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(54) Title: PROCESS FOR THE CONVERSION OF HEAVY HYDROCARBON FEEDSTOCKS TO DISTILLATES WITH THE SELF- PRODUCTION OF HYDROGEN

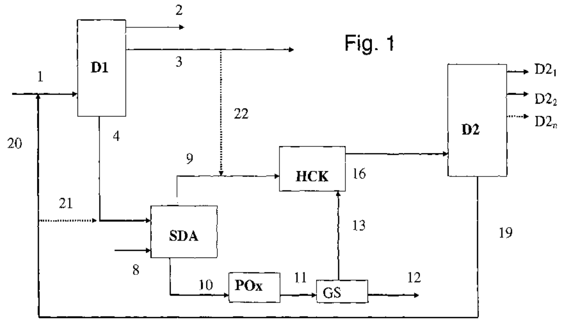

Fig. 1

(57) Abstract: Process for the conversion of heavy feedstocks selected from heavy and extra-heavy crude oils, distillation residues from crude oil or from catalytic treatment, "visbreaking tars", "thermal tars", bitumens from "oil sands" liquids from coals of different origins and other high-boiling feedstocks of a hydrocarbon origin, known as "black oils", characterized in that it comprises the following steps: sending the heavy feedstock to a first distillation zone (D1) having one or more atmospheric and/or vacuum distillation steps, whereby one or more light fractions are separated from the distillation residue; sending the fraction consisting of the distillation residue of the first distillation zone (Dl) to a deasphalting zone (SDA) in the presence of solvents, obtaining two streams, one consisting of deasphalted oil (DAO), the other containing asphaltenes; sending the stream containing asphaltenes to a gasification zone (PO_x) so as to obtain a mixture of H_2 and CO; mixing of the stream consisting of deasphalted oil (DAO) with a suitable hydrogenation catalyst and sending the mixture obtained to a hydrocracking (HCK) zone in which hydrogen is added, self-produced in the gasification zone (PO_x) after being separated in a gas separation zone (GS) from the mixture containing CO; sending the effluent stream from the hydrocracking zone to a second distillation zone (D2), consisting of one or more flash steps and/or one or more atmospheric distillation steps, through which the different fractions are separated, coming from the hydrocracking reaction of the distillation residue which is recycled to the first distillation zone (D1) and/or to the deasphalting zone (SDA).

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PROCESS FOR THE CONVERSION OF HEAVY HYDROCARBON FEEDSTOCKS TO DISTILLATES WITH THE SELF-PRODUCTION OF HYDROGEN

The present invention relates to a high-productivity process for the total conversion to distillates alone, with no contextual production of fuel oil or coke, of heavy feedstocks, among which heavy crude oils also with a high metal content, distillation residues, heavy oils coming from catalytic treatment, "visbreaker tars", "thermal tars", bitumens from "oil sands" possibly obtained from mining, liquids from different types of coal and other high-boiling feedstocks of a hydrocarbon nature, known as "black oils", also comprising hydrogenating treatment in which hydrogen, self produced in the same process, is used.

The conversion of heavy feedstocks to liquid products can be substantially effected through two methods: one of the thermal type, the other based on hydrogenating treatment. The increasing demand for high-quality distilled products and the parallel reduction in the demand for by-products such as coke and fuel oil, make it necessary to look for new integrated processes which allow the complete conversion of heavy feedstocks.

Thermal processes, mainly coking and Visbreaking, have certain advantages as they allow feedstocks having a high polluting level to be fed. The high production of coke and tar, however, is such that its validity is greatly limited in some cases. In addition, the poor quality of the distillates leads to the necessity of severe hydrogenating treatment to favour the removal of heteroatoms and bring the products to specification.

Visbreaking allows very low yields to distillates to be obtained together with low-quality products, obtaining, on the contrary, high amounts of tar.

Coking, in addition to having higher investment costs, also produces low-quality distillates and high quantities of coke.

As far as hydrogenating processes are concerned, these consist of treating the feedstock in the presence of hydrogen and suitable catalysts, following various objectives:

- to demolish the high molecular weight asphaltene structures, favouring the removal of Ni and V (hydrodemetallation, HDM) and, contemporaneously, reduce the content of asphaltenes in the feedstock

- to remove S and N through hydrogenation and hydrogenolysis reactions (hydrodesulphurization, HDS and hydrodenitrogenation HDN, respectively)
- to reduce CCR (Conradson Carbon Residue) by means of Hydrocracking (HC) and Hydrodearomatization (HDA) reactions
- to transform high molecular weight molecules into light molecules (distillates) through Hydrocracking (HC) reactions.

The hydroconversion technologies currently used make use of fixed bed or ebullated bed reactors and adopt catalysts generally consisting of one or more transition metals (Mo, W, Ni, Co, etc.) supported on silica and/or alumina or another oxide support.

Fixed bed technologies, even in the most advanced versions, have severe limitations both with respect to the flexibility of the feedstock fed (as the presence of high concentrations of metals and other pollutants would imply excessively frequent regeneration cycles of the catalyst) and also because they do not allow the conversion of heavy feedstocks to levels higher than 30-40%. As a result of said limitations, fixed bed hydroconversion technologies prove to be completely inadequate for configuring total conversion schemes of heavy feedstocks to distillates.

In order to at least partly overcome these limitations, ebullated bed processes were developed, wherein the catalytic bed, even if confined in a certain part of the reactor, is moveable and can expand due to the effect of the reagent flow in liquid and gaseous phase. This allows the reactor to be equipped with mechanical apparatuses for removing the exhausted catalyst and feeding the fresh catalyst in continuous, without interrupting the running. As a result of this possibility of continuously substituting the exhausted catalyst, ebullated bed technologies can process heavy feedstocks with a metal content of up to 1,200 ppm Ni + V. Even if the ebullated bed technology benefits from the improvements provided by the continuous regeneration of the catalyst, it allows conversion levels to distillates of up to a maximum of 60% to be obtained. It is possible to reach a conversion of 80% by operating under high severity conditions and recycling an aliquot of the products, encountering however problems of stability of the fuel oil produced by the separation of the non-converted asphaltene phase, which, in this case too, represents the heart of the problem. For the above reasons, the ebullated bed technology is also unsuitable for total conversion processes to distillates, as it is associated with a significant production of fuel oil.

Processes have been proposed which use catalysts homogeneously dispersed in the reaction medium (slurry), as an alternative to hydroconversion processes based on the use of catalysts supported on a fixed bed or ebullated bed. These slurry processes are characterized by the presence of catalyst particles with very small average dimensions and uniformly dispersed in the hydrocarbon phase. The catalytic activity is consequently scarcely influenced by the presence of metals or carbonaceous residues deriving from the degradation of asphaltenes.

With respect to thermal processes, hydroconversion technologies of residues also have limitations due to the high investment costs. They also require considerably high hydrogen consumptions. This latter element represents a very critical factor, mainly in certain cases in which there is a limited availability of natural gas. It can therefore be important to produce hydrogen starting from alternative sources, for example through the gasification of by-products such as coke, residues, tar, asphaltenes, etc..

For the above reasons, the effecting of integrated processes in which it is possible to use low-value by-products for the production of hydrogen for internal use, represents an advantageous solution from all points of view.

Deasphaltation, a liquid-liquid extraction treatment based on the use of paraffins, allows a variable aliquot of DAO, deasphalted oil, to be separated, which can have qualitative characteristics (in terms of metal content, carbonaceous residue, etc..) which are such as to favour the subsequent conversion. This process has several advantages with respect to coking: significantly lower investment costs, the possibility of modulating the yield and quality of DAO and asphaltenes according to necessity, the production of a by-product (the same asphaltenes) which can be fed to the gasification process.

As is known, deasphalting does not produce distillates: it is therefore necessary to subject the DAO to subsequent cracking treatment.

In US.6274003 of Ormat Industries a process has been recently claimed for the primary upgrading of heavy hydrocarbons, which combines distillation, solvent deasphalting and thermal cracking to produce a synthetic crude oil, partially upgraded, substantially without metals and asphaltenes. In the upgrading process, the feedstock is first distilled to produce a lighter fraction, substantially with no asphaltenes, and a residue containing metals and asphaltenes.

An aliquot of the distilled fraction is sent to a hydrotreating unit, whereas the residual fraction is deasphalted to produce an oil (DAO) and an asphaltene residue. DAO, and possibly an aliquot of the hydrotreating product (which acts as a diluent, hydrogen donor) are joined and sent to thermal cracking: the cracking product returns to the distillation column, from which the fractions forming the partially upgraded syncrude, are collected.

The process scheme is improved in subsequent patents of the same owner (WO03060042, US-6,702,936, US-20040118745, EP1,465,967) claiming the use of a treatment which also comprises the gasification of asphaltenes to produce synthesis gas, the treatment of the synthesis gas with the production of hydrogen and the hydroprocessing of the distillates. In patent application IT-2004A002446 a conversion process of heavy feedstocks is claimed, which allow the complete transformation of the same ("zero residue refinery"). In said patent application IT-2004A002446 a process is described more specifically including the use of the following units: solvent deasphalting (SDA), DAO hydroconversion with slurry phase catalysts, distillation. The residue from the hydrotreating stream, together with the catalyst in slurry phase contained therein, is recycled to the hydrotreatment section. The asphaltene stream can be sent to a gasification section (POx) in order to obtain a mixture of H_2 and CO.

We have surprisingly found that, by subjecting the DAO obtained from the deasphalting of the distillation residue of the heavy feedstock to hydrocracking in the presence of low concentrations of dispersed catalyst, high yields to distillate can be obtained with an optimum control on the formation of coke and gases. In this way, it is not necessary to recycle the non-converted residue to the hydrocracking section. This residue can be directly recycled to the initial fractionation column or to the deasphalting zone, from which, in addition to the asphaltenes present in the feedstock, the side-products possibly formed in the hydrocracking phase can be removed, said by-products thus being used, at the same time self-producing the hydrogen necessary for the hydrogenating treatment envisaged, by sending the asphaltene stream to a gasification section. By comparing this solution with that comprising a thermal cracking step for the DAO conversion, it is possible to optimize the process selectivity, maximizing the yield to distillates and minimizing the production of coke and gas. With respect to the solution claimed in patent application IT-2004A002446, which includes the use of high catalyst concentrations and the recycling of the same together with the distillation residue from the hydrotreatment, the new solution proposed herein allows the use of minimum concentrations of catalyst, which can be used only once, greatly simplifying the scheme; even at low catalyst concentrations, its formulation allows an optimal hydrogenation of the feedstock, preventing or minimizing the formation of coke. The sending of the hydrotreatment residue to the deasphalting section allows the possible recovery of further quantities of DAO to be converted and, at the same time, to send the most concentrated fraction of pollutants (metals deriving from the feedstock, together with traces of catalyst) to gasification.

The process, object of the present invention, for the conversion of heavy feedstocks, comprises the following steps:

- sending the heavy feedstock to a first distillation zone (D1) having one or more atmospheric and/or vacuum distillation steps whereby one or more light fractions are separated from the distillation residue;
- sending the fraction consisting of the distillation residue of the first distillation zone (D1) to a deasphalting zone (SDA) in the presence of solvents, obtaining two streams, one consisting of deasphalted oil (DAO), the other containing asphaltenes;
- sending the stream containing asphaltenes to a gasi-

fication zone (POx) in order to obtain a mixture of H_2 and CO;

- mixing the stream consisting of deasphalted oil (DAO) with a suitable hydrogenation catalyst and sending the mixture thus obtained to a hydrocracking zone (HCK) in which hydrogen is introduced self-produced in the gasification area (POx) after separation in a gas separation (GS) zone from the mixture containing CO;
- sending the effluent stream from the hydrocracking zone to a second distillation zone (D2), consisting of one or more flash steps, and/or one or more atmospheric distillation steps, whereby the different fractions coming from the hydrocracking reaction are separated from the distillation residue, which is recycled to the first distillation zone (D1) and/or to the deasphalting zone (SDA).

The heavy feedstocks treated can be of different kinds: they can be selected from heavy feedstocks, distillation residues, "heavy oils" from catalytic treatments, for example "unconverted oils" from hydrotreatment with fixed or ebullated beds, "heavy cycle oils" from catalytic cracking treatment, "thermal tars" (coming, for example, from visbreaking or similar thermal processes), bitumens from "oil sands", different kinds of coals and any high-boiling feedstock of a hydrocarbon origin, generally known in the art as "black oils".

The choice of sending the recycling of the distillation residue of the second distillation zone to the first distillation zone (D1) and/or the deasphalting zone (SDA) is influenced by how the second distillation zone is effected: it is in fact preferable to send this residue completely, or at least partially, to the deasphalting area (SDA) if said second area consists of one or more atmospheric distillation steps.

The first distillation zone (D1) preferably consists of one or more atmospheric distillation steps or one or more distillation steps and one vacuum step.

The heavier fraction of the light fractions separated in the first distillation zone, can possibly be at least partially sent to the hydrocracking zone (HCK).

The gasification can be effected by feeding the stream containing asphaltenes to the gasifier, together with oxygen and vapour which react under exothermic conditions at a temperature of over 1,300°C and a pressure ranging from 30 to 80 bar, to produce mainly H_2 and CO.

The separation of H_2 from the mixture of H_2 and CO obtained from the gasification is preferably effected by means of molecular sieves.

A portion of the syngas stream, i.e. a mixture of H_2

and CO, obtained from the gasification, can be further upgraded as fuel for the generation of vapour or by combustion with combined cycles (IGCC) or it can be transformed into paraffin hydrocarbons through Fischer-Tropsch synthesis or it can be converted to methanol, dimethylether, formaldehyde and, more generally, into the series of products deriving from C1 chemistry.

The distillation steps are preferably carried out at a reduced pressure ranging from 0.001 to 0.5 MPa, preferably between 0.1 and 0.3 MPa.

The deasphalting step (SDA), effected by means of extraction with a hydrocarbon or non-hydrocarbon solvent is generally carried out at temperatures ranging from 40 to 200°C and pressures of between 0.1 and 7 MPa.

Furthermore, the same can be composed of one or more sections operating with the same solvent or different solvents; the recovery of the solvent can be carried out under sub-critical or super-critical conditions, with several steps, thus allowing a further fractionation between deasphalted oil and resins.

It is advisable for the solvent of this deasphalting step to be selected from light paraffins having from 3 to 6 carbon atoms, preferably from 4 to 5 carbon atoms, or a mixture of the same.

The hydrocracking (HCK) step is carried out in the presence of catalysts in slurry phase, preferably at temperatures ranging from 380 to 480°C, more preferably from 420 to 470°C, at a pressure ranging from 2 to 20 MPa, more preferably from 10 to 18 MPa.

Hydrogen is fed to the hydrocracking reactor which can operate both in the down-flow and, preferably, up-flow mode. This gas can be fed to different sections of the reactor.

The catalyst precursors used can be selected from those obtainable from easily decomposable oil-soluble precursors (metal naphthenates, metal derivatives of phosphonic acids, metal-carbonyls, etc..) or from pre-formed compounds based on one or more transition metals such as Ni, Co, Ru, W and Mo: the latter is preferred thanks to its higher catalytic activity.

The concentration of the catalyst, defined according to the concentration of the metal or metals present in the hydrocracking reactor, ranges from 50 to 5,000 ppm, preferably from 50 to 900 ppm.

The process claimed therein allows the production of a completely deasphalted and demetallized "light syncrude" (atmospheric and vacuum distillates) and also upgraded in terms of density, viscosity, CCR sulphur content.

An embodiment of the present invention is now provided with the help of the enclosed figure 1, which should not be considered as limiting the scope of the invention itself.

In Fig. 1, the heavy feedstock (1) is fractionated in a first distillation zone (D1) from which the light fractions are separated (2) and (3) from the distillation residue (4).

The first distillation residue (4) is sent to a deasphalting unit (SDA), said operation being effected by means of solvent extraction (8).

Two streams are obtained from the deasphalting unit (SDA): one (9) consisting of deasphalted oil (DAO), the other containing asphaltenes (10).

Once the stream consisting of deasphalted oil (9) has been freed from the solvent used for the extraction, it is sent to a hydrocracking zone (HCK).

The stream containing asphaltenes (10) is sent to a gasification section (POx) in order to obtain syngas, i.e. a gaseous mixture of H_2 and CO (11) which is sent to a separation area (GS), whereby a stream essentially consisting of CO (12) is separated and a stream essentially consisting of H_2 (13) which is sent to the hydrocracking step, another part (15) to the hydrotreatment step, thus providing the necessary quantity of hydrogen.

The stream (16) leaving the hydrocracking step (HCK) is sent to a second distillation zone (D2).

In the second distillation zone (D2), consisting of a distillation column, possibly preceded by a flash, the lighter fractions ($D2_1$, D''_2, $D2_3$, ...$D2_n$) are separated from the heavier fraction (19) at the bottom, which is recycled (20) to the first distillation zone (D1) and/or (21) to the deasphalting zone (SDA).

At least part (22) of the heavier light fraction (3), separated in the first distillation zone (D1), can possibly be sent to the hydrocracking (HCK) zone.

Some examples are provided hereunder for a better illustration of the invention, it being understood that the same should not be considered as being limited thereto or thereby.

Example 1: Preparation of a deasphalted oil

- Feedstock: 250 g of atmospheric residue
- Deasphalting agent: about 2.5 l of n-pentane
- Temperature: 180°C
- Pressure: 16 atm.

The residue and a volume of n-pentane equal to 8-10 times the residue volume are charged into an autoclave. The mixture of feedstock and solvent is heated to a temperature of 180°C, with stirring (800 rpm) by means of a mechanical stirrer for a period of 30 minutes. At the end of this operation, the two phases are decanted and separated, the asphaltene phase which is deposited on the bottom of the autoclave and the deasphalted oil phase diluted in the solvent. The decanting lasts for about two hours. The DAO-solvent phase is then transferred to a second tank, by means of a suitable recovery system. The DAO-pentane phase is subsequently recovered, and the solvent is then eliminated by evaporation.

The yield obtained using the procedure described above is equal to 89.8% by weight of deasphalted oil with respect to the starting residue.

Example 2: Hydrocracking of the deasphalted oil with n-pentane.

The test was effected making use of a stirred micro-autoclave of 30 cm^3, according to the following general operative procedure:

- about 10 g of the feedstock are charged into the reactor, and the catalyst precursor is added;
- the system is pressurized with hydrogen and brought to temperature by means of an electrically heated oven;
- during the reaction the system is kept under stirring by a swinging capillary system operating at a rotation rate of 900 rpm; furthermore, the total pressure is kept constant by means of an automatic reintegration system of the hydrogen consumed;
- at the end of the test, quenching of the reaction is

effected; the autoclave is then depressurized and the gases collected in a sampling bag; the gaseous samples are then sent for gas chromatographic analysis;

- the solids are separated from the products present in the reactor by filtration; the liquid products are analyzed in order to determine: the yields to distillates, sulphur content, nitrogen content, carbonaceous residue and metal content.

The reaction was carried out by feeding the feedstock produced in example 1, under the same operative conditions indicated in Table 1. The distribution data obtained are shown in Table 2.

Example 3: Thermal cracking of the deasphalted oil with n-pentane.

The test was effected according to the operative procedure described in Example 2, without the addition of catalyst and by substituting hydrogen with nitrogen. The reaction was carried out by feeding the feedstock produced in example 1, under the operative conditions indicated in Table 1. The product distribution data are shown in Table 2.

Table 1: Operative conditions

Operative conditions	Test A – Example 2	Test B – Example 3
Temperature	460°C	460°C
Residence time	2 hours	2 hours
Pressure	160 bar H_2	160 bar N_2
Molybdenum	100	---

Table 2: Product distribution

Product distribution (w %)	Test A – Example 2	Test B – Example 3
Gas C1-C4	8.4	15.6
C5 – 160°C	26.7	18.1
160-220°C	16.9	10.5
220-365°C	27.3	15.8
365-500°C	12.5	5.7
500°C +	4.3	2.0
Solids	3.9	32.3

CLAIMS

1. A process for the conversion to distillates of heavy feedstocks selected from heavy and extra-heavy crude oils, distillation residues from crude oil or from catalytic treatment, "visbreaking tars", "thermal tars", bitumens from "oil sands" liquids from coals of different origins and other high boiling feedstocks of a hydrocarbon origin, known as "black oils", comprising the following steps:

- sending the heavy feedstock to a first distillation zone (D1) having one or more atmospheric and/or vacuum distillation steps, whereby one or more light fractions are separated from the distillation residue;
- sending the fraction consisting of the distillation residue of the first distillation zone (D1) to a deasphalting zone (DSA) in the presence of solvents, obtaining two streams, one consisting of deasphalted oil (DAO), the other containing asphaltenes;
- sending the stream containing asphaltenes to a gasification zone (PO_x) in order to obtain a mixture of H_2 and CO;
- mixing the stream consisting of deasphalted oil (DAO) with a suitable hydrogenation catalyst and sending the mixture obtained to a hydrocracking (HCK) zone into which hydrogen self-produced in the gasification area

(POx) is introduced, after separation from the mixture containing CO in a gas separation area (GS);

- sending the stream coming from the hydrocracking area to a second distillation area (D2) consisting of one or more flash steps and/or one or more atmospheric distillation steps whereby the different fractions coming from the hydrocracking reaction are separated from the distillation residue, which is recycled to the first distillation area (D1) and/or to the deasphalting area (SDA).

2. The process according to claim 1, wherein the gasification is effected by feeding the stream containing asphaltenes to the gasifier together with oxygen and vapour, which react under exothermic conditions at a temperature of over 1,300 °C and a pressure ranging from 30 to 80 bar, to produce mainly H_2 and CO.

3. The process according to claim 1, wherein, before being sent to the separation zone (GS), the mixture of H_2 and CO obtained in the gasification zone (POx) is sent to a water-gas-shift (WGS) zone to generate hydrogen by means of reaction with water.

4. The process according to claim 1, wherein the first distillation zone (D1) consists of one or more atmospheric distillation steps.

5. The process according to claim 1, wherein the first

distillation zone (D1) consists of one or more distillation steps and a vacuum step.

6. The process according to claim 1, wherein the heavier fraction of the light fractions separated in the first distillation zone, is at least partially sent to the hydrocracking zone (HCK).

7. The process according to claim 1, wherein the distillation steps are carried out at a reduced pressure of between 0.001 and 0.5 MPa.

8. The process according to claim 7, wherein the distillation steps are carried out at a reduced pressure of between 0.01 and 0.3 MPa.

9. The process according to claim 1, wherein the deasphalting step (SDA) is carried out at temperatures ranging from 40 to 200°C and pressures of between 0.1 and 7 MPa.

10. The process according to at least one of the claims from 1 to 9, wherein the solvent of the deasphalting step (SDA) is a light paraffin or a mixture of light paraffins having a number of carbon atoms ranging from 3 to 6.

11. The process according to claim 10, wherein the deasphalting solvent is a light paraffin or a mixture of light paraffins, having a number of carbon atoms ranging from 4 to 5.

12. The process according to claim 1, wherein the

deasphalting step (SDA) is carried out with the recovery of the solvent under supercritical conditions.

13. The process according to claim 1, wherein the hydrocracking step (HCK) is carried out at temperatures ranging from 380 to 480°C, preferably from 420 to 470°C, and at a pressure ranging from 2 to 20 MPa, preferably between 10 and 18 MPa.

14. The process according to at least one of the claims from 1 to 13, wherein the hydrogenation catalyst for hydrocracking is an easily decomposable precursor or a preformed compound based on one or more transition metals.

15. The process according to claim 14, wherein the transition metal is molybdenum.

16. The process according to claim 1, wherein the concentration of the catalyst in the hydrocracking reactor, defined on the basis of the concentration of the metal or metals present, ranges from 50 to 5,000 ppm.

17. The process according to claim 15, wherein the concentration of the catalyst in the hydrocracking reactor ranges from 50 to 900 ppm.

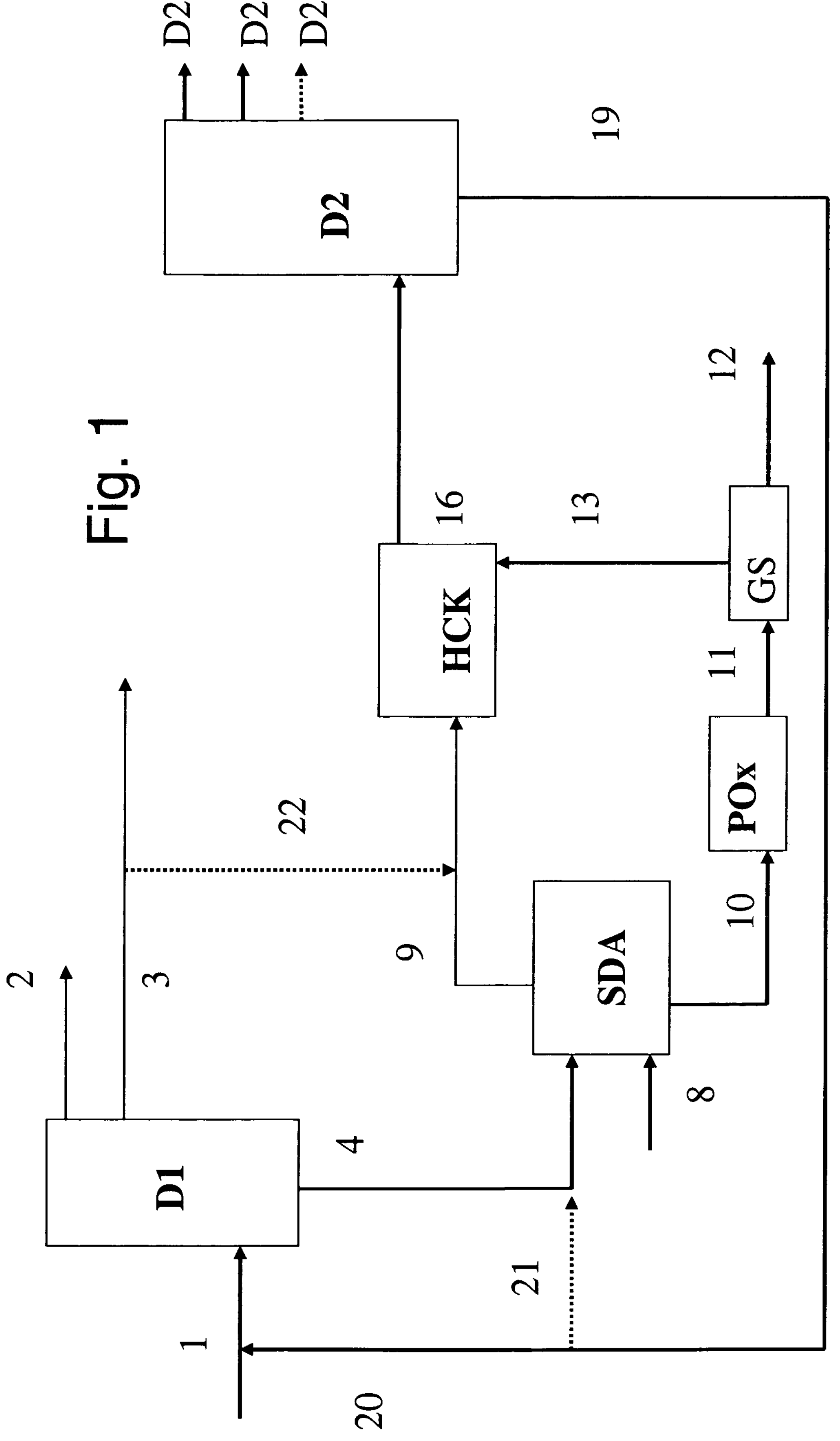

Fig. 1

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2008/005207

A. CLASSIFICATION OF SUBJECT MATTER
INV. C10G21/00 C10G47/02 C10G67/04 C01B3/34

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 C01B

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 practical, 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	EP 1 785 468 A (BOC GROUP INC [US]) 16 May 2007 (2007-05-16) figure 1 paragraph [0015]	1-17
X	US 5 958 365 A (LIU STEPHEN K [US]) 28 September 1999 (1999-09-28) figure 2	1-17
X	US 2004/118745 A1 (RETTGER PHILIP [US] ET AL) 24 June 2004 (2004-06-24) figures 1,2 paragraph [0068]	1-17
P,X	WO 2008/017742 A (IFP [FR]; LENGLET ERIC [FR]; ROJEY ALEXANDRE [FR]) 14 February 2008 (2008-02-14) figure 1	1-17

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☒ 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 30 September 2008	Date of mailing of the international search report 09/10/2008
Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31–70) 340–2040, Tx. 31 651 epo nl, Fax: (+31–70) 340–3016	Authorized officer Bernet, Olivier

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