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(54) **Title:** SURFACTANT COMPOSITION

(57) **Abstract:** A surfactant composition comprising compound I according to formula I and/or a salt thereof and compound II according to formula II and/or a salt thereof wherein the ratio of compound I to compound II (weight : weight) is of from 1 : 10 to 10 : 1 and in which formula I and II are as follows R₁- (CH₂-CH (CH₃) -O-)_x SO₃H (I) and R₂- (CH₂-CH₂-O-)_y SO₃H (II) in which in which R₁ is an alkyl group containing of from 1 to 20 carbon atoms and is linear or is branched by containing one or more methyl side-groups, x is of from 2 to 20, R₂ is an alkyl group containing of from 1 to 20 carbon atoms and is linear or is branched by containing one or more methyl side-groups and y is of from 1 to 20.



SURFACTANT COMPOSITION

This application claims the benefit of European Patent Application No. 15156394.7 filed February 24 2015, which is
5 incorporated herein by reference.

Field of the Invention:

The present invention relates to surfactant composition and to a process for mineral oil production with the help of such composition.

10 Background of the Invention:

In natural mineral oil deposits, mineral oil is present in the cavities of porous formation rocks which are sealed toward the surface of the earth by impermeable top layers. The cavities may be very fine cavities, capillaries, pores or
15 the like. As well as mineral oil, including fractions of natural gas, a deposit generally also comprises water with a greater or lesser salt content.

In mineral oil production, a distinction is drawn between primary and subsequent production such as secondary
20 and/or tertiary production.

In primary production, after commencement of drilling of the deposit, the mineral oil flows of its own accord through the borehole to the surface owing to the autogeneous pressure of the deposit. The autogeneous pressure can be caused, for
25 example, by gases present in the deposit, such as methane, ethane or propane. The autogeneous pressure of the deposit, however, generally declines relatively rapidly on extraction of mineral oil, such that usually only a limited amount of the mineral oil present in the deposit can be produced by
30 means of primary production. Thereafter, the autogeneous pressure is no longer sufficient to produce mineral oil.

After primary production, enhanced oil recovery can be applied. One enhanced oil recovery method utilizes surfactant

or a combination of surfactant and polymer to flood an oil-bearing formation to increase the amount of oil recovered from the formation. An aqueous solution of a surfactant, and optionally a polymer is injected into an oil-bearing

5 formation to increase recovery of oil from the formation, either after primary recovery or after a secondary recovery water flood. Without wishing to be bound by a theory, it is thought that the surfactant enhances recovery of oil from the formation by lowering interfacial tension between oil and

10 water phases in the formation thereby mobilizing the oil for production. Additionally, alkali can be present in the surfactant composition to assist in forming soap with acids in the oil and/or to reduce the adsorption of surfactant to the mineral surface of the formation. Polymer preferably is

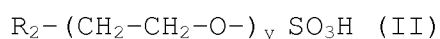
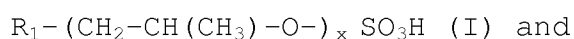
15 present in the surfactant composition to increase its viscosity, typically to the same order of magnitude as the oil in the formation in order to force the mobilized oil through the formation for production by the polymer containing flood.

20 It has now been found that the use of a novel surfactant composition can increase oil production in oil recovery applying water of high total dissolved solids content (TDS), more specifically if used after primary and secondary water assisted oil production.

25 Summary of the Invention:

Therefore, the present invention relates to a surfactant composition comprising compound I according to formula I and/or a salt thereof and compound II according to formula II and/or a salt thereof wherein the ratio of compound I to

30 compound II (weight : weight) is of from 1 : 10 to 10 : 1 and in which formula I and II are as follows



in which R_1 is an alkyl group containing of from 1 to 20 carbon atoms and is linear or is branched by containing one or more methyl side-groups, x is of from 2 to 20, R_2 is an alkyl group containing of from 1 to 20 carbon atoms and is linear or is branched by containing one or more methyl side-groups and y is of from 1 to 20.

Detailed Description of the Invention:

A surprising advantage of the present invention is that the composition was found to give good oil production while only applying water having a high TDS such as from 10,000 to 60,000, more specifically sea-water having a TDS of from 20,000 to 50,000 ppm. The surfactant composition of the present invention makes it possible to recover a relatively high percentage of oil from the formation without having to reduce the TDS of water used in the recovery. This is an important advantage over known surfactant compositions which tend to require lowering the TDS concentration of water used for recovering oil.

A further aspect of the invention is a process for mineral oil production, which process comprises injecting a surfactant composition according to the invention into a mineral oil formation. Preferably, this process further comprises subsequently injecting into the formation a polymer containing solution having a TDS content of from 10,000 to 60,000, more specifically water having a TDS of from 20,000 to 50,000 ppm. The TDS concentration is in addition to any polymer and/or surfactant which is present.

The organic sulfate compounds for use of the present invention contain an alkyl group, an alkylene oxide block and a sulphate group. It will be clear to the person skilled in the art that the length of the alkyl group and the number of alkylene oxide groups in the alkylene oxide block is the average of the molecules in question. For the present

invention, each of these is the number average. It is preferred that each compound I and compound II is present as a salt, more specifically the sodium salt. However, it is possible to convert the acid into the salt just before or
5 during use in oil production.

Furthermore, it will be clear to someone skilled in the art that Compound I can contain a minor amount of ethylene oxide derived units and Compound II can contain a minor amount of propylene oxide derived units. Preferably, Compound
10 I contains less than 5 %wt of ethylene oxide derived units and Compound II contains less than 5 %wt of propylene oxide derived units based on total amount of compound. Most preferably, Compound I consists of an alkyl group, propylene oxide derived units and a sulphate group while Compound II
15 consists of an alkyl group, ethylene oxide derived units and a sulphate group.

Preferably, compound I according to the present invention is a compound or salt according to formula (I) in which R_1 is an alkyl group containing at least 5 carbon
20 atoms, more preferably at least 8 carbon atoms, more preferably at least 10 carbon atoms, most preferably at least 11 carbon atoms. The alkyl group of compound I can be straight or branched by containing one or more methyl groups. Preferably, a substantial amount of the alkyl groups of the
25 compound according to formula (I) is branched in that the alkyl group contains one or more methyl side-groups. If R_1 is branched, R_1 solely contains methyl side-groups. R_1 does not contain side-groups other than methyl. Preferably, at least 40 % of the alkyl groups of compound I is branched, more
30 preferably at least 60 %, more preferably at least 80 %, all based on number averages. Furthermore, this alkyl group preferably contains at most 20 carbon atoms, more specifically at most 18 carbon atoms, most specifically at

most 15 carbon atoms. Compound I has been propoxylated and preferably contains at least 3 units derived from propylene oxide, more preferably at least 5 of such units, more preferably at least 6 of such units. Furthermore, compound I
5 contains preferably at most 20 of such units, more preferably at most 15, more preferably at most 12 and most preferably at most 9 of such units. Most preferably, compound I is ENORDET J771 surfactant commercially available from Shell Chemicals. ENORDET is a Shell trade mark.

10 Preferably, compound II according to the present invention is a compound or salt according to formula (II) in which R_2 is an alkyl group containing at least 5 carbon atoms, more preferably at least 7 carbon atoms, more preferably at least 8 carbon atoms, most preferably at least
15 10 carbon atoms. The alkyl group of compound II can be straight or branched which means that the alkyl group contains one or more methyl side-groups. If R_2 is branched, R_2 solely contains methyl side-groups. R_2 does not contain side-groups other than methyl. Preferably, the compound according
20 to formula (II) is mostly linear which means that a minority of the compounds according to formula (II) contains an alkyl R_2 having one or more methyl side-groups. Preferably, at most 40 % of the alkyl groups of compound II are branched, more preferably at most 30 %, more preferably of from 10 to 30 %, all based on number averages. Furthermore, this alkyl group
25 preferably contains at most 20 carbon atoms, more specifically at most 18 carbon atoms, most specifically at most 17 carbon atoms. Compound II has been ethoxylated and preferably contains at least 1 unit derived from ethylene
30 oxide, more preferably at least 2 of such units, more preferably at least 3 of such units. Furthermore, compound II contains preferably at most 15 of such units, more preferably at most 10, more preferably at most 8 and most preferably at

most 5. Most preferably, compound I is STEOL CS-370 surfactant commercially available from Stepan Company or is derived by sulfonation from NEODOL 25-3 ethoxylated alcohol as commercially available from Shell Chemicals.

5 Compound I and Compound II can be mixed together at any time. It is preferred to mix the compounds such that the ratio of the compounds is substantially similar throughout the composition which will be brought into contact with the formation. The weight ratio of compound I to compound II
10 preferably is of from 1:1 to 10:1, more preferably of from 1:1 to 6:1.

 The surfactant composition which will be used in treating the oil formation additionally comprises water and can additionally comprise one or more polymers besides the
15 surfactants according to the present invention. However, these additional compounds can be added at a later stage such as at the site of the actual oil recovery.

 As it is practical and advantageous to use either formation water or sea-water, the surfactant composition of
20 the present invention to be contacted with the formation generally will have a total dissolved salt concentration of from 1000 to 80,000, more specifically to 60,000, parts per million by weight (ppmw) of total dissolved solids measured according to ASTM D5907, preferably at least 5000 ppmw, more
25 preferably at least 10,000 ppmw, more preferably at least 20,000 ppm and most preferably at least 30,000 ppmw based on total amount of surfactant composition. This TDS is present in the composition in addition to any surfactant and/or polymer.

30 Preferably, the surfactant composition which will be brought into contact with the formation will be an aqueous composition comprising of from 0.1 to 2.0 %wt of compound I, of from 0.05 to 2.0 %wt of compound II and a TDS of from 1000

to 80,000 ppm all amounts based on total amount of surfactant composition.

The surfactant composition may contain one or more water soluble polymers which increase its viscosity. These may be
5 selected from the group consisting of polyacrylamides; partially hydrolyzed polyacrylamides; polyacrylates; ethylenic co-polymers; biopolymers; carboxymethylcelluloses; polyvinyl alcohols; polystyrene sulfonates; polyvinylpyrrolidones; 2-acrylamide-methyl propane sulfonate
10 (AMPS); co-polymers of acrylamide, acrylic acid, AMPS, and n-vinylpyrrolidone in any ratio; and combinations thereof. Examples of ethylenic co-polymers include co-polymers of acrylic acid and acrylamide, acrylic acid and lauryl acrylate, and lauryl acrylate and acrylamide. Examples of
15 biopolymers include xanthan gum, guar gum, and scleroglucan.

The molecular weight average of the polymer in the surfactant composition preferably is such as to provide sufficient viscosity to the surfactant composition to drive the mobilized oil through the formation. The polymer may have
20 a molecular weight average of at least 10000 daltons, preferably at least 50000 daltons, more preferably at least 100000 daltons. The polymer may have a molecular weight average of from 10000 to 30000000 daltons, most specifically from 100000 to 15000000 daltons. The quantity of the polymer
25 in the surfactant composition may be sufficient to provide the surfactant composition with a dynamic viscosity at formation temperatures on the same order of magnitude, or, less preferably a greater order of magnitude, as the dynamic viscosity of the oil in the oil-bearing formation at
30 formation temperatures so the surfactant composition may push the oil through the formation. The quantity of the polymer in the surfactant composition may be sufficient to provide the surfactant composition with a dynamic viscosity of at least 1

mPa s (1 cP), or at least 4 mPa s, or at least 10 mPa s (10 cP), or at least 100 mPa s (100 cP), or at least 1000 mPa s (1000 cP) at 52°C or at a temperature within a formation temperature range. The concentration of polymer in the
5 surfactant composition preferably is of from 250 ppm to 10000 ppm, more preferably from 500 ppm to 5000 ppm, and most preferably from 1000 to 2000 ppm.

Optionally, a co-solvent may be included in the surfactant composition to inhibit the formation of a viscous
10 emulsion upon deploying the surfactant composition in the oil-bearing formation. The co-solvent may be a low molecular weight alcohol including, but not limited to, methanol, ethanol, and iso-propanol, isobutyl alcohol, secondary butyl alcohol, n-butyl alcohol, t-butyl alcohol, or a glycol
15 including, but not limited to, ethylene glycol, 1,3-propanediol, 1,2-propandiol, diethylene glycol butyl ether, triethylene glycol butyl ether, or a sulfosuccinate including, but not limited to, sodium dihexyl sulfosuccinate. If present, the co-solvent may be present in an amount from
20 100 ppm to 50000 ppm, more specifically from 500 ppm to 5000 ppm based on total amount of the surfactant composition. The surfactant composition may be free of a co-solvent.

The oil contained in the oil-bearing formation or formation may be a light oil or an intermediate weight oil
25 containing less than 25 wt%, or less than 20 wt%, or less than 15 wt%, or less than 10 wt%, or less than 5 wt% of hydrocarbons having a boiling point of at least 538°C (1000°F) and having an API gravity of at least 20°, or at least 25°, or at least 30°. The oil of the oil bearing-
30 formation may be a heavy oil containing more than 25 wt% of hydrocarbons having a boiling point of at least 538°C and having an API gravity of less than 20°.

The oil contained in the oil-bearing formation may have a dynamic viscosity under formation conditions (in particular, at temperatures within the temperature range of the formation) of at least 1 mPa.s (1 cP), or at least 10 mPa.s (10 cP), or at least 100 mPa.s (100 cP), or at least 1000 mPa.s (1000 cP), or at least 10000 mPa.s (10000 cP). The oil contained in the oil-bearing formation may have a dynamic viscosity under formation temperature conditions of from 1 to 10000000 mPa.s (1 to 10000000 cP).

Compounds to be used in the present invention are commercially available from suppliers such as Shell Chemicals and Stepan Company. Furthermore, the manufacture of Compound I and Compound II is well known. A suitable method involves alkoxyating an alcohol containing the suitable amount of carbon atoms followed by sulfonation. The reaction conditions, especially the selection of the catalyst, can influence the molecular weight distribution of the alkoxyates and the orientation of the alkylene oxide units in a polyether chain.

The alkoxyates can be prepared, for example, by base-catalyzed alkoxylation. For this purpose, the alcohol used as the starting material can be admixed in a pressure reactor with alkali metal hydroxides, preferably potassium hydroxide, or with alkali metal alkoxides, for example sodium methoxide. By means of reduced pressure and/or increase of the temperature, water still present in the mixture can be removed. Thereafter, the alcohol is present as the corresponding alkoxide. This is followed by inertization with inert gas such as nitrogen and, in a first step, stepwise addition of the appropriate alkylene oxide at temperatures such as of 60 to 180° C, preferably 130 to 150° C. The addition is typically effected within 2 to 5 h. After the addition has ended, the reaction mixture is appropriately

allowed to continue to react, for example for 0.5 h to 1 h.

The alkoxylation can also be undertaken by means of techniques which lead to narrower molecular weight distributions than the base-catalyzed synthesis. For this
5 purpose, the catalysts used may, for example, be double hydroxide clays as described in DE 43 25 237 A1. The alkoxylation can more preferably be affected using double metal cyanide catalysts (DMC catalysts). Typically, not more than 250 ppmw of catalyst based on the mixture are used, and
10 the catalyst can remain in the product due to this small amount.

The alkoxylation can additionally also be undertaken under acid catalysis. The acids may be Bronsted or Lewis acids. To perform the reaction, the alcohol used as the
15 starting material can be admixed with the catalyst, and the mixture can be dewatered as described above and reacted with the alkylene oxides as described. At the end of the reaction, the acidic catalyst can be neutralized by addition of a base, for example potassium hydroxide or sodium hydroxide, and
20 filtered off if required.

The surfactant composition according to the invention can be used in a system comprising at least one production borehole and at least one injection borehole which are sunk into the mineral oil deposit. In general, a deposit is
25 provided with several injection boreholes and with several production boreholes.

In a preferred embodiment of the process, the surfactant composition according to the invention is used after water flooding of the formation. For this purpose, at first only
30 water or salt-containing water is injected into the mineral oil formation through the said injection boreholes, and hence mineral oil is produced. This can proceed until significant watering out of production is observed. "Watering out" of

production is understood by the person skilled in the art to mean that the proportion of water in the oil-water mixture produced increases with increasing duration of water flooding. The cause of this is that water flows

5 preferentially through already exploited regions of the mineral oil deposit with low flow resistance with increasing duration of water flooding. After the formation has been treated with the surfactant composition according to the present invention, the formation preferably is treated with

10 an aqueous solution containing polymer and water of relatively high TDS and optionally co-solvent, each as described above, in order to further increase the amount of oil recovered.

The composition according to the invention is preferably

15 applied with mineral oil deposits at a temperature of at most 90 °C, more preferably at most 80 °C, more preferably at most 70 °C, most preferably at most 60 °C. Typical deposit temperatures are in the range from 20° C to 150° C. In particular, the deposit temperature may be 35° C to 120° C,

20 preferably 40° C to 90° C, more preferably 45° C to 75° C and, for example, 50° C to 70° C.

The injection of the surfactant composition according to the present invention can be undertaken by means of customary apparatus. The formulation can be injected into one or more

25 injection boreholes by means of customary pumps. The injection boreholes are typically lined with cemented steel tubes, and the steel tubes are perforated at the desired site. The formulation exits through the perforation from the injection borehole into the mineral oil formation. The

30 pressure applied by means of the pumps, in a manner known in principle, fixes the flow rate of the formulation and hence also the shear stress with which the aqueous formulation enters the formation.

The rate of injection can be fixed by the person skilled in the art according to the conditions in the formation.

The following examples only are to illustrate the present invention.

5 EXAMPLES

A surfactant composition I according to the invention was prepared comprising 0.45 %wt ENORDET J771 surfactant, 0.15 %wt of sulfonated NEODOL 25-3 ethoxylated alcohol and 0.25 %wt of Flopaam 3230 polyacrylamide with the remainder
10 being sea-water containing about 33,000 ppm TDS.

ENORDET J771 surfactant is a sulfonated high purity alcohol containing of from 12 to 13 carbon atoms with an average of approximately 7 moles of propylene oxide per mole of alcohol. NEODOL 25-3 is a high purity alcohol containing
15 of from 12 to 15 carbon atoms with an average of approximately 3 moles of ethylene oxide per mole of alcohol.

Surfactant composition A is not according to the invention and contained 0.36 %wt of ENORDET J771 surfactant as described above, 0.24 %wt of ENORDET O332 surfactant and
20 0.25 %wt of Flopaam 3230 polyacrylamide.

ENORDET O332 surfactant is an internal olefin sulfonate having a carbon number chain length of from 15 to 18 and does not contain a propylene oxide or ethylene oxide block.

The remainder of composition A was sea-water containing
25 about 33,000 ppm TDS.

Polymer composition B contains sea-water containing about 33,000 ppm TDS and 0.25 %wt of Flopaam 3230 polyacrylamide.

ENORDET J771 surfactant, ENORDET O332 surfactant and
30 NEODOL 25-3 ethoxylated alcohol are commercially available from Shell Chemicals. ENORDET and NEODOL are trademarks of the Shell group. Flopaam 3230 polyacrylamide is commercially available from SNF.

EXAMPLE 1

A core containing a known amount of oil was first flooded with water and subsequently composition I gradually was injected until 0.4 times the pore volume of the core was added. At this point in time, injection of composition I was stopped and injection of polymer composition B started until the total volume of aqueous solution injected was 3 times the pore volume of the core.

EXAMPLE 2

A core similar to the one used in Example 1 was first flooded with water and subsequently composition A gradually was injected until 0.4 times the pore volume of the core had been injected. At this point in time, injection of composition A was stopped and injection of polymer composition B started until the total volume of aqueous solution injected was 3 times the pore volume of the core.

EXAMPLE 3

A core similar to the one used in Example 1 was first flooded with water and subsequently composition A gradually was injected until an amount of 0.4 times the pore volume of the core had been injected. At this point in time, the use of composition A was stopped and injection started of a 50:50 (weight:weight) mixture of composition B and deionized water having a TDS of less than 1,000 ppm and 0.25 %wt of Flopaam 3230 polyacrylamide. Injecting this mixture continued until the total volume of polymer composition injected was 3 times the pore volume of the core.

The oil recovery was measured as percentage of the total volume of oil present in the core. Below are shown the oil recovery when the volume of aqueous solution injected was equal to the pore volume of the core (1 PV) and when the volume of aqueous solution injected was 3 times the pore volume of the core (3 PV).

Table 1

	Example 1	Example 2	Example 3
Oil recovery at 1 PV (%)	67	36	75
Oil recovery at 3 PV (%)	80.5	43.5	80.5

It is clear from Table 1 that the present invention allows to recover a high percentage of oil from the formation without
5 requiring the use of fresh water or reducing the salt content of sea-water as applied in Example 3.

C L A I M S

1. A surfactant composition comprising compound I
 according to formula I and/or a salt thereof and
 5 compound II according to formula II and/or a salt
 thereof wherein the ratio of compound I to compound
 II (weight:weight) is of from 1 : 10 to 10 : 1 and in
 which formula I and II are as follows

$$R_1-(CH_2-CH(CH_3)-O-)_x SO_3H \text{ (I) and}$$
 10
$$R_2-(CH_2-CH_2-O-)_y SO_3H \text{ (II)}$$
 in which in which R_1 is an alkyl group containing of
 from 1 to 20 carbon atoms and is linear or is
 branched by containing one or more methyl side-
 groups, x is of from 2 to 20, R_2 is an alkyl group
 15 containing of from 1 to 20 carbon atoms and is linear
 or is branched by containing one or more methyl side-
 groups and y is of from 1 to 20.
2. A composition according to claim 1 in which R_1
 contains of from 5 to 20 carbon atoms, x is of from 3
 20 to 15, R_2 contains of from 5 to 20 carbon atoms and y
 is of from 1 to 10.
3. A composition according to claim 2 in which R_1
 contains of from 8 to 18 carbon atoms, x is of from 3
 to 12, R_2 contains of from 7 to 18 carbon atoms and y
 25 is of from 1 to 8.
4. A composition according to any one of claims 1 to 3
 in which R_1 contains of from 11 to 15 carbon atoms, x
 is of from 6 to 9, R_2 contains of from 10 to 17 carbon
 atoms and y is of from 2 to 5.
- 30 5. A composition according to any one of claims 1 to 4
 for use in mineral oil production.

6. A composition according to any one of claims 1 to 5 in which the composition is an aqueous composition comprising of from 0.1 to 2.0 %wt of compound I, of from 0.05 to 2.0 %wt of compound II and a total dissolved solids content (TDS, measured according to ASTM D5907) of from 1000 to 80,000 ppmw.
7. A composition according to any one of claims 1 to 6 in which the TDS is of from 1000 to 60,000 ppm.
8. A composition according to any one of claims 1 to 7 in which the viscosity of the composition is at least 4 mPas (measured at 52° C).
9. A composition according to any one of claims 1 to 8 in which the ratio of compound I to compound II is of from 1:1 to 10:1.
10. A composition according to claim 9 in which the ratio of compound I to compound II is of from 1:1 to 6:1.
11. A composition according to any one of claims 1 to 10 which composition further comprises polymer.
12. Process for mineral oil production, which process comprises injecting a surfactant composition according to any one of claims 1 to 11 into a mineral oil formation.
13. The process according to claim 12 wherein water is injected into the mineral oil formation in a step preceding the injection of the surfactant composition.
14. The process according to claim 12 or 13 which process further comprises injecting a polymer containing solution having a TDS content of from 10,000 to 60,000 after injection of the surfactant composition.

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2016/053711

A. CLASSIFICATION OF SUBJECT MATTER
INV. C09K8/584 E21B43/16
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)
C09K E21B

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 7 119 125 B1 (O'LENICK JR ANTHONY J [US] ET AL) 10 October 2006 (2006-10-10) * column 2, line 50 through column 5, line 20, examples, claims *	1-14
X	WO 2011/031946 A2 (UNIV TEXAS [US]; WEERASOORIYA UPALI P [US]; POPE GARY A [US]; NGUYEN Q) 17 March 2011 (2011-03-17) * page 2, paragraph [0009] through page 6, paragraph [0057], claims *	1-14
A	US 3 500 923 A (REISBERG JOSEPH) 17 March 1970 (1970-03-17) the whole document	1-14
A	US 3 391 750 A (ZIKA HARRY T) 9 July 1968 (1968-07-09) the whole document	1-14
	- / - -	



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents :

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Date of the actual completion of the international search

15 April 2016

Date of mailing of the international search report

29/04/2016

Name and mailing address of the ISA/

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INTERNATIONAL SEARCH REPORT

International application No

PCT/EP2016/053711

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2013/102504 A1 (BITTNER CHRISTIAN [DE] ET AL) 25 April 2013 (2013-04-25) the whole document -----	1-14

INTERNATIONAL SEARCH REPORT

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