel van Bylandtlaan 30, NL-2596 HR The Hague (NL).

(71) Applicant (for US only): **SHELL OIL COMPANY** [US/US]; PO Box 2463, One Shell Plaza, Houston, Texas 77252-2463 (US).

(72) Inventor: **WEDLOCK, David John**; Pool Lane, Ince, Chester Cheshire CH2 4NU (GB).

(74) Agent: **MATTHEZING, Robert Maarten**; PO Box 384, NL-2501 CJ The Hague (NL).

(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Declarations under Rule 4.17:

— as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))

Published:

— with international search report (Art. 21(3))

(54) Title: PROCESS TO PREPARE TWO OR MORE BASE OILS

(57) Abstract: The present invention provides a process to prepare two or more base oils, which process at least comprises the following steps: (a) providing a paraffinic hydrocarbon feedstock stream; (b) subjecting a paraffinic hydrocarbon feedstock stream provided in step (a) to a hydrocracking/ hydroisomerization step to obtain an at least partially isomerised product stream; (c) separating the product stream of step (b), thereby obtaining a lower boiling fraction and a higher boiling fraction; (d) dewaxing the lower boiling fraction of step (c) to obtain a light base oil; and (e) dewaxing the higher boiling fraction of step (c) to obtain a heavy base oil.



PROCESS TO PREPARE TWO OR MORE BASE OILS

The present invention relates to a process to prepare two or more base oils.

It is known to prepare two or more base oils by catalytically dewaxing of a paraffinic base oil precursor component of a broad range of carbon numbers in one and in the same device. For example in WO 02/070631 a process to prepare two or more base oil grades from a waxy paraffinic Fischer-Tropsch product is described. In WO 02/070631 first a Fischer-Tropsch derived distillate base oil precursor fraction, having a viscosity corresponding to the desired base oil product, is prepared. This distillate base oil precursor is subsequently subjected to a catalytic dewaxing step, followed by a final vacuum distillation, to obtain one of the desired base oils.

A problem of the process disclosed in WO 02/070631 is that base oils precursors need to be stored in tanks for each desired base oil and all the process steps need to be repeated. Furthermore, the base oil prepared by the process as disclosed in WO 02/070631 may have large cloud point/ pour point differentials.

It is an object of the invention to provide a more efficient method for preparing two or more base oils having different viscosities.

It is a further object of the present invention to provide an alternative method for preparing two or more base oils having different viscosities.

One of the above or other objects may be achieved according to the present invention by providing a process to prepare two or more base oils, the process at least comprising the following steps:

(a) providing a paraffinic hydrocarbon feedstock stream;

(b) subjecting a paraffinic hydrocarbon feedstock stream provided in step (a) to a

hydrocracking/hydroisomerization step to obtain an at least partially isomerised product stream;

5 (c) separating the product stream of step (b), thereby obtaining a lower boiling fraction and a higher boiling fraction;

(d) dewaxing the lower boiling fraction of step (c) to obtain a light base oil; and

10 (e) dewaxing the higher boiling fraction of step (c) to obtain a heavy base oil.

It has now surprisingly been found according to the present invention that two or more base oils having different viscosities can be simultaneously prepared on a continuous basis in a surprisingly simple and elegant manner.

An important advantage of the present invention is that two or more base oils are obtained having low cloud point/pour point differentials.

20 Preparation of two or more base oils by catalytically dewaxing of a paraffinic base oil precursor component with carbon numbers covering several viscosities in one and the same device may result in base oils having high cloud point/pour point differentials. These high cloud point/pour point differentials demonstrate poor isomerisation of the heavier waxes in the obtained base oils.

25 Base oils with different viscosities according to the present invention can thus be prepared in a efficient manner having low cloud point/pour point differentials.

30 A further advantage of the present invention is that by separately but simultaneously catalytic dewaxing the lower and higher boiling fractions to obtain the light

and heavy base oils, no intermediate tankage is necessary to separately store the lower and higher boiling fractions prior to individually catalytic dewaxing of these fractions.

5 In step (a) of the process according to the present invention a paraffinic hydrocarbon feedstock stream is provided.

 Suitably, the paraffinic hydrocarbon feedstock stream is a hydrowax feedstock, a Fischer-Tropsch product or mixtures thereof. Preferably, the paraffinic
10 hydrocarbon feedstock stream is a Fischer-Tropsch product.

 Various processes to provide a hydrowax are known in the art. By the term "hydrowax" is meant a mineral
15 feedstock product, which product is derived from crude oil. Suitably, the hydrowax is derived from waxy crude oils, by a process comprising contacting hydrocarbonaceous feedstock derived from a waxy crude oil with a hydroisomerisation catalyst under hydroisomerising
20 conditions and is the ~370°C + bottoms fraction of a fuels hydrocracker optimised for automotive gas oil. This process is for example described in EP-A-0400742.

 Suitably, the density of the hydrowax at 70°C according to ASTM D-4052 is between 800 and 850 kg/m³,
25 preferably between 810 and 820 kg/m³, more preferably between 819 and 820 kg/m³.

 The hydrowax has preferably an initial boiling point of between 200 to 430°C, more preferably between 228 to 421°C and most preferably between 322 to 421°C and a
30 final boiling point of between 400 to 540°C, preferably between 420 to 485°C, more preferably between 425 to 483°C and most preferably between 458 to 483°C.

The Fischer-Tropsch product is known in the art. By the term "Fischer-Tropsch product" is meant a synthesis product of a Fischer-Tropsch process. In a Fischer-Tropsch process synthesis gas is converted to a synthesis product. Synthesis gas or syngas is a mixture of hydrogen and carbon monoxide that is obtained by conversion of a hydrocarbonaceous feedstock. Suitable feedstock include natural gas, crude oil, heavy oil fractions, coal, biomass and lignite. A Fischer-Tropsch product may also be referred to a GTL (Gas-to-Liquids) product.

The preparation of a Fischer-Tropsch product has been described in e.g. WO2003/070857.

The Fischer-Tropsch product of the Fischer-Tropsch process is usually separated into a water stream, a gaseous stream comprising unconverted synthesis gas, carbon dioxide, inert gases and C1 to C2, and a C3+ product stream by distillation. Commercially available equipment can be used. The distillation may be carried out at atmospheric pressure, but also reduced pressure may be used. By Fischer-Tropsch product in the present invention is meant the C3+ product stream.

In step (b) a paraffinic hydrocarbon feedstock stream provided in step(a) is subjected to a hydrocracking/hydroisomerization step to obtain an at least partially isomerised product stream.

It has been found that the amount of the isomerised product is dependent on the hydrocracking/hydroisomerization conditions. Hydrocracking/hydroisomerization processes are known in the art and therefore not discussed here in detail.

Hydrocracking/hydroisomerization and the effect of hydrocracking/hydroisomerization conditions on the amount of isomerised product are for example described in

Chapter 6 of "Hydrocracking Science and Technology", Julius Scherzer; A. J. Cruia, Marcel Dekker, Inc, New York, 1996, ISBN 0-8247-9760-4.

5 The preparation of an at least partially Fischer-Tropsch derived isomerised feedstock in step (b) has been described in e.g. WO 2009/080681. The preparation of an at least partially mineral derived isomerised feedstock in step (b) has been described in e.g. EP-A-0400742.

10 In step (c) the product stream of step (b) is separated to obtain a lower boiling fraction and a higher boiling fraction.

15 Preferably, the lower boiling fraction of step (c) boils in a temperature range of from 350 to 500°C and the higher boiling fraction of step (c) boils in a temperature range of from 425 to 600°C.

By boiling points at atmospheric conditions is meant atmospheric boiling points, which boiling points can be determined using methods such as ASTM D2887 or ASTM D7169.

20 The separation is preferably performed by means of a high vacuum distillation.

The lower boiling fraction of step (c) preferably comprises a C₂₀ to C₃₀ fraction, more preferably comprising a C₂₀ to C₂₃ fraction.

25 The higher boiling fraction of step (c) preferably comprises a C₃₀ to C₄₀ fraction, more preferably comprising a C₂₃ to C₄₀ fraction.

In step (d) the lower boiling fraction of step (c) is dewaxed to obtain a light base oil.

30 In a further aspect the present invention provides a light base oil obtainable by the process according to the present invention.

The light base oil may be characterized by one or more of the features described herein below, with no additional limiting technical meaning being attributed to the label "light".

Typically dewaxing processes are catalytic dewaxing and solvent dewaxing. Catalytic and solvent dewaxing processes are known in the art and therefore not described here in detail. Typical catalytic and solvent dewaxing processes are for example described in Chapter 7 and 8 of "Lubricant base oil and wax processing", Avilino Sequeira, Jr., Marcel Dekker, Inc, New York, 1994, ISBN 0-8247-9256-4.

Dewaxing of the low boiling fraction in step (d) is preferably performed by means of a catalytic dewaxing process.

Typical catalytic dewaxing processes are for example described in WO 2009/080681 and WO2012055755.

Suitably, catalytic dewaxing is performed in the presence of a catalyst comprising a molecular sieve and a group VIII metal.

Suitable dewaxing catalyst are heterogeneous catalysts comprising molecular sieve, more suitably intermediate pore size zeolites and optionally in combination a metal having a hydrogenation function, such as the Group VIII metals. Preferably, the intermediate pore size zeolites have a pore diameter of between 0.35 and 0.8 nm.

Preferably, catalytic dewaxing is performed in the presence of a catalyst comprising a molecular sieve and a group VIII metal, wherein the molecular sieve is selected from a group consisting of a MTW, MTT, TON type molecular sieve, ZSM-12, ZSM-48 and EU-2.

In the present invention, the reference to ZSM-48 and EU-2 is used to indicate that all zeolites can be used that belong to the ZSM-48 family of disordered structures also referred to as the *MRE family and described in the Catalog of Disorder in Zeolite Frameworks published in 2000 on behalf of the Structure Commission of the International Zeolite Association. Even if EU-2 would be considered to be different from ZSM-48, both ZSM-48 and EU-2 can be used in the present invention. Zeolites ZBM-30 and EU-11 resemble ZSM-48 closely and also are considered to be members of the zeolites whose structure belongs to the ZSM-48 family. In the present application, any reference to ZSM-48 zeolite also is a reference to ZBM-30 and EU-11 zeolite.

Besides ZSM-48 and/or EU-2 zeolite, further zeolites can be present in the catalyst composition especially if it is desired to modify its catalytic properties. It has been found that it can be advantageous to have present zeolite ZSM-12 which zeolite has been defined in the Database of Zeolite Structures published in 2007/2008 on behalf of the Structure Commission of the International Zeolite Association.

Suitable Group VIII metals are nickel, cobalt, platinum and palladium. Preferably, a Group VIII metal is platinum or palladium.

The dewaxing catalyst suitably also comprises a binder. The binder can be non-acidic. Examples of suitable binders are clay, silica, titania, zirconia, alumina, mixtures and combinations of the above and other binders known to one skilled in the art.

Preferably the catalyst comprises a silica or a titania binder.

The catalytically dewaxed light base oil in step (d) preferably has a cloud point according to ASTM D-2500 of below -15°C, more preferably below -20°C, more preferably below -28°C, more preferably below -32°C and most preferably below -40°C.

The kinematic viscosity of the catalytically dewaxed light base oil in step (d) at 100°C according to ASTM D-445 is preferably from 2.5 to 6.0 mm²/s, more preferably from 3.0 to 5.0 mm²/s, more preferably from 3.5 to 4.5 mm²/s, and most preferably from 3.8 to 4.2 mm²/s.

The pour point of the light base oil according to ASTM D5950 is preferably of below 0°C, more preferably below -5°C, more preferably below -15°C, more preferably below -20°C, and most preferably below -25°C and preferably for at most above -48°.

In step (e) the higher boiling fraction of step (c) is dewaxed to obtain a heavy base oil.

Preferred dewaxing conditions step are described above.

Preferably, catalytic dewaxing of the lower boiling fraction of step (c) to obtain a light base oil and catalytic dewaxing of the higher boiling fraction of step (c) occurs simultaneously but separately. Thus, suitably, step (d) and (e) of the present invention occurs simultaneously.

In another aspect the present invention provides a heavy base oil obtainable by the process according to the present invention. The heavy base oil may be characterised by one or more of the features described herein below, with no additional limiting technical meaning being attributed to the label "heavy".

The catalytically dewaxed heavy base oil in step (e) preferably has a cloud point according to ASTM D-2500 of

below -10°C, preferably below -15°C, more preferably below -18°C and most preferably below -20°C.

The kinematic viscosity of the catalytically dewaxed heavy base oil in step (e) at 100°C according to ASTM D-445 is preferably from 5.0 to 12.0 mm²/s, more preferably from 6.0 to 10.0 mm²/s, more preferably from 7.0 to 9.0 mm²/s, and most preferably from 7.5 to 8.5 mm²/s.

The pour point of the catalytically dewaxed heavy base oil according to ASTM D5950 is preferably of below -5°C, more preferably below -10°C, more preferably below -15°C, more preferably below -20°C, and most preferably below -25°C and preferably for at most above -48°.

Suitably, the light and heavy base oils according to the present invention are Group II mineral base oils, Group III mineral base oils, and Group III Fischer-Tropsch derived base oils according to the definitions of American Petroleum Institute (API) for category II and III. These API categories are defined in API Publication 1509, 15th Edition, Appendix E, April 2002.

In another aspect the process according to the present invention comprises a further step (f) wherein the light base oil of step (d) and the heavy base oil of step (e) are each separated by vacuum distillation to remove light ends and obtain a first light base oil and a first heavy base oil and light ends. Typically light ends are compounds such as methane, ethane and propane, which light ends in this present invention are obtained from cracking in the catalytic dewaxing steps (d) and (e).

The difference between the cloud point and the pour point of the catalytically dewaxed light base oil of step (d) and of the heavy base oil of step (e) is less than 6°C, preferably less than 3°C, and more preferably less than 2°C.

Figure 1 schematically shows a process scheme of the process scheme of a preferred embodiment of the process according to the present invention.

For the purpose of this description, a single
5 reference number will be assigned to a line as well as a stream carried in that line.

The process scheme is generally referred to with reference numeral 1.

In a paraffin hydrocarbon process reactor 2a a
10 paraffin product stream 10a is obtained. This product is fed to a hydrocracking/hydroisomerization reactor 3a wherein the paraffinic product stream 10a is converted to an at least partially isomerised product stream 20a. This isomerised product stream 20a is distilled in a
15 distillation column 4a to recover a lower boiling fraction 30a and a higher boiling fraction 30b.

The lower boiling fraction 30a of distillation column 4a is fed to a catalytic dewaxing reactor 5a to obtain a light base oil 40a. The effluent 40a of reactor
20 5a is distilled in a distillation column 6a to recover further base oils 50a with different kinematic viscosities at 100°C from 2.5 to 6.0 mm²/s, preferably from 3.0 to 5.0 mm²/s, more preferably from 3.5 to 4.5 mm²/s, and most preferably from 3.8 to 4.2 mm²/s.

25 Simultaneously to the preparation of light base oil 40a as described above, a heavy base oil 40b is prepared.

The higher boiling fraction 30b of distillation column 4a is fed to a catalytic dewaxing reactor 5b to
30 obtain a heavy base oil 40b. The effluent 40b of reactor 6b is distilled in a distillation column 6b to recover further base oils 50b with different kinematic viscosities at 100°C from 5.0 to 12.0 mm²/s, preferably

from 6.0 to 10.0 mm²/s, more preferably from 7.0 to 9.0 mm²/s, and most preferably from 7.5 to 8.5 mm²/s.

The present invention is described below with reference to the following Examples, which are not intended to limit the scope of the present invention in any way.

Example 1

Preparation of catalytically dewaxed API GP II Base oils

The GPII Base oils were derived from a hydrowax feedstock (also known as fuel hydrocracker bottoms). This hydrowax feedstock was obtained from Shell Pernis refinery (Pernis, Netherlands)

The properties of the hydrowax feedstock are listed in Table 1.

Table 1

Hydrowax feedstock	
Initial boiling point	360°C
Final boiling point	483°C

The hydrowax feedstock was continuously fed to a hydrocracking step. In the hydrocracking step the fraction was contacted with a hydrocracking catalyst of Example 1 of EP-A-532118. The conditions in the hydrocracking step (a) were: a fresh feed Weight Hourly Space Velocity (WHSV) of 0.6 kg/l.h, recycle feed WHSV of 0.17 kg/l.h, hydrogen gas rate = 750 Nl/kg, total pressure = 77 bar, and a reactor temperature of 334 °C.

The effluent of the hydrocracking step (isomerised product) was continuously distilled under vacuum to give four fractions (see Table 2: Experiments A, B, C and D).

In the dewaxing step, the four fractions described above were contacted with a dealuminated silica bound

ZSM-5 catalyst comprising 0.7% by weight Pt and 30 wt.% ZSM-5 as described in Example of WO-A-0029511. The dewaxing conditions were 40 bar hydrogen, WHSV = 1kg/l/h and a temperature of 355°C. The properties of the obtained catalytic dewaxed base oils are listed in Table 3.

Table 2

Feed to catalytic dewaxing	Experiment A	Experiment B	Experiment C	Experiment D
Wt.% recovered at				
IBP	228	322	421	470+
5%	268	392	429	
10%	290	398	434	
30%	342	410	447	
50%	367	419	456	
70%	383	427	464	
90%	398	437	472	
95%	404	442	475	
99%	418	453	480	
FBP	425	458	483	

Table 3

Properties of catalytic dewaxed base oils	Experiment A	Experiment B	Experiment C	Experiment D
Kinematic viscosity at 100°C according to ASTM D-445 [cSt]	4.104	8.603	12.94	13.01
Kinematic viscosity at 40°C according to ASTM D-445 [cSt]	19.71	63.05	120.9	119.6
VI according to ASTM D-2270	108	108	100	102
Pour point according to ASTM D-5950 (°C)	-15	-15	-12	-9
Cloud point according to ASTM D-2500 (°C)	-11	-13	-10	-4
Cloud/pour point differential (°C)	4	2	2	5

Content of aromatics according to IP 368 [wt.%]	1.1	1.6	9.0	3.0
Content of sulphur according to ASTM D-2622-98 [ppm]	<5	6	31	20
Visual Appearance	Clear and bright	Clear and bright	Clear and bright	Clear and bright

Comparative Example A

The procedure of Example 1 was repeated, with the proviso that the isomerised product was catalytic dewaxed in one and the same device prior to distillation into several base oils.

The isomerised product was catalytically dewaxed as described above in Example 1 to obtain a catalytically dewaxed mineral derived base oil.

The obtained catalytically dewaxed mineral derived base oil was distilled into four base oil fractions.

The properties of these four base oils are listed in Table 4.

Table 4

Properties of catalytic dewaxed base oils	Experiment E	Experiment F	Experiment G	Experiment H
Kinematic viscosity at 100°C according to ASTM D-445 [cSt]	2.143	4.735	6.452	11.42
Kinematic viscosity at 40°C according to ASTM D-445 [cSt]	7.086	25.07	40.21	93.64
VI according to ASTM D-2270	102	107	111	110
Pour point according to ASTM D-5950 (°C)	-33	-21	-15	-9
Cloud point according to ASTM D-2500 (°C)	-30	-14	-6	-2
Cloud/pour point differential (°C)	3	7	9	7

Content of aromatics according to IP 368 [wt.%]	0.7	1.3	1.2	1.8
Content of sulphur according to ASTM D-2622-98 [ppm]	76	68	73	105
Visual Appearance	Clear and bright	Clear and bright	Clear and bright	Clear and bright

Figure 2 shows a simple comparison between the cloud point/pour point differentials of the GP II base oils with several viscosities obtained according the present invention (Example 1) and the cloud point/pour point differentials of base oils with several viscosities obtained when the isomerised product was catalytic dewaxed in one and the same device prior to separation of this isomerised product into fractions with different boiling ranges (Comparative Example A).

Discussion

The results in Table 4 (Example 1) show that the process according to the present invention resulted in several clear and bright GP II base oils having low cloud point/pour point differentials. This indicates that the microcrystalline particles can be easy separated from the obtained base oils or in other words poor isomerisation of the heavier waxes in the obtained base oils. When compared with Comparative Example A (see Figure 2) wherein the feedstock was catalytic dewaxed but without

prior separation of the feedstock into fractions with different boiling ranges, catalytic dewaxing followed by separation into several GP II base oils resulted in GP II base oils with high cloud point/pour point differentials.

C L A I M S

1. Process to prepare two or more base oils, the process at least comprising the following steps:

(a) providing a paraffinic hydrocarbon feedstock stream;

(b) subjecting a paraffinic hydrocarbon feedstock stream provided in step (a) to a hydrocracking/hydroisomerization step to obtain an at least partially isomerised product stream;

(c) separating the product stream of step (b), thereby obtaining a lower boiling fraction and a higher boiling fraction;

(d) dewaxing the lower boiling fraction of step (c) to obtain a light base oil; and

(e) dewaxing the higher boiling fraction of step (c) to obtain a heavy base oil.

2. Process according to claim 1, wherein the paraffinic hydrocarbon feedstock stream is a hydrowax feedstock, a Fischer-Tropsch product or mixtures thereof.

3. Process according to claim 1 or 2, wherein the lower boiling fraction of step(c), boils in a temperature range of from 350 to 500°C, and the higher boiling fraction of step (c), boils in a temperature range of from 425 to 600°C.

4. Process according to any one of claims 1 to 3, wherein dewaxing is performed by means of a catalytic dewaxing process in the presence of a catalyst comprising a molecular sieve and a group VIII metal.

5. Process according to claim 4, wherein the molecular sieve is selected from a group consisting of a MTW, MTT, TON type molecular sieve, ZSM-12, ZSM-48, and EU-2.

6. Process according to claim 4 or 5, wherein the Group VIII metal is platinum or palladium.

7. Process according to any one of claims 4 to 6, wherein the catalyst comprises a silica or titania binder.

8. Process according to any one of claims 1 to 7, wherein the catalytically dewaxed light base oil in step (d) has a cloud point of below -15°C , preferably below -20°C , more preferably below -28°C , more preferably below -32°C and most preferably below -40°C .

9. Process according to any one of claims 1 to 8, wherein the catalytically dewaxed light base oil in step (d) has a kinematic viscosity at 100°C from 2.5 to $6.0\text{ mm}^2/\text{s}$ preferably from 3.0 to $5.0\text{ mm}^2/\text{s}$, more preferably from 3.5 to $4.5\text{ mm}^2/\text{s}$, and most preferably from 3.8 to $4.2\text{ mm}^2/\text{s}$.

10. Process according to any one of claims 1 to 9, wherein the catalytically dewaxed light base oil in step (d) has a pour point of below 0°C , preferably below -5°C , more preferably below -15°C , more preferably below -20°C and most preferably below -25°C and preferably for at most above -48°C .

11. Process according to any one of claims 1 to 10, wherein step (d) and (e) occurs simultaneously.

12. Process according to any one of claims 1 to 11, wherein the catalytic dewaxed heavy base oil in step (e) has a cloud point of below -10°C , preferably below -15°C , more preferably below -18°C , and most preferably below -20°C .

13. Process according to any one of claims 1 to 12, wherein the catalytically dewaxed heavy base oil in step (e) has a kinematic viscosity at 100°C from 5.0 to $12.0\text{ mm}^2/\text{s}$, preferably from 6.0 to $10.0\text{ mm}^2/\text{s}$, more preferably from 7.0 to $9.0\text{ mm}^2/\text{s}$, and most preferably from 7.5 to $8.5\text{ mm}^2/\text{s}$.

14. Process according to any one of claims 1 to 13,
wherein the catalytically dewaxed heavy base oil in step
(e) has a pour point of below -5°C , preferably below $-$
 10°C , more preferably below -15°C , more preferably below
5 -20°C and most preferably below -25°C and preferably for
at most above -48°C .

15. Process according to any one of claims 1 to 14,
wherein the light and heavy base oil are Group II mineral
base oils, Group III mineral base oils, and Group III
10 Fischer-Tropsch derived base oils according to the
definitions of American Petroleum Institute (API) for
category II and III as defined in API publication 1509.

16. Process according to any one of claims 1 to 15,
wherein the difference between the cloud point and the
15 pour point of the catalytically dewaxed light base oil of
step (d) and of the heavy base oil of step (e) is less
than 6°C , preferably less than 3°C , and more preferably
less than 2°C .

Figure 1

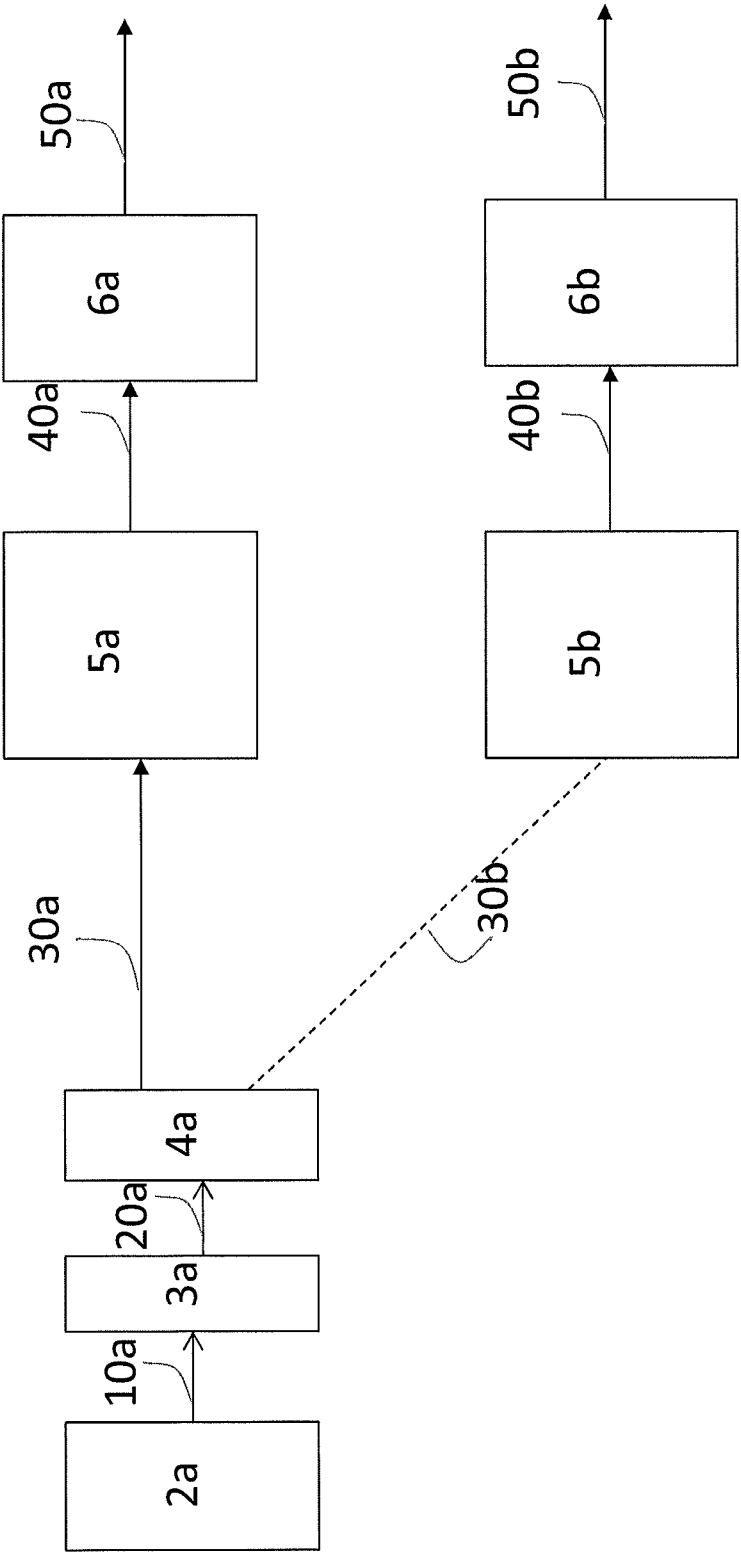
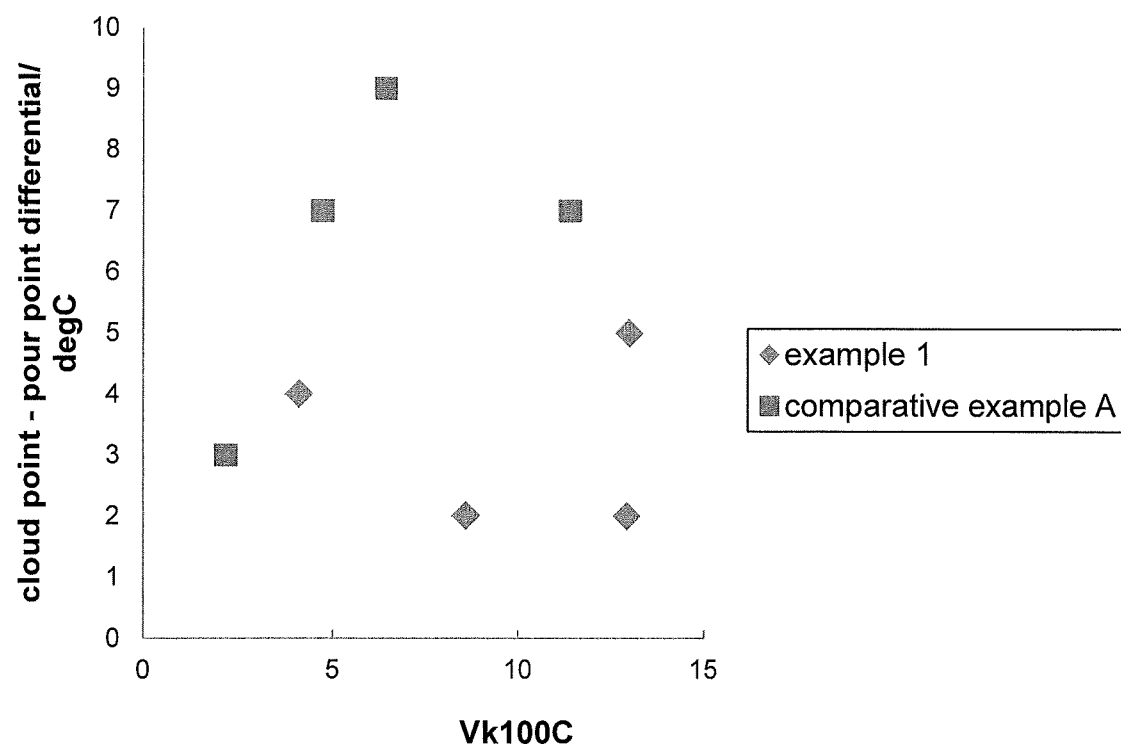


Figure 2



INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2014/065052

A. CLASSIFICATION OF SUBJECT MATTER

INV. C10G45/58 C10G45/62 C10G45/64 C10G47/00 C10G47/18
C10G65/12 C10G65/16 C10G73/02 C10M101/00

ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

C10G C10M

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2004/065588 A1 (GENETTI WILLIAM BERLIN [US] ET AL) 8 April 2004 (2004-04-08) claim 1	1-16
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Further documents are listed in the continuation of Box C.



See patent family annex.

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Date of the actual completion of the international search

4 September 2014

Date of mailing of the international search report

11/09/2014

Name and mailing address of the ISA/

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040,
Fax: (+31-70) 340-3016

Authorized officer

Gzil, Piotr

INTERNATIONAL SEARCH REPORT

International application No

PCT/EP2014/065052

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