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Nederland te Petten.**

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54 **Method and system for gasifying biomass.**

57 Method and system for gasifying biomass. Tar loaded gas from the reactor for gasifying the biomass is subjected to a saturation and absorption treatment with a first and second fluid respectively. The first fluid comprises aromatic hydrocarbons whilst the second fluid comprises linear hydrocarbons. Tars received in the aromatic fluid is entered together with such fluid in a separation column. Separation is effected based on evaporation temperature and the lighter fraction is returned to the inflow of the saturation separator. The heavier fractions are either discharged or sent back to the biomass reactor. An intermediate buffer vessel can be provided between the discharge of the saturation cleaner and the separator.

NL C 2003547

Dit octrooi is verleend ongeacht het bijgevoegde resultaat van het onderzoek naar de stand van de techniek en schriftelijke opinie. Het octrooischrift wijkt af van de oorspronkelijk ingediende stukken. Alle ingediende stukken kunnen bij NL Octrooicentrum worden ingezien.

Method and system for gasifying biomass.

5 The present invention relates to a method for gasifying biomass in a reactor at a temperature of 600-1300°C and cleaning the gas flow resulting therefrom, more particular removing tars from the gas flow, comprising removal of said tars in two steps, wherein in a first upstream cleaning step the gas from the reactor is saturated at a temperature of 250-900°C with a first fluid based on hydrocarbons, and wherein in a second cleaning step subsequent to the first cleaning step the remaining tars are absorbed with a second fluid on hydrocarbon base.

10 Such a method is known from WO 03/018723 of applicant. Therein a so-called OLGA system is disclosed which is specifically designed for gasifying biomass. The gas which results from gasifying is subjected to a two step cleaning treatment to remove tars. In a first step the gas is condensed in a first cleaning fluid which is an oil. Saturating can take place for example by showering oil in the gas stream..

15 In a second stage oil is used for absorption of the remaining tars in an absorption column.

After use the oil laden with tars is discharged to a separator wherein the heavy fractions are returned to the biomass gasifier and the lighter fractions are further used as oil for the above process.

20 Although theoretically a well functioning system, in practice it revealed that at after a start up period in which cleaning was very effective, subsequently least in the first cleaning step a substantial part of the tars is not removed and has to be removed in the second absorption step. However the absorber used to this end should have relatively small dimensions. This means that the efficiency of the first cleaning step is not as could be expected. Furthermore the oil quality changes in time, requiring some form of oil recovery.

The invention aims to overcome this objection and to provide a first cleaning step wherein a more substantial part of the tars present in the gas and being specific for biomass gasification can be removed.

30 According to the invention this aim is realised with a method as described above wherein the first fluid substantially comprises aromatic hydrocarbons.

Surprisingly it has been found that if aromatic hydrocarbons are used the efficiency of cleaning in the first cleaning step can considerably be increased.

In the original OLGA concept as cleaning oil an aliphatic hydrocarbon was used having a linear molecule chain, or alkene.

It appears and can be explained that the solving properties of aromatic tar components in an aromatic solvent are much better than in an aliphatic solvent.

5 According to a preferred embodiment of the invention the aromatic hydrocarbons are carbons corresponding to the aromatic hydrocarbons of the tars. More particular such hydrocarbons comprise both heavy and light tars. A relatively light tar is defined as a tar comprising up to three to four rings PAH.

10 According to a further preferred embodiment a first mixture comprising the first cleaning fluid and the tar received therein are subjected to a first separation step. In such separation step separation is effected based on the evaporation temperature of the related component in the first mixture. According to a preferred embodiment the lighter fraction resulting from such separation is added to the gas flow from the gasifying reactor and the heavier fraction is discharged. Part of this discharged heavy fraction can  
15 be returned to the inlet of the biomass reactor, or, as this fraction contains much chemical energy, can be used for other heating purposes..

As example the lighter fraction contains one or more of ethylbenzene, m/p-xylene, o-xylene+styrene, phenol, o-cresol, indene, m/p-cresol, naphthalene, quinoline, isoquinoline, 2-methyl-naphthalene, 1-methyl-naphthalene, biphenyl, ethenyl-naphthalene,  
20 acenaphthylene, acenaphthene, fluorene, phenanthrene, anthracene, fluoranthene, pyrene and the heavier fraction contains for example one or more of benzo(a)-anthracene, chrysene, benzo(b)-fluoranthene, benzo(k)-fluoranthene, benzo(e)-pyrene, benzo(a)-pyrene, perylene, indeno(123-cd)-perylene, dibenzo(ah)-anthracene, benzo(ghi)-perylene, coronene.

25 According to a further preferred embodiment the first mixture is not directly subjected to the first separation step but stored in an intermediate buffer. From this intermediate buffer part of the first mixture is entered in the first separator described above. A further part is subjected to the first cleaning step. This means that the first mixture from the first cleaning step is only partially subjected to the first separation  
30 step. Furthermore to such intermediate buffer substances can be added having effect on the viscosity of the mixture therein. More particular dust (char and ash) like substances can be added for increasing the viscosity. As example dust separated from the gas from the biomass reactor is mentioned. Such dust can be separated from the gas in a step

before the first cleaning step or after the first cleaning step. If separation is effected before the first cleaning step preferably cleaning based on gravity such as in een cyclone is effected. If separation is effected after the first cleaning step preferably separation is effected through an electrostatic filter.

5           After the first cleaning step a second cleaning step is provided being based on absorption.

It will be noticed that in this process substances can be added to maintain the required cleaning properties of the first fluid. Furthermore steps should be taken to increase, maintain or decrease the relevant temperature at the related position.

10           Downstream from the first cleaning step a second cleaning step is provided which could be effected by absorption through the use of an oil having a more linear molecule chain structure (aliphatic oil). Relative minor quantities of tars could very effectively be removed in such downstream absorption system. However it is a prerequisite that in the first separation step most of the tars are already removed.

15           The invention also relates to a system gasifying biomass, comprising a biomass gasifier having an inlet for biomass to be gasified and an outlet for resulting gas, said outlet being connected with a first cleaning device, said first cleaning device comprising an inlet connected with said outlet as well as an inlet for a first cleaning fluid, an outlet for cleaned gas and an outlet for product resulting from cleaning,  
20           wherein said first cleaning device comprises a saturation device and said outlet is connected with a first separator device for recovery of said first fluid from said outlet, wherein said first separator device comprises a stripper column of which the outlet for light aromatic fractions is connected with inlet for a first cleaning fluid of said first cleaning device and the outlet for heavy aromatic fraction is connected with a  
25           discharge.

More particular a buffer vessel is provided connected between the first cleaning device and the first separator device wherein such buffer vessel is connected with the inlet for first cleaning fluid of said first cleaning device. The invention will be further elucidated referring to an example thereof which is schematically shown in the single  
30           figure.

In the figure a system according to the invention is schematically shown. A biomass gasifier 3 is provided to which a flow of biomass 1 is added through its inlet  
40. A gasifying gas such as air, oxygen and/or steam is schematically indicated by 2

and entered at inlet 43. Except from biomass 1 also a flow of relatively heavy tars at 34 can be entered through either inlet 40 or a separate inlet 42, depending on the type of gasifier (e.g. single or dual reactor gasifier)..

In the biomass gasifier gasification takes place at a temperature of 600-1300°C.  
5 Sub-stoichiometric quantities of oxygen are supplied.

The gasses leaving the outlet 41 of the gasifier contain except from the desired components (CO, H<sub>2</sub>, H<sub>2</sub>O, CH<sub>4</sub>) also (carbon) dust and tars (heavier hydrocarbons).

In a first step separation based on gravitation and more particular with a cyclone  
5 for removing dust the production of gas 6 is realised. The flow of dust resulting from  
10 the cyclone is indicated by 7 and is partially fed to inlet 53 of a buffer vessel 13, as  
shown with arrow 37, whilst a further part thereof can be discharged through other  
means as is indicated by 38.

The (partly dust) cleaned gas flow 6 is mixed with the lighter fraction from the  
product 22. The mixture resulting is indicated by 29 and is entered in a saturation  
15 device 8. Through inlet 46 of the saturation device a first cleaning fluid 11 is sprayed in  
downward direction on the gas flow which moves in upward direction to outlet 47.  
Most of the tars contained in the gas flow are caught in this way and together with the  
first fluid discharged through outlet 49 and entered in buffer vessel 13 as indicated by  
arrow 12. Except from an inlet for the discharge of first cleaning device 8 buffer vessel  
20 13 comprises the inlet 53 as described above for dust particles from the cyclone 5. Also  
an inlet 34 is provided to which further dust from a downstream filter 15 can be entered  
as is indicated by arrow 35. The buffer vessel 13 has two outlets one outlet 56 for the  
first cleaning fluid 11 which is supplied to a pump 10 as shown by arrow 9 and  
subsequently entered in the first separator device 8. A second outlet 57 provides the  
25 connection through arrow 22 to a separator column 23. In this column 23 a gas 24 is  
entered in the lower part thereof. This gas is preferably from an outside source and can  
comprise steam, carbon dioxide and/or nitrogen. It is also possible that this gas is part  
of the final product gas and this gas is indicated by 26 in the figure. Such relatively  
clean gas 24 is entered in the lower part of the column 23 and could be pre-heated.  
30 Because of the flow of such gas, separation based on evaporation temperature is  
effected. The lighter fraction from the product 22 entering the inlet 52 of column 23  
is separated through outlet 50, this flow 28 is mixed with the gas flow 5 resulting in flow  
29.

For example the evaporation temperature in the first separator device 8 is 280-320°C. However this depends on the light fraction which is acceptable in the gas flow 6.

5 The heavier portion of the mixture, comprising the tars and dust, and the first cleaning fluid will not evaporate and is discharged through outlet 51. This flow 30 can partially be returned to the lower side of the biomass gasifier as is indicated by arrow 32, pump 33 and arrow 34. However it is also possible to discharge this heavy fraction in another way as indicated by arrow 31. Of course it is possible that depending on the circumstances one of these discharges is (more) preferred.

10 Except from tars containing only hydrocarbons and dust also sulphur and chloride containing compositions can be removed from the gas flow.

Through the addition of solid components such as dust as indicated by arrows 35 and 37 the viscosity of the mixture in vessel 13 as well as product 30 will change. This can be desirable and the ratio of the dust from cyclone 5 being entered in vessel 13 and 15 being discharged as indicated by arrow 38 as well as the ratio of quantities being discharged according to arrows 35 and 36 determine the increase in viscosity of the mixture leaving the vessel 13.

As indicated above downstream from the first separator device 8 a filter 15 is provided. Preferably this filter 15 is an electrostatic precipitator removing dust. After 20 the two dust removal steps at 5 and 15 the gas is substantially free of dust and this gas flow 17 is entered into the lower part of an absorber 18. A flow of (alkane based) oil (aliphatic) is entered in the top of this absorber indicated by 19. The tars together with the oil are discharged through 20 whilst the clean gas not containing tars is indicated by 21. A part of it can be recycled through 26 and the gas indicated with 27 is the final 25 product gas.

Example:

In an example the gas stream 6 has a temperature above the tar dewpoint of the gas, typically 200 to 400 degrees Celsius at atmospheric conditions, slightly higher at elevated pressures. The gas is partially condensed in column 8 by oil with a 30 temperature preferably slightly above the water dewpoint of the gas stream 6, typically 50 to 90 degrees Celsius. The mixture in vessel 13 as such will have a temperature in between the initial oil temperature and the initial gas stream temperature, hence between 150 and 250 degrees Celsius. This temperature is increased typically with 50

to 100 degrees Celsius in order to provide the separation of stream 50 and 51. The yields at the different stages will strongly depend on the composition of the gas stream 6, hence the gasifier applied and the operating conditions of the gasifier chosen. For gasifiers without primary tar measures like catalytic bed materials implemented the split off between light and heavy tars in column 8 will be between 20 and 80%. The split off in column 23 will strongly depend on the desired viscosity of the mixture in vessel 13 and of the product 51, though typically 30 tot 70% will be separated from the top.

After the above it will be immediately clear for the person skilled in the art that numerous changes can be brought about to the system as described above depending on the purpose of use. More particular depending from the contents of the biomass added to the gasifier 3, the desired output of the system and the allowable discharge adaptations can be made to the several process flows and further devices can be added or omitted.

Such amendments are within the range of a person skilled in the art and within the scope of the appended claims.

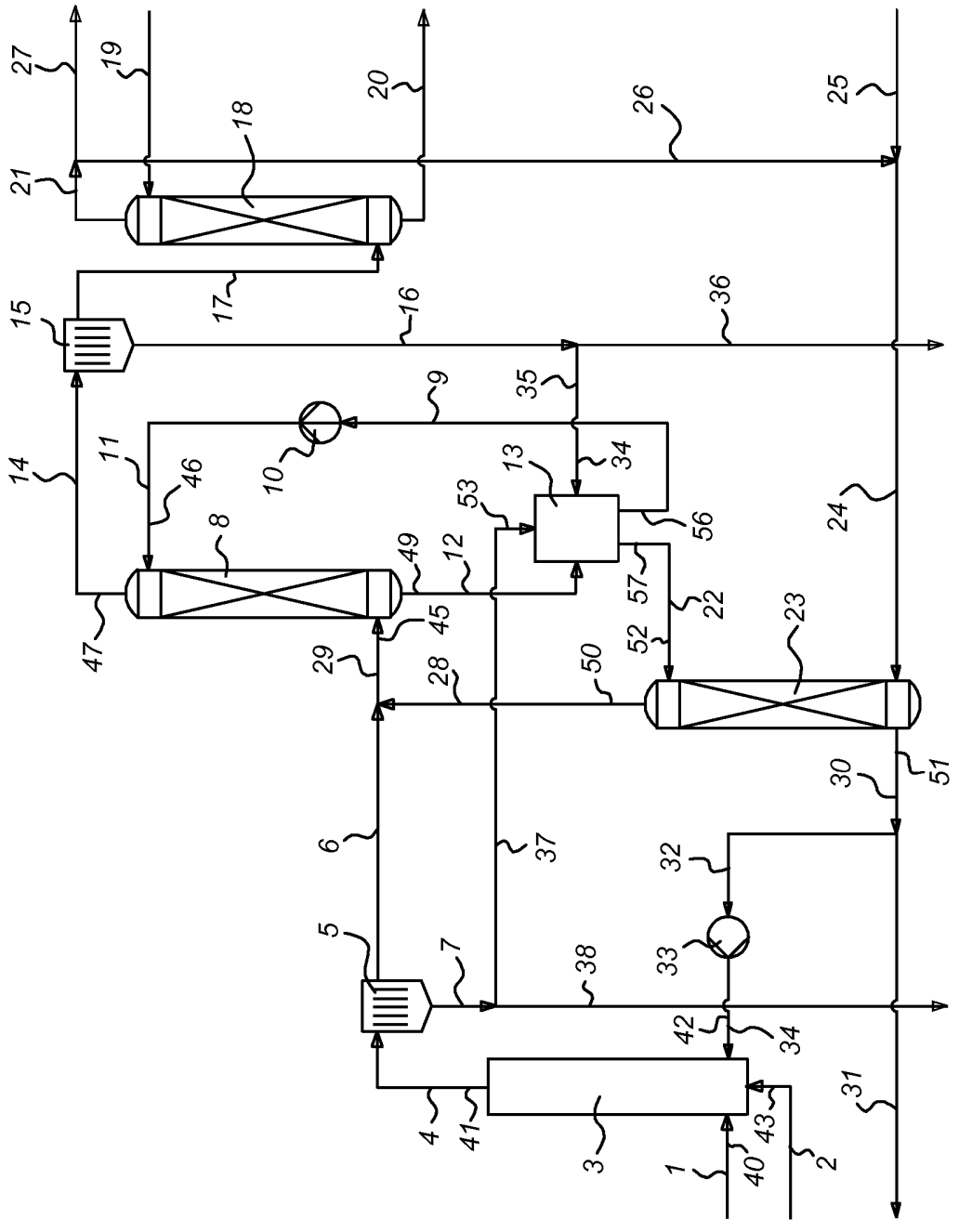
CONCLUSIES

1. Werkwijze voor het vergassen van biomassa in een reactor (3) bij een  
5 temperatuur van 600-1300°C en het reinigen van de daarbij ontstane gasstroom  
door het uit die gasstroom verwijderen van teersoorten, omvattende het in twee  
stappen verwijderen van die teersoorten, waarbij in een eerste stroomopwaartse  
reinigingsstap het uit de reactor afkomstige gas bij een temperatuur van  
250-900°C verzadigd wordt met een eerste fluïdum op koolwaterstofbasis en het  
10 in een tweede reinigingsstap volgend op de eerste reinigingsstap absorberen van  
de resterende teersoorten met een tweede fluïdum op koolwaterstofbasis, met het  
kenmerk, dat dat eerste fluïdum in hoofdzaak aromatische koolwaterstoffen  
omvat.
2. Werkwijze volgens conclusie 1, waarbij dat eerste fluïdum met de te verwijderen  
15 teersoorten overeenkomende aromatische koolwaterstoffen omvat.
3. Werkwijze volgens een van de voorgaande conclusies, waarbij het bij de eerste  
reinigingsstap vrijkomende eerste mengsel van teersoorten een eerste fluïdum  
gescheiden van dat tweede fluïdum aan een eerste scheidingsstap (23) toegevoerd  
20 wordt, waarbij in die eerste scheidingsstap scheiding op basis van  
verdampingstemperatuur van de betreffende fractie uitgevoerd wordt.
4. Werkwijze volgens conclusie 3, waarbij de lichte fractie die ontstaat bij de eerste  
scheidingsstap aan de gasstroom afkomstig van de reactor toegevoerd wordt bij  
25 de eerste reinigingsstap.
5. Werkwijze volgens conclusie 4, waarbij de lichte fractie omvat een of meer van  
ethylbenzeen, m/p-xyleen, o-xyleen+styreen, fenol, o-cresol, indeen, m/p-cresol,  
naftaleen, chinoline, isochinoline, 2-methyl-naftaleen, 1-methyl-naftaleen,  
30 bifenyl, ethenyl-naftaleen, acenaftyleen, acenafteen, fluoreen, fenantreen,  
anthraceen, fluorantheen, pyreen en waarbij de zware fractie omvat een of meer  
van benzo(a)-anthraceen, chryseen, benzo(b)-fluorantheen, benzo(k)-

fluorantheen, benzo(e)-pyreen, benzo(a)-pyreen, peryleen, indeno(123-cd)-perylene, dibenzo(ah)-anthraceen, benzo(ghi)-perylene, coroneen.

- 5 6. Werkwijze volgens een van de conclusies 3-5, waarbij dat eerste mengsel voor de eerste scheidingsstap in een opslag (13) gebracht wordt, een deel van het eerste mengsel aan die eerste scheidingsstap onderworpen wordt en een ander deel vanuit die opslag opnieuw gebruikt wordt voor die eerste reinigingsstap.
- 10 7. Werkwijze volgens een van de voorgaande conclusies, waarbij dat gas voor die eerste reinigingsstap in een cycloon (5) gereinigd wordt.
- 15 8. Werkwijze volgens een van de voorgaande conclusies, waarbij dat gas tussen die eerste en tweede reinigingsstap door een elektrostatisch filter (15) gereinigd wordt.
- 20 9. Werkwijze volgens een van de conclusies 6-8, waarbij de bij het reinigen van die cycloon of elektrostatisch filter vrijkomende niet gasvormige fractie aan die opslag (13) toegevoerd wordt.
- 25 10. Werkwijze volgens conclusie 9, waarbij de viscositeit van het uit de opslag tredende fluïdum door de toevoer volgens conclusie 9 geregeld wordt.
- 30 11. Werkwijze volgens een van de voorgaande conclusies, waarbij dat tweede fluïdum in hoofdzaak lineaire koolwaterstoffen omvat.
12. Stelsel voor het vergassen van biomassa (1) omvattende een biomassavergasser (3) met een inlaat (40) voor te vergassen biomassa en een uitlaat voor daarbij ontstaand gas, waarbij die uitlaat (41) verbonden is met een eerste reinigingsinrichting (8) welke eerste reinigingsinrichting (8) een met die uitlaat (41) verbonden inlaat (45) omvat, alsmede een inlaat (46) voor een eerste reinigingsfluïdum, een uitlaat (47) voor gereinigd gas en een afvoer (49) voor bij die reiniging vrijkomend restproduct, waarbij die eerste reinigingsinrichting een verzadigingsinrichting omvat, waarbij die afvoer (49) verbonden is met een eerste

- 5  
scheidingsinrichting (23) voor het terugwinnen van dat eerste fluidum uit die afvoerstroom, met het kenmerk, dat die eerste scheidingsinrichting (23) een destillatiekolom omvat, waarvan de uitlaat (50) voor lichte aromatische fracties verbonden is met de inlaat (45) voor eerste reinigingsfluidum van die eerste  
5  
reinigingsinrichting, en de uitlaat (51) voor zware aromatische fracties met een afvoer (30) verbonden is.
- 10  
13. Stelsel volgens conclusie 12, omvattende een opslagvat (13) geschakeld tussen die eerste reinigingsinrichting (8) en die eerste scheidingsinrichting (23), waarbij dat opslagvat met de inlaat (46) voor dat eerste reinigingsfluidum van die eerste  
10  
reinigingsinrichting (8) verbonden is.
- 15  
14. Stelsel volgens conclusie 13, waarbij het opslagvat (13) voorzien is van een toevoer (53, 54) voor viscositeitverhogende stoffen.
- 20  
15. Stelsel volgens conclusie 14, omvattende een tussen die vergasser (3) en die eerste reinigingsinrichting (8) geschakelde gravitatiescheider (5), waarvan de afvoer (7) met die opslag (13) verbonden is en een na die eerste reinigingsinrichting (8) aangebracht elektrostatisch filter (15) waarvan de afvoer  
20  
(16) met die opslag (13) verbonden is.



## SAMENWERKINGSVERDRAG (PCT)

### RAPPORT BETREFFENDE NIEUWHEIDSONDERZOEK VAN INTERNATIONAAL TYPE

IDENTIFICATIE VAN DE NATIONALE AANVRAGE	KENMERK VAN DE AANVRAGER OF VAN DE GEMACHTIGDE  <b>P6025900NL</b>
Nederlands aanvraag nr.  <b>2003547</b>	Indieningsdatum  <b>25-09-2009</b>
	Ingeroepen voorrangsdatum
Aanvrager (Naam)  <b>Stichting Energieonderzoek Centrum Nederland</b>	
Datum van het verzoek voor een onderzoek van internationaal type  <b>03-11-2009</b>	Door de Instantie voor Internationaal Onderzoek aan het verzoek voor een onderzoek van internationaal type toegekend nr.  <b>SN 53199</b>
<b>I. CLASSIFICATIE VAN HET ONDERWERP</b> (bij toepassing van verschillende classificaties, alle classificatiesymbolen opgeven)	
Volgens de internationale classificatie (IPC)  <b>C10K1/18                      C10J3/84</b>	
<b>II. ONDERZOCHE GEBIEDEN VAN DE TECHNIEK</b>	
Onderzochte minimumdocumentatie	
Classificatiesysteem	Classificatiesymbolen
<b>IPC 8</b>	<b>C10K                      C10J</b>
Onderzochte andere documentatie dan de minimum documentatie, voor zover dergelijke documenten in de onderzochte gebieden zijn opgenomen	
III. <input type="checkbox"/>	<b>GEEN ONDERZOEK MOGELIJK VOOR BEPAALDE CONCLUSIES</b> (opmerkingen op aanvullingsblad)
IV. <input type="checkbox"/>	<b>GEBREK AAN EENHEID VAN UITVINDING</b> (opmerkingen op aanvullingsblad)

**ONDERZOEKSRAPPORT BETREFFENDE HET  
RESULTAAT VAN HET ONDERZOEK NAAR DE STAND  
VAN DE TECHNIEK VAN HET INTERNATIONALE TYPE**

Nummer van het verzoek om een onderzoek naar  
de stand van de techniek  
NL 2003547

A. CLASSIFICATIE VAN HET ONDERWERP  
INV. C10K1/18 C10J3/84  
ADD.

Volgens de Internationale Classificatie van octrooien (IPC) of zowel volgens de nationale classificatie als volgens de IPC.

**B. ONDERZOCHE GEBIEDEN VAN DE TECHNIEK**

Onderzochte minimum documentatie (classificatie gevolgd door classificatiesymbolen)  
C10K C10J

Onderzochte andere documentatie dan de minimum documentatie, voor dergelijke documenten, voor zover dergelijke documenten in de onderzochte gebieden zijn opgenomen

Tijdens het onderzoek geraadpleegde elektronische gegevensbestanden (naam van de gegevensbestanden en, waar uitvoerbaar, gebruikte trefwoorden)

EPO-Internal

**C. VAN BELANG GEACHTE DOCUMENTEN**

Categorie °	Geciteerde documenten, eventueel met aanduiding van speciaal van belang zijnde passages	Van belang voor conclusie nr.
X	WO 2008/010717 A2 (STICHTING ENERGIE [NL]; VAN PAASEN SANDER VINCENT BERN [NL]) 24 januari 2008 (2008-01-24) * bladzijde 6, regel 26 - bladzijde 10, regel 20; figuur 1 *	1-15
X,D	WO 03/018723 A1 (STICHTING ENERGIE [NL]; BOERRIGTER HAROLD [NL]; BERGMAN PETER CHRISTIA) 6 maart 2003 (2003-03-06) in de aanvraag genoemd * bladzijde 3, regel 31 - bladzijde 4, regel 1; conclusie 1; figuur 1 * * bladzijde 5, regel 6 - regel 13 * * bladzijde 6, regel 20 - regel 30 *	1-15
A	GB 158 915 A (BARBET & FILS & CIE E) 24 februari 1921 (1921-02-24) * het gehele document *	1-15
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Verdere documenten worden vermeld in het vervolg van vak C.

Leden van dezelfde octrooifamilie zijn vermeld in een bijlage

° Speciale categorieën van aangehaalde documenten

\*A\* niet tot de categorie X of Y behorende literatuur die de stand van de techniek beschrijft

\*D\* in de octrooiaanvraag vermeld

\*E\* eerdere octrooi(aanvraag), gepubliceerd op of na de indieningsdatum, waarin dezelfde uitvinding wordt beschreven

\*L\* om andere redenen vermelde literatuur

\*O\* niet-schriftelijke stand van de techniek

\*P\* tussen de voorrangsdatum en de indieningsdatum gepubliceerde literatuur

\*T\* na de indieningsdatum of de voorrangsdatum gepubliceerde literatuur die niet bezwend is voor de octrooiaanvraag, maar wordt vermeld ter verheldering van de theorie of het principe dat ten grondslag ligt aan de uitvinding

\*X\* de conclusie wordt als niet nieuw of niet inventief beschouwd ten opzichte van deze literatuur

\*Y\* de conclusie wordt als niet inventief beschouwd ten opzichte van de combinatie van deze literatuur met andere geciteerde literatuur van dezelfde categorie, waarbij de combinatie voor de vakman voor de hand liggend wordt geacht

\*&\* lid van dezelfde octrooifamilie of overeenkomstige octrooipublicatie

Datum waarop het onderzoek naar de stand van de techniek van internationaal type werd voltooid

22 juni 2010

Verzenddatum van het rapport van het onderzoek naar de stand van de techniek van internationaal type

Naam en adres van de instantie

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

De bevoegde ambtenaar

Gzil, Piotr

**ONDERZOEKSRAPPORT BETREFFENDE HET  
RESULTAAT VAN HET ONDERZOEK NAAR DE STAND  
VAN DE TECHNIEK VAN HET INTERNATIONALE TYPE**

Nummer van het verzoek om een onderzoek naar  
de stand van de techniek  
**NL 2003547**

C.(Vervolg). VAN BELANG GEACHTE DOCUMENTEN		
Categorie °	Geciteerde documenten, eventueel met aanduiding van speciaal van belang zijnde passages	Van belang voor conclusie nr.
A	GB 568 593 A (FOSTER WHEELER LTD; RAOUL KONRAD FISCHER) 12 april 1945 (1945-04-12) * het gehele document * -----	1-15

**ONDERZOEKSRAPPORT BETREFFENDE HET  
RESULTAAT VAN HET ONDERZOEK NAAR DE STAND  
VAN DE TECHNIEK VAN HET INTERNATIONALE TYPE**

Informatie over leden van dezelfde octrooifamilie

Nummer van het verzoek om een onderzoek naar  
de stand van de techniek

NL 2003547

In het rapport genoemd octrooigescrift	Datum van publicatie	Overeenkomend(e) geschrift(en)	Datum van publicatie
WO 2008010717	A2	24-01-2008	NL 2000151 C2 24-01-2008
			NL 2000151 A1 22-01-2008
WO 03018723	A1	06-03-2003	AT 311427 T 15-12-2005
			CA 2458365 A1 06-03-2003
			DE 60207735 D1 05-01-2006
			DE 60207735 T2 03-08-2006
			DK 1419222 T3 27-03-2006
			EP 1419222 A1 19-05-2004
			ES 2254711 T3 16-06-2006
			JP 2005501169 T 13-01-2005
			NL 1018803 C2 25-02-2003
			US 2004220285 A1 04-11-2004
GB 158915	A	24-02-1921	GEEN
GB 568593	A	12-04-1945	GEEN



OCTROOICENTRUM NEDERLAND

WRITTEN OPINION

File No. SN53199	Filing date ( <i>day/month/year</i> ) 25.09.2009	Priority date ( <i>day/month/year</i> )	Application No. NL2003547
International Patent Classification (IPC) INV. C10K1/18 C10J3/84			
Applicant Stichting Energieonderzoek Centrum Nederland te Pe			

This opinion contains indications relating to the following items:

- Box No. I Basis of the opinion
- Box No. II Priority
- Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- Box No. IV Lack of unity of invention
- Box No. V Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- Box No. VI Certain documents cited
- Box No. VII Certain defects in the application
- Box No. VIII Certain observations on the application

	Examiner Gzil, Piotr
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## WRITTEN OPINION

Application number

NL2003547

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### Box No. I Basis of this opinion

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1. This opinion has been established on the basis of the latest set of claims filed before the start of the search.
2. With regard to any **nucleotide and/or amino acid sequence** disclosed in the application and necessary to the claimed invention, this opinion has been established on the basis of:
  - a. type of material:
    - a sequence listing
    - table(s) related to the sequence listing
  - b. format of material:
    - on paper
    - in electronic form
  - c. time of filing/furnishing:
    - contained in the application as filed.
    - filed together with the application in electronic form.
    - furnished subsequently for the purposes of search.
3.  In addition, in the case that more than one version or copy of a sequence listing and/or table relating thereto has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.
4. Additional comments:

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### Box No. V Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

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#### 1. Statement

Novelty	Yes: Claims	
	No: Claims	1-15
Inventive step	Yes: Claims	
	No: Claims	1-15
Industrial applicability	Yes: Claims	1-15
	No: Claims	

#### 2. Citations and explanations

**see separate sheet**

**Re Item V**

**Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

Reference is made to the following documents:

- D1 WO 2008/010717 A2 (STICHTING ENERGIE [NL]; VAN PAASEN SANDER VINCENT BERN [NL]) 24 januari 2008 (2008-01-24)
- D2 WO 03/018723 A1 (STICHTING ENERGIE [NL]; BOERRIGTER HAROLD [NL]; BERGMAN PETER CHRISTIA) 6 maart 2003 (2003-03-06)

- 1 Document D1 discloses the gasification of biomass comprising (the references in parentheses applying to document D1, the references in straight parentheses applying to Fig. 1 of D1) feeding biomass [2] to a gasification reactor [1] operated at a temperature of 600-1300 °C, passing the produced gas through a cyclone [6,10] to an oil condenser [12] at a temperature of [380 °C], supplying a wash oil [14] to the oil condenser [12] to saturate the gas with the oil and thereby remove tar from the gas, whereby the wash oil is preferably a tar oil, i.e. a mixture of aromatic compounds, discharging the liquid oil [16] from the oil condenser [12] and transferring it to a separation unit consisting of a filter [30] wherein the dust particles and liquid tar [17,19] are separated from the washing oil [14] which is recycled to the oil condenser [12], passing the saturated gas [15] from the oil condenser [12] to an electrostatic precipitator [18], further passing the gas to an absorber device [32] and supplying a wash oil [35] to the absorber device (p. 6, line 26 - p. 10, line 20).
- 2 Document D2 discloses a method for gasifying biomass comprising (the references in parentheses applying to document D2, the references in straight parentheses applying to Fig. 1 of D2) feeding biomass to a reactor [1] operated at a temperature of 600-1300 °C, subjecting the synthesis gas obtained [3] to a cleaning step in order to remove the grades of tar which are present from it, said cleaning of synthesis gas comprising saturating the gas with an oil [8] and subsequently passing the gas through an absorption device [15] while further oil is being added in order to absorb the tar (claim 1).
- 2.1 - The cleaning step is performed at a relatively high temperature, such as 500 °C (p. 3, line 31 - p. 4, line 1); a temperature of 280 °C is also disclosed (p. 7, line 22).
- The tar which is separated out of the synthesis gas is preferably used as the oil in the saturation step (p. 5, lines 6-13). Such tar comprises mainly aromatic hydrocarbons (see also p. 6, lines 20-30).

- 3 The present application therefore does not meet the criteria of patentability, because the subject-matter of independent claim 1 is not new.
- 4 Document D1 is regarded as being the prior art closest to the subject-matter of independent claim 12, and discloses the gasification of biomass and the corresponding apparatus comprising (the references in parentheses applying to document D1, the references in straight parentheses applying to Fig. 1 of D1) feeding biomass [2] to a gasification reactor [1], passing the produced gas through a cyclone [6,10] to an oil condenser [12], supplying a wash oil [14] to the oil condenser [12] to saturate the gas with the oil and thereby remove tar from the gas, discharging the liquid oil [16] from the oil condenser [12] and transferring it to a separation unit consisting of a filter [30] wherein the dust particles and liquid tar [17,19] are separated from the washing oil [14] which is recycled to the oil condenser [12], passing the saturated gas [15] from the oil condenser [12] to an electrostatic precipitator [18], further passing the gas to an absorber device [32] and supplying a wash oil [35] to the absorber device (p. 6, line 26 - p. 10, line 20).
- 4.1 The subject-matter of claim 12 therefore differs from this known apparatus in that the separation unit for the recovery of the washing oil comprises a distillation column whereas the separation unit of D2 comprises a filter. No unexpected technical effect results from this difference and the objective technical problem may therefore be formulated as providing an alternative separation unit for the recovery of the washing oil.
- 4.2 The feature of a distillation column is merely one of several straightforward possibilities from which the skilled person would select, in accordance with circumstances, without the exercise of inventive skill, in order to solve the problem posed. It is moreover pointed out that the regeneration of a washing oil through a distillation step is already disclosed in documents D3 (p. 2, lines 9-13) and D4 (p. 2, lines 60-75).
- 4.3 The present application therefore does not meet the criteria of patentability, because the subject-matter of independent claim 12 does not involve an inventive step.
- 5 The additional features of dependent claims 2-11 and 13-15 are either known from documents D1 and D2 or do not appear to be associated with an unexpected technical effect that could support an inventive step.