

used, and these are independent or can be used collectively.

[0026]

Thus, to the biogas containing methane and carbon dioxide, the high Btu gas for quantity-of-heat regulation is added at a predetermined ratio, and it is considered as mixed gas. And the gas for fuel by which the high Btu gas was added to methane above specified proportion can be obtained by separating carbon dioxide from this mixed gas. Setting up the addition ratio of a high Btu gas here to double the quantity of heat of the fuel gas obtained eventually with standards, such as town gas, is performed.

[0027]

The mixed gas with which propane was added with specified proportion to biogas is voltage-increased by the predetermined pressure of a 0.5 - 0.9MPa (gage pressure) degree with the compressor 6, and is introduced into the methane concentration equipment 1. Therefore, in this embodiment, the adding means of a high Btu gas adds a high Btu gas to biogas in the upper stream of the compressor 6 as pressure rising means which voltage-increase the gas introduced into the 1st concentration equipment 11 mentioned later.

[0028]

Although carbon dioxide is separated from the mixed gas of methane and carbon dioxide and methane is condensed, the above-mentioned methane concentration equipment 1, In addition to methane and carbon dioxide, the propane as a high Btu gas is also added, and the mixed gas of this embodiment separates carbon dioxide from this mixed gas, and condenses methane and a high Btu gas. As for the above-mentioned mixed gas, other gas, such as air, may be mixed in addition to methane, a high Btu gas, and carbon dioxide.

[0029]

The above-mentioned methane concentration equipment 1 is provided with the 1st concentration equipment 11, the 2nd concentration equipment 12, and the recovery system 13 which were provided with the separation film, respectively, and is constituted.

[0030]

The 1st concentration equipment 11 makes carbon dioxide transmit preferentially from the above-mentioned mixed gas by a separation film, and condenses methane and a high Btu gas. The introducing pressure power of the mixed gas to the 1st concentration equipment 11 is set as a 0.5 - 0.9MPa (gage pressure) degree. The penetration gas of the separation film in the 1st concentration equipment 11 is the gas by which the methane which has transmitted the separation film, and a high Btu gas were contained in the carbon dioxide which transmitted the separation film, and is introduced into the recovery system 13. The nontransparent gas of the separation film in the 1st concentration equipment 11 is the gas by which some carbon dioxide which did not transmit a separation film was contained in

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methane and a high Btu gas, and is introduced into the 2nd concentration equipment 12.

[0031]

The 2nd concentration equipment 12 condenses methane and a high Btu gas further by the separation film which makes carbon dioxide transmit preferentially from the nontransparent gas of the above-mentioned 1st concentration equipment 11. The introducing pressure power of the mixed gas to the 2nd concentration equipment 12 becomes substantially comparable as the introducing pressure power to the 1st concentration equipment 11 from the introducing pressure power to the 1st concentration equipment 11 by the degree which falls 0.005 to 0.05 MPa, unless flow regulation is performed. The penetration gas of the separation film in the 2nd concentration equipment 12 is the gas by which methane etc. were contained in the carbon dioxide which transmitted the separation film, flows back to the introduction side of the 1st concentration equipment 11, i.e., the upstream of the compressor 6, and is again introduced into the 1st concentration equipment 11. Methane and a high Btu gas are the mixed gas mixed with the predetermined ratio, and the nontransparent gas of the separation film in the 2nd concentration equipment 12 is sent to a post process as product gas.

[0032]

at this example, the area of the separation film of the above-mentioned 1st concentration equipment 11 and the 2nd concentration equipment 12 is abbreviation – it is set up to become equal. By doing in this way, the 1st concentration equipment 11 and the 2nd concentration equipment 12 can make the same separation film equipment serve a double purpose, and their equipment efficiency is good.

[0033]

The above-mentioned recovery system 13 collects methane and high Btu gases by the separation film which makes carbon dioxide transmit preferentially further from the penetration gas of the above-mentioned 1st concentration equipment 11. That is, the introductory gas to the recovery system 13 is the gas by which the carbon dioxide and methane which transmitted the separation film of the 1st concentration equipment 11, and a high Btu gas were contained, as mentioned above, and carbon dioxide is made to transmit preferentially further, it separates from this gas, and it collects methane and high Btu gases.

[0034]

The nontransparent gas of the separation film in the above-mentioned recovery system 13 is gas containing methane and the high Btu gas which were collected, flows back to the introduction side of the 1st concentration equipment 11, i.e., the upstream of the compressor 6, and is again introduced into the 1st concentration equipment 11. The penetration gas of the separation film in the above-mentioned recovery system 13 is gas which is mainly

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concerned with high-concentration carbon dioxide, is discharged from the exhaust passage 14, or is stored by the carbon dioxide tank 15 as product carbon dioxide.

[0035]

The introducing pressure of the gas introduced into the above-mentioned recovery system 13 is a pressure of the penetration gas of the above-mentioned 1st concentration equipment 11, and serves as a below 0.1MPa (gage pressure) degree. As for the differential pressure before and behind the penetration of the separation film in the above-mentioned recovery system 13, it is preferable to set to a 0.1 or less MPa degree.

[0036]

Area of the separation film of the above-mentioned recovery system 13 can be made the same as the area of the separation film of the 1st concentration equipment 11. By doing in this way, the recovery system 13 and the 2nd concentration equipment 12 can make the same separation film equipment serve a double purpose, and their equipment efficiency is good.

[0037]

It may be made to set up smaller than the area of the separation film of the 1st concentration equipment 11 the area of the separation film of the above-mentioned recovery system 13. By doing in this way, methane becomes more difficult to transmit the separation film of the recovery system 13, and the recovering efficiency of methane in the recovery system 13 can be improved.

[0038]

As a separation film used for the above-mentioned 1st concentration equipment 11, the 2nd concentration equipment 12, and the recovery system 13, mainly -- polymer gas permeation membrane, such as a polyimide film, polysulfone membrane, a cellulose triacetate film, polytetrafluoroethylene membrane, and a polyether sulphone film, a carbon film, fine porous glass bipolar membrane, etc. -- ****, although things are made, Also in these, the separation factor of a polyimide film of methane and carbon dioxide is high, and, moreover, for a certain reason, hydrogen sulfide-proof nature also has it. [preferable]

[0039]

Thus, the fuel gas which is the mixed gas with which methane and a high Btu gas were mixed with the predetermined ratio as nontransparent gas of the 2nd concentration equipment 12 is refined, and it is drawn from the product gas passages leading 16.

[0040]

As mentioned above, the gas for fuel by which the high Btu gas was added with specified proportion to methane is obtained by separating carbon dioxide from the mixed gas which added the high Btu gas with specified proportion to the biogas containing methane and

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carbon dioxide. Methane in the fuel gas which is product gas, and the ratio of a high Btu gas are determined by the addition ratio of the high Btu gas added to biogas first, and this addition ratio is adjusted by the flow regulator 26 provided by the propane addition way 5.

[0041]

When the concentration detection machine 17 which detects the methane concentration in the biogas which is material gas is provided by the above-mentioned material gas introduction path 3 here and the methane concentration in material gas is deteriorated below to the rate of a constant ratio, The raw material valve 18 of the material gas introduction path 3 and the propane valve 19 of the propane addition way 5 are closed, and introduction of the mixed gas to the methane concentration equipment 1 is suspended. When the methane concentration in material gas becomes again more than the rate of a constant ratio, the raw material valve 18 and the propane valve 19 are opened, and introduction of the mixed gas to the methane concentration equipment 1 is resumed. This keeps more than fixed level the ratio of the high Btu gas to methane in the fuel gas which is product gas.

[0042]

Here, the concentration detection machine 17 is replaced with providing to the material gas introduction path 3, and the concentration detection machine 17a can be provided to the product gas passages leading 16 of methane concentration equipment 1 downstream. In this case, when the methane concentration in product gas separates from the predetermined range. The raw material valve 18 of the material gas introduction path 3 and the propane valve 19 of the propane addition way 5 are closed, introduction of the mixed gas to the methane concentration equipment 1 is suspended, and quantity of heat is prevented from being filled up with the product gas which separated from the appropriate range to the high pressure tank 7.

[0043]

While the flow regulator 27 which adjusts the flow rate of purified gas is provided by the product gas passages leading 16, While the scenting gas bomb 20 for adding scenting gas to the refined fuel gas and the scenting gas addition way 21 are connected, the buffer tank 22 which stores temporarily the product gas with which scenting gas was added is connected. The product gas stored by the above-mentioned buffer tank 22 is compressed with the compressor 23, and is stored by each high pressure tank 7 of the high pressure gas tank unit 24.

[0044]

And the fuel gas stored by each above-mentioned high pressure tank 7 is carried to the place which an individual filling is carried out and is used for the fuel cylinder 8 as predetermined fuel, or is supplied to vehicles with an internal-combustion engine as fuel from the feeding

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nozzle 9.

[0045]

As mentioned above, since the methane concentration equipment 1 and the method of this embodiment remove carbon dioxide by two steps of concentration, the 1st step and the 2nd step, by a separation film and condense methane, they can obtain high-concentration concentration methane. Since a separation film separates carbon dioxide for the penetration gas of the 1st-step concentration further and methane is collected, the recovery rate of methane can be improved by leaps and bounds. Thus, high-concentration methane can be obtained with high recovery, for example, even if the content of methane is the environment which impurity gas, such as air, mixes into less than 60% of mixed gas, and mixed gas, high-concentration methane can be obtained with high recovery. The high-concentration choke damp can be obtained as exhaust gas after collecting methane with high recovery, and the function as a carbon dioxide recovery system is also exhibited simultaneously.

[0046]

The manufacturing installation and method of fuel gas of this embodiment add a high Btu gas to biogas beforehand, make it the mixed gas of biogas and a high Btu gas, separate carbon dioxide from this mixed gas, and condense methane and a high Btu gas. By defining the mixing ratio over biogas beforehand and adding a high Btu gas by doing in this way, The fuel gas of predetermined quantity of heat with which the high Btu gas was mixed with methane with the predetermined ratio can be obtained, and the fuel gas of the quality stabilized by quantity of heat sufficient as a raw material in biogas can be obtained by easy control in this way.

[0047]

In refluxing the above-mentioned 2nd concentration equipment 12 or the penetration gas of a process, and the nontransparent gas of the recovery system 13 to the introduction side of the 1st concentration equipment 11 or a process, While introducing again carbon dioxide and methane transmitted in the 2nd concentration equipment 12 or a process into the 1st concentration equipment 11 or a process, The methane which was not transmitted with the recovery system 13 can be again introduced into the 1st concentration equipment 11 or a process, and the concentration concentration and the recovery rate of methane can be improved.

[0048]

Omit, and the area of the separation film of the above-mentioned 1st concentration equipment 11, a process and the 2nd concentration equipment 12, or a process is, and to a case, By [on which abbreviation etc. spread the area of the separation film of the above-mentioned 1st concentration equipment 11, a process and the 2nd concentration equipment

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12 or a process] carrying out, the concentration equipment of the same separation film as the 1st concentration equipment 11 and the 2nd concentration equipment 12 can be used, and it is advantageous in respect of equipment efficiency. Since there are few differences with the introducing pressure of the 1st concentration equipment 11, the introducing pressure of a process and the 2nd concentration equipment 12, or a process, The concentration performance of an abbreviated EQC is exerted by the thing on which abbreviation etc. spread the area of a separation film and to do, and the 1st concentration equipment 11 or the process of the 2nd concentration equipment 12 or a process can also improve the concentration concentration and the recovery rate of methane.

[0049]

When area of the separation film of the above-mentioned recovery system 13 or a process is made smaller than the area of the separation film of the 1st concentration equipment 11 or a process, methane becomes more difficult to transmit the separation film of the recovery system 13 or a process, and the recovering efficiency of methane can be improved.

[0050]

When differential pressure before and behind the penetration of the separation film in the above-mentioned recovery system 13 or a process is set to 0.1 or less MPa, methane becomes more difficult to transmit the separation film of the recovery system 13 or a process, and the recovering efficiency of methane can be improved.

[0051]

When adding a high Btu gas to biogas in the upper stream of the compressor 6 which is pressure rising means which voltage-increase the gas introduced into the 1st concentration equipment 11 or a process, the above-mentioned adding means can add a high Btu gas to low pressure biogas, and prevents liquefaction of a high Btu gas. Thereby, change of methane after a separation film penetration and the mixing ratio of a high Btu gas can be prevented, and the fuel gas of the stable quality can be obtained by easy control.

[Working example]

[0052]

Methane was condensed using the above-mentioned fuel gas manufacturing installation from the mixed gas of 55 to 60% of methane, 5% of nitrogen gas, and the remaining carbon dioxide. The example condensed using the methane concentration equipment 1 mentioned above as a working example is shown, and the example condensed only with the 1st concentration equipment 11 as the comparative example 1 and the example condensed with the 1st concentration equipment 11 and the 2nd concentration equipment 12 as the comparative example 2 are shown. The introducing pressure power of mixed gas was changed with 0.6MPa, 0.65MPa, and 0.7MPa, respectively, and the flow rate of purified gas

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was changed with 4-m³/Hr, 5-m³/Hr, and 6-m³/Hr further, respectively. The recovery rate of methane at each time is shown in the following table 1. Adjusting flow rate by opening and closing of the valve which was provided to the product gas passages leading 16 and which is not illustrated, introducing pressure power adjusted at the rotational speed of the compressor 6 at the time of each flow rate.

[0053]

[Table 1]

段数	压力 (MPa)	流量(m ³ /hr)		
		4	5	6
		回收率(%)	回收率(%)	回收率(%)
比较例1	0.6	64	66	69
	0.65	63	67	71
	0.7	62	68	71
比较例2	0.6	66	70	77
	0.65	66	66	72
	0.7	63	72	76
实施例	0.6	99	99	99
	0.65	99	99	99
	0.7	99	99	—

[0054]

As shown in the above-mentioned table 1, each recovery rate of the working example showed the value higher than not less than 99% and the comparative examples 1 and 2.

[0055]

The introducing pressure power of mixed gas is changed with 0.6MPa, 0.65MPa, and 0.7MPa about the above-mentioned working example, The measurement result of the methane concentration of gas concentration when changing the flow rate of purified gas with 4-m³/Hr, 5-m³/Hr, and 6-m³/Hr further, respectively is shown in the following table 2.

[0056]

[Table 2]

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圧力(Mpa)	精製ガス流量 (m ³ /hr)		
	4	5	6
0.6	89.5%	86.0%	83.6%
0.65	89.9%	87.3%	84.0%
0.7	91.0%	87.4%	—

[0057]

The above-mentioned table 2 uses the gas emitted from a biogas plant for a raw material. Since air is contained in addition to methane and carbon dioxide, nitrogen gas mixes into production gas and a value of a degree is taken 90% or less as an actual measurement. Then, the methane concentration which does not take into consideration the nitrogen gas resulting from air was computed.

[0058]

First, composition of the purified gas at the time of 1-m³/Hr and 6-m³/Hr was measured [the introducing pressure power of mixed gas] for the flow rate of purified gas by 0.6MPa. The result is shown in the following table 3. The measurement result of composition of material gas is also shown in Table 3.

[0059]

[Table 3]

精製圧力 (MPa)	精製ガス流量 (m ³ /hr)	精製ガス組成				
		CH ₄ (%)	CO ₂ (%)	N ₂ (%)	O ₂ (%)	Total(%)
0.6	1	95.29	0.00	4.71	0.00	100
0.6	6	82.72	5.63	11.65	0.00	100
原料ガス組成		58.37	34.73	5.52	1.38	100

[0060]

According to the above-mentioned table 3, when purified gas flow rate is 1 m³/Hr in 0.6MPa about introducing pressure power of mixed gas, they are 95.29% of methane concentration, and 4.71% of nitrogen concentration.

When purified gas flow rate was 6-m³/Hr, they were 82.72% of methane concentration, and 11.65% of nitrogen concentration.

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[0061]

Based on this result, the diagram of Fig.2 plotted the relation between methane concentration and residual nitrogen concentration as separation performance of a separation film when changing purified gas flow rate, and this straight line shows that the relation of the following formula (1) is realized between methane concentration and residual nitrogen concentration.

$$y(\text{residual nitrogen concentration}) = -0.5521x(\text{methane concentration}) + 57.32 \dots (1)$$

[0062]

And the value which computed the residual nitrogen concentration and remains carbon dioxide levels in each purified gas by having applied the actual measurement of the above-mentioned table 2 to the above-mentioned formula (1) is shown in the following table 4. Since it is expressed with the following formula (2), if the transmission rate of penetration gas constituents changes the partial pressure difference of penetration gas constituents, it will also change separation performance. However, since the permeability coefficient of the gas of a separation film is a characteristic value according to gas constituents, if its methane concentration of purified gas is the same, even if the introducing pressure power of mixed gas changes, it will be thought that influence on the separation performance of a separation film is very small. Therefore, the above-mentioned formula (1) was applied also to the actual measurement of introducing pressure power 0.65MPa and 0.7MPa.

$$F = \{P - (P_1 - P_2)\} / L \dots (2)$$

F: The transmission rate of gas constituents

P: The permeability coefficient of gas constituents

P1-P2: The partial pressure difference of penetration gas constituents

L: Thickness of a separation film

[0063]

[Table 4]

流量(m ³ /hr)	4			5			6		
压力(Mpa)	CH ₄ (%)	CO ₂ (%)	N ₂ (%)	CH ₄ (%)	CO ₂ (%)	N ₂ (%)	CH ₄ (%)	CO ₂ (%)	N ₂ (%)
0.6	89.5	2.6	7.9	86.0	4.2	9.8	83.6	5.2	11.2
0.65	89.9	2.4	7.7	87.3	3.6	9.1	84.0	5.1	10.9
0.7	91.0	1.9	7.1	87.4	3.5	9.1	—	—	—

[0064]

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The result of having computed the methane concentration which does not take residual nitrogen into consideration from the result of the above-mentioned table 4 is shown in the following table 5.

[0065]

[Table 5]

流量(m ³ /hr)	4		5		6	
压力(Mpa)	CH ₄ (%)	CO ₂ (%)	CH ₄ (%)	CO ₂ (%)	CH ₄ (%)	CO ₂ (%)
0.6	97.2	2.8	95.4	4.6	94.1	5.9
0.65	97.4	2.6	96.1	3.9	94.3	5.7
0.7	97.9	2.1	96.1	3.9	—	—

[0066]

If it is material gas which does not contain air as refining capacity of methane of an working example as the result of the above-mentioned table 5 shows, it turns out that it is possible to condense methane until it becomes not less than 94% of methane concentration. Thus, according to the fuel gas manufacturing installation of an working example, methane is recoverable with the high recovery rate of not less than 99%, securing sufficient methane separation performance.

[Brief Description of the Drawings]

[0067]

[Drawing 1] It is a figure showing one embodiment of methane concentration equipment and a fuel gas manufacturing installation to which the present invention was applied.

[Drawing 2] It is the diagram which plotted the relation between methane concentration and residual nitrogen concentration as separation performance of a separation film.

[Explanations of letters or numerals]

[0068]

- 1: Methane concentration equipment
- 3: Material gas introduction path
- 4: LPG cylinder
- 5: Propane addition way
- 5a: Propane addition way
- 6: Compressor
- 7: High pressure tank

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- 8: Fuel cylinder
- 9: Feeding nozzle
- 11: The 1st concentration equipment
- 12: The 2nd concentration equipment
- 13: Recovery system
- 14: Exhaust passage
- 15: Carbon dioxide tank
- 16: Product gas passages leading
- 17: Concentration detection machine
- 17a: Concentration detection machine
- 18: Raw material valve
- 19: Propane valve
- 20: Scenting gas bomb
- 21: Scenting gas addition way
- 22: Buffer tank
- 23: Compressor
- 24: High pressure gas tank unit
- 26: Flow regulator
- 27: Flow regulator

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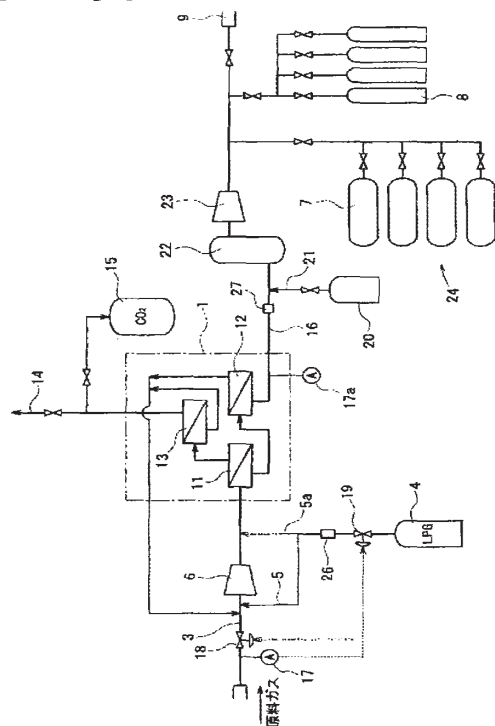
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Drawings

[Brief Description of the Drawings]

[0067]

[Drawing 1]

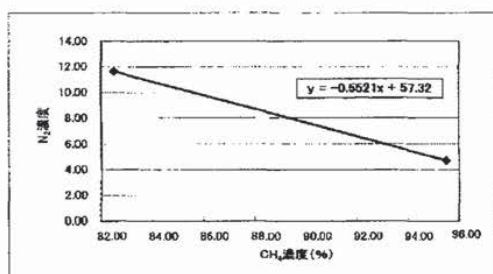


It is a figure showing one embodiment of methane concentration equipment and a fuel gas manufacturing installation to which the present invention was applied.

[Drawing 2]

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It is the diagram which plotted the relation between methane concentration and residual nitrogen concentration as separation performance of a separation film.

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Appendix

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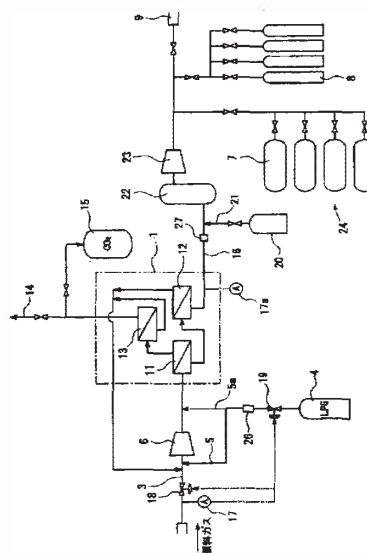
(54) 【発明の名称】 メタンガス濃縮装置および方法ならびに燃料ガスの製造装置および方法

(57) 【要約】

【課題】 高回収率で高濃度のメタンガスを得ることができるメタンガス濃縮装置を提供する。

【解決手段】 少なくともメタンガスと二酸化炭素を含む混合ガスから二酸化炭素を分離してメタンガスを濃縮するメタンガス濃縮装置1であって、上記混合ガスから二酸化炭素を優先的に透過させる分離膜によりメタンガスを濃縮する第1濃縮装置11と、上記第1濃縮装置11の非透過ガスから二酸化炭素を優先的に透過させる分離膜によりメタンガスをさらに濃縮する第2濃縮装置12と、上記第1濃縮装置11の透過ガスからさらに二酸化炭素を優先的に透過させる分離膜によりメタンガスを回収する回収装置13とを備えたことにより、高回収率で高濃度のメタンガスを得ることができる。

【選択図】 図1



【特許請求の範囲】

【請求項1】

少なくともメタンガスと二酸化炭素を含む混合ガスから二酸化炭素を分離してメタンガスを濃縮するメタンガス濃縮装置であって、

上記混合ガスから二酸化炭素を優先的に透過させる分離膜によりメタンガスを濃縮する第1濃縮装置と、

上記第1濃縮装置の透過ガスから二酸化炭素を優先的に透過させる分離膜によりメタンガスをさらに濃縮する第2濃縮装置と、

上記第1濃縮装置の透過ガスからさらに二酸化炭素を優先的に透過させる分離膜によりメタンガスを回収する回収装置とを備えたことを特徴とするメタンガス濃縮装置。

【請求項2】

上記第2濃縮装置の透過ガスおよび回収装置の非透過ガスを第1濃縮装置の導入側に還流させる請求項1記載のメタンガス濃縮装置。

【請求項3】

上記第1濃縮装置と第2濃縮装置の分離膜の面積が略等しい請求項1または2記載のメタンガス濃縮装置。

【請求項4】

上記回収装置の分離膜の面積を第1濃縮装置の分離膜の面積よりも小さくした請求項1～3のいずれか一項に記載のメタンガス濃縮装置。

【請求項5】

少なくともメタンガスと二酸化炭素を含む混合ガスから二酸化炭素を分離してメタンガスを濃縮するメタンガス濃縮方法であって、

上記混合ガスから二酸化炭素を優先的に透過させる分離膜によりメタンガスを濃縮する第1濃縮工程と、

上記第1濃縮工程の非透過ガスから二酸化炭素を優先的に透過させる分離膜によりメタンガスをさらに濃縮する第2濃縮工程と、

上記第1濃縮工程の透過ガスからさらに二酸化炭素を優先的に透過させる分離膜によりメタンガスを回収する回収工程とを備えたことを特徴とするメタンガス濃縮方法。

【請求項6】

メタンガスと熱量調節用の高熱量ガスとを含む燃料ガスの製造装置であって、

有機物を分解して得られたバイオガスに対して高熱量ガスを添加してバイオガスと高熱量ガスとの混合ガスとする高熱量ガス添加手段と、

上記混合ガスから二酸化炭素を優先的に透過させる分離膜によりメタンガスおよび高熱量ガスを濃縮する第1濃縮装置と、

上記第1濃縮装置の透過ガスからさらに二酸化炭素を優先的に透過させる分離膜によりメタンガスおよび高熱量ガスを回収する回収装置とを備えたことを特徴とする燃料ガスの製造装置。

【請求項7】

上記添加手段は、第1濃縮装置に導入するガスを昇圧する昇圧手段の上流においてバイオガスに対して高熱量ガスを添加する請求項6記載の燃料ガスの製造装置。

【請求項8】

上記回収装置の分離膜の面積を第1濃縮装置の分離膜の面積よりも小さくした請求項6または7記載の燃料ガスの製造装置。

【請求項9】

メタンガスと熱量調節用の高熱量ガスとを含む燃料ガスの製造方法であって、

有機物を分解して得られたバイオガスに対して高熱量ガスを添加してバイオガスと高熱量ガスとの混合ガスとする高熱量ガス添加工程と、

上記混合ガスから二酸化炭素を優先的に透過させる分離膜によりメタンガスおよび高熱量ガスを濃縮する第1濃縮工程と、

上記第1濃縮工程の透過ガスからさらに二酸化炭素を優先的に透過させる分離膜によりメタンガスおよび高熱量ガスを回収する回収工程とを備えたことを特徴とする燃料ガスの

【発明の詳細な説明】

【技術分野】

【0001】

本発明は、メタンガスと二酸化炭素を含む混合ガスから二酸化炭素を分離してメタンガスを濃縮するメタンガス濃縮装置および方法、ならびにメタンガスと熱量調節用の高熱量ガスとを含む燃料ガスの製造装置および方法に関するものである。

【背景技術】

【0002】

従来から、し尿、浄化水汚泥、下水処理汚泥、家畜糞尿、生ゴミ等の有機性廃棄物をメタン発酵菌により嫌気性発酵処理することにより、有機性廃棄物を分解して主としてメタンガスと二酸化炭素を含むバイオガスを発生させ、このバイオガスをエネルギーとして有効活用する技術が開発されている。

【0003】

一方、発生させたバイオガスから高濃度のメタンや二酸化炭素を分離する回収技術も種々のものが開発されている。特に、小型～中型の設備に利用できるものとして膜分離法があげられる。

【0004】

このような膜分離法は、高分子膜等を用いてガス成分の透過速度の差によって成分分離を行なうものであり、加圧ガスを膜に通過させるだけでガス成分の分離が可能で、対象ガスの種類や処理ガス量等に合わせて分離膜を選択し、必要に応じて複数の分離膜を並列に組み合わせて使用したり（下記の特許文献1～3）、直列に組み合わせて使用したりすることが行なわれている（下記の特許文献4）。

【特許文献1】特開平11-3723号公報

【特許文献2】特開2001-949号公報

【特許文献3】特表2006-507385号公報

【特許文献4】特開2007-254572号公報

【発明の開示】

【発明が解決しようとする課題】

【0005】

しかしながら、複数の分離膜を単に並列に使用したのでは、回収率はある程度あげることができるものの、高濃度のメタンガスを得るには限界がある。一方、複数の分離膜を単に直列に使用したのでは、ある程度高濃度のメタンガスを得ることができるものの、回収率を上げるには限界がある。このように、高回収率で高濃度のメタンガスを得ることができるメタンガスの濃縮装置は得られていなかったのが実情である。また、二酸化炭素とメタンを主として含むバイオガスを原料として燃料ガスを得ようとする、メタンガスだけでは十分な熱量が得られない場合があるという問題があった。

【0006】

本発明は、このような問題を解決するためになされたものであり、高回収率で高濃度のメタンガスを得ることができるメタンガス濃縮装置および方法ならびに燃料ガスの製造装置および方法を提供することを目的とする。

【課題を解決するための手段】

【0007】

上記目的を達成するため、本発明のメタンガス濃縮装置は、少なくともメタンガスと二酸化炭素を含む混合ガスから二酸化炭素を分離してメタンガスを濃縮するメタンガス濃縮装置であって、

上記混合ガスから二酸化炭素を優先的に透過させる分離膜によりメタンガスを濃縮する第1濃縮装置と、

上記第1濃縮装置の非透過ガスから二酸化炭素を優先的に透過させる分離膜によりメタ

ンガスをさらに濃縮する第2濃縮装置と、

上記第1濃縮装置の透過ガスからさらに二酸化炭素を優先的に透過させる分離膜によりメタンガスを回収する回収装置とを備えたことを要旨とする。

【0008】

また、上記目的を達成するため、本発明のメタンガス濃縮方法は、少なくともメタンガスと二酸化炭素を含む混合ガスから二酸化炭素を分離してメタンガスを濃縮するメタンガス濃縮方法であって、

上記混合ガスから二酸化炭素を優先的に透過させる分離膜によりメタンガスを濃縮する第1濃縮工程と、

上記第1濃縮工程の非透過ガスから二酸化炭素を優先的に透過させる分離膜によりメタンガスをさらに濃縮する第2濃縮工程と、

上記第1濃縮工程の透過ガスからさらに二酸化炭素を優先的に透過させる分離膜によりメタンガスを回収する回収工程とを備えたことを要旨とする。

【0009】

また、上記目的を達成するため、本発明の燃料ガスの製造装置は、メタンガスと熱量調節用の高熱量ガスとを含む燃料ガスの製造装置であって、

有機物を分解して得られたバイオガスに対して高熱量ガスを添加してバイオガスと高熱量ガスとの混合ガスとする高熱量ガス添加手段と、

上記混合ガスから二酸化炭素を優先的に透過させる分離膜によりメタンガスおよび高熱量ガスを濃縮する第1濃縮装置と、

上記第1濃縮装置の透過ガスからさらに二酸化炭素を優先的に透過させる分離膜によりメタンガスおよび高熱量ガスを回収する回収装置とを備えたことを要旨とする。

【0010】

また、上記目的を達成するため、本発明の燃料ガスの製造方法は、メタンガスと熱量調節用の高熱量ガスとを含む燃料ガスの製造方法であって、

有機物を分解して得られたバイオガスに対して高熱量ガスを添加してバイオガスと高熱量ガスとの混合ガスとする高熱量ガス添加工程と、

上記混合ガスから二酸化炭素を優先的に透過させる分離膜によりメタンガスおよび高熱量ガスを濃縮する第1濃縮工程と、

上記第1濃縮工程の透過ガスからさらに二酸化炭素を優先的に透過させる分離膜によりメタンガスおよび高熱量ガスを回収する回収工程とを備えたことを要旨とする。

【発明の効果】

【0011】

本発明のメタンガス濃縮装置および方法は、分離膜による第1段階と第2段階の2段階の濃縮により二酸化炭素を除去してメタンガスを濃縮するため、高濃度の濃縮メタンガスを得ることができる。また、第1段階の濃縮の透過ガスをさらに分離膜によって二酸化炭素を分離してメタンガスを回収することから、メタンガスの回収率を飛躍的に向上することができる。このように、高回収率で高濃度のメタンガスを得ることができ、例えば、メタンガスの含有率が60%未満の混合ガスや、混合ガス中に空気等の不純ガスが混入するような環境であっても高回収率で高濃度のメタンガスを得ることができる。また、メタンガスを高回収率で回収した後の排ガスとして高濃度の二酸化炭素ガスを得ることができ、二酸化炭素回収装置としての機能も同時に発揮する。

【0012】

本発明のメタンガス濃縮装置および方法において、上記第2濃縮装置または工程の透過ガスおよび回収装置の非透過ガスを第1濃縮装置または工程の導入側に還流させる場合には、第2濃縮装置または工程において透過した二酸化炭素およびメタンガスを第1濃縮装置または工程に再び導入するとともに、回収装置で透過しなかったメタンガスを第1濃縮装置または工程に再び導入し、メタンガスの濃縮濃度および回収率を向上することができる。

【0013】

本発明のメタンガス濃縮装置および方法において、上記第1濃縮装置または工程と第2濃縮装置または工程の分離膜の面積が略等しい場合には、上記第1濃縮装置または工程と第2濃縮装置または工程の分離膜の面積を略等しくすることにより、第1濃縮装置と第2濃縮装置に同じ分離膜の濃縮装置を用いることができ、設備効率面で有利である。また、第1濃縮装置または工程の導入圧と第2濃縮装置または工程の導入圧との差が少ないため、分離膜の面積を略等しくすることで第1濃縮装置または工程も第2濃縮装置または工程も略同等の濃縮性能が発揮され、メタンガスの濃縮濃度および回収率を向上することができる。

【0014】

本発明のメタンガス濃縮装置および方法において、上記回収装置または工程の分離膜の面積を第1濃縮装置または工程の分離膜の面積よりも小さくした場合には、回収装置または工程の分離膜をメタンガスがより透過し難くなり、メタンガスの回収効率を向上することができる。

【0015】

本発明のメタンガス濃縮装置および方法において、上記回収装置または工程における分離膜の透過前後の差圧を0.1MPa以下とした場合には、回収装置または工程の分離膜をメタンガスがより透過し難くなり、メタンガスの回収効率を向上することができる。

【0016】

本発明の燃料ガスの製造装置および方法は、あらかじめバイオガスに対して高熱量ガスを添加してバイオガスと高熱量ガスとの混合ガスとし、この混合ガスから二酸化炭素を分離してメタンガスと高熱量ガスを濃縮する。このようにすることにより、あらかじめバイオガスに対する混合比率を定めて高熱量ガスを添加することにより、メタンガスと高熱量ガスが所定比率で混合された所定熱量の燃料ガスを得ることができ、このように、バイオガスを原料として十分な熱量で安定した品質の燃料ガスを簡単な制御で得ることができる。

【0017】

本発明の燃料ガスの製造装置および方法において、上記添加手段は、第1濃縮装置または工程に導入するガスを昇圧する昇圧手段の上流においてバイオガスに対して高熱量ガスを添加する場合には、低圧なバイオガスに対して高熱量ガスを添加でき、高熱量ガスの液化を防ぐ。これにより、分離膜透過後のメタンガスと高熱量ガスの混合比率の変動を防止し、安定した品質の燃料ガスを簡単な制御で得ることができる。

【0018】

本発明の燃料ガスの製造装置および方法において、上記回収装置または工程の分離膜の面積を第1濃縮装置または工程の分離膜の面積よりも小さくした場合には、回収装置または工程の分離膜をメタンガスがより透過し難くなり、メタンガスの回収効率を向上することができる。

【発明を実施するための最良の形態】

【0019】

つぎに、本発明を実施するための最良の形態を説明する。

【0020】

図1は、本発明が適用される燃料ガス製造装置の一例を示す構成図である。

【0021】

この燃料ガス製造装置は、少なくともメタンガスと二酸化炭素を含む混合ガスから二酸化炭素を分離してメタンガスを濃縮するメタンガス濃縮装置1を備え、メタンガスと熱量調節用の高熱量ガスとを含む燃料ガスを製造するものである。

【0022】

上記燃料ガス製造装置は、原料ガスとして有機物を分解して得られたバイオガスを使用する。上記バイオガスは、有機性廃棄物を嫌気性発酵でメタン菌などの嫌気性微生物を用いて有機物を分解処理する消化槽（図示せず）等により発生させ、メタンを高濃度に含有するとともに二酸化炭素を含有するガスである。

【0023】

上記消化槽は、例えば、円筒槽、矩形槽及び卵形槽などの形状が用いられる。また、上記消化槽としては、発生した消化ガスを循環するとともに攪拌する攪拌装置が設けられた1段構造のものを用いることもできるし、通性嫌気性菌により蛋白質などの高分子有機物を有機酸などの低分子有機物に分解する酸発酵槽や、油脂分などを高温で分解して溶解する可溶化槽などを前段に設けて2段構造のものを用いることもできる。

【0024】

上記原料ガスをメタンガス濃縮装置1に導入する原料ガス導入路3には、LPGボンベ4に連通するプロパンガス添加路5が接続され、有機物を分解して得られたバイオガスに対して高熱量ガスとしてプロパンガスを添加してバイオガスとプロパンガスとの混合ガスとする。LPGボンベ4およびプロパンガス添加路5が本発明の高熱量ガス添加手段として機能する。なお、プロパンガス添加路5に変えて図示において鎖線で示すプロパンガス添加路5aを設け、高熱量ガスを圧縮機6の下流側において添加するようにすることもできる。

【0025】

高熱量ガスとしては、プロパンガスだけでなく、エタンガスやブタンガスを用いることもでき、これらは単独でもしくは併せて用いることができる。

【0026】

このように、メタンガスと二酸化炭素を含むバイオガスに対して、熱量調節用の高熱量ガスを所定の割合で添加して混合ガスとする。そして、この混合ガスから二酸化炭素を分離することにより、メタンガスに対して所定割合以上で高熱量ガスが添加された燃料用ガスを得ることができる。ここでの高熱量ガスの添加割合は、最終的に得られる燃料ガスの熱量を例えば都市ガス等の規格に合わせるように設定することが行なわれる。

【0027】

バイオガスに対して所定割合でプロパンガスが添加された混合ガスは、圧縮機6で0.5～0.9MPa（ゲージ圧力）程度の所定圧力に昇圧されてメタンガス濃縮装置1に導入される。したがって、本実施形態では、高熱量ガスの添加手段は、後述する第1濃縮装置11に導入するガスを昇圧する昇圧手段としての圧縮機6の上流においてバイオガスに対して高熱量ガスを添加するようになっている。

【0028】

上記メタンガス濃縮装置1は、メタンガスと二酸化炭素の混合ガスから二酸化炭素を分離してメタンガスを濃縮するものであるが、本実施形態の混合ガスは、メタンガスと二酸化炭素に加えて高熱量ガスとしてのプロパンガスも添加されており、この混合ガスから二酸化炭素を分離してメタンガスと高熱量ガスを濃縮する。また、上記混合ガスは、メタンガス、高熱量ガス、二酸化炭素以外に、空気等の他のガスが混入されている場合もある。

【0029】

上記メタンガス濃縮装置1は、それぞれ分離膜を備えた第1濃縮装置11、第2濃縮装置12ならびに回収装置13とを備えて構成されている。

【0030】

第1濃縮装置11は、分離膜により上記混合ガスから二酸化炭素を優先的に透過させてメタンガスおよび高熱量ガスを濃縮する。第1濃縮装置11への混合ガスの導入圧力は、0.5～0.9MPa（ゲージ圧力）程度に設定される。第1濃縮装置11における分離膜の透過ガスは、分離膜を透過した二酸化炭素に分離膜を透過してしまつたメタンガスや高熱量ガスが含まれたガスであり、回収装置13に導入される。第1濃縮装置11における分離膜の非透過ガスは、メタンガスおよび高熱量ガスに分離膜を透過しなかつた多少の二酸化炭素が含まれたガスであり、第2濃縮装置12に導入される。

【0031】

第2濃縮装置12は、上記第1濃縮装置11の非透過ガスから二酸化炭素を優先的に透過させる分離膜によりメタンガスおよび高熱量ガスをさらに濃縮する。第2濃縮装置12への混合ガスの導入圧力は、流量調節を行なわない限り、第1濃縮装置11への導入圧力

から0.005～0.05MPa下がる程度で、第1濃縮装置11への導入圧力とはほぼ同程度となる。第2濃縮装置12における分離膜の透過ガスは、分離膜を透過した二酸化炭素にメタンガス等が含まれたガスであり、第1濃縮装置11の導入側すなわち圧縮機6の上流側に還流されて再び第1濃縮装置11に導入される。また、第2濃縮装置12における分離膜の非透過ガスは、メタンガスおよび高熱量ガスが所定比率で混合された混合ガスであり、製品ガスとして後工程に送られる。

【0032】

この例では、上記第1濃縮装置11と第2濃縮装置12の分離膜の面積が略等しくなるよう設定されている。このようにすることにより、第1濃縮装置11と第2濃縮装置12は同じ分離膜装置を兼用することができて設備効率がよい。

【0033】

上記回収装置13は、上記第1濃縮装置11の透過ガスからさらに二酸化炭素を優先的に透過させる分離膜によりメタンガスおよび高熱量ガスを回収する。すなわち、回収装置13への導入ガスは、上述したように第1濃縮装置11の分離膜を透過した二酸化炭素およびメタンガスや高熱量ガスが含まれたガスであり、このガスからさらに二酸化炭素を優先的に透過させて分離し、メタンガスおよび高熱量ガスを回収する。

【0034】

上記回収装置13における分離膜の非透過ガスは、回収されたメタンガスおよび高熱量ガスを含むガスであり、第1濃縮装置11の導入側すなわち圧縮機6の上流側に還流されて再び第1濃縮装置11に導入される。上記回収装置13における分離膜の透過ガスは、高濃度の二酸化炭素を主とするガスであり、排出路14から排出するか、あるいは製品二酸化炭素として二酸化炭素タンク15に貯留される。

【0035】

上記回収装置13に導入されるガスの導入圧は、上記第1濃縮装置11の透過ガスの圧力であり、0.1MPa（ゲージ圧力）以下程度となる。また、上記回収装置13における分離膜の透過前後の差圧は0.1MPa以下程度に設定するのが好ましい。

【0036】

上記回収装置13の分離膜の面積は、第1濃縮装置11の分離膜の面積と同じにすることができる。このようにすることにより、回収装置13と第2濃縮装置12は同じ分離膜装置を兼用することができて設備効率がよい。

【0037】

また、上記回収装置13の分離膜の面積を第1濃縮装置11の分離膜の面積よりも小さく設定するようにしてもよい。このようにすることにより、回収装置13の分離膜をメタンガスがより透過し難くなり、回収装置13でのメタンガスの回収効率を向上することができる。

【0038】

上記第1濃縮装置11、第2濃縮装置12および回収装置13に用いられる分離膜としては、主としてポリイミド膜、ポリスルホン膜、三酢酸セルロース膜、ポリテトラフルオロエチレン膜、ポリエーテルスルホン膜などの高分子気体分離膜や、カーボン膜、微多孔質ガラス複合膜などを用いることができるが、これらのなかでも、ポリイミド膜がメタンガスと二酸化炭素との分離係数が高く、しかも耐硫化水素性もあるために好ましい。

【0039】

このようにして、第2濃縮装置12の非透過ガスとして、メタンガスおよび高熱量ガスが所定比率で混合された混合ガスである燃料ガスが精製され、製品ガス導出路16から導出される。

【0040】

上述したように、メタンガスと二酸化炭素を含むバイオガスに対して高熱量ガスを所定割合で添加した混合ガスから二酸化炭素を分離することにより、メタンガスに対して所定割合で高熱量ガスが添加された燃料用ガスを得る。製品ガスである燃料ガス中のメタンガスと高熱量ガスの比率は、最初にバイオガスに対して添加する高熱量ガスの添加比率によ

り決定され、この添加比率は、プロパンガス添加路5に設けられた流量調節器26により調節する。

【0041】

ここで、上記原料ガス導入路3には、原料ガスであるバイオガス中のメタンガス濃度を検知する濃度検知器17が設けられ、原料ガス中のメタンガス濃度が一定比率以下に低下したときに、原料ガス導入路3の原料弁18およびプロパンガス添加路5のプロパン弁19を閉じて、メタンガス濃縮装置1への混合ガスの導入を停止する。再び原料ガス中のメタンガス濃度が一定比率以上になったときに、原料弁18およびプロパン弁19を開けてメタンガス濃縮装置1への混合ガスの導入を再開する。これにより、製品ガスである燃料ガス中のメタンガスに対する高熱量ガスの比率を一定以上に保つようになっている。

【0042】

ここで、濃度検知器17を原料ガス導入路3に設けるのに代えて、メタンガス濃縮装置1下流の製品ガス導出路16に濃度検知器17aを設けるようにすることもできる。この場合、製品ガス中のメタンガス濃度が所定の範囲を外れたときには、原料ガス導入路3の原料弁18およびプロパンガス添加路5のプロパン弁19を閉じてメタンガス濃縮装置1への混合ガスの導入を停止し、熱量が適正範囲を外れた製品ガスを高圧タンク7へ充填してしまうことを防止するようになっている。

【0043】

製品ガス導出路16には、精製ガスの流量を調節する流量調節器27が設けられるとともに、精製された燃料ガスに対して付臭ガスを添加するための付臭ガスポンプ20および付臭ガス添加路21が接続されるとともに、付臭ガスが添加された製品ガスを一時的に貯留するバッファタンク22が接続されている。また、上記バッファタンク22に貯留された製品ガスは、圧縮機23で圧縮されて高圧ガスタンクユニット24の各高圧タンク7に貯留される。

【0044】

そして、上記各高圧タンク7に貯留された燃料ガスは、燃料ポンプ8に個別充填されて所定の燃料として使用される場所に運ばれたり、あるいは、供給ノズル9から内燃機関付きの車両に燃料として供給される。

【0045】

以上のように、本実施形態のメタンガス濃縮装置1および方法は、分離膜による第1段階と第2段階の2段階の濃縮により二酸化炭素を除去してメタンガスを濃縮するため、高濃度の濃縮メタンガスを得ることができる。また、第1段階の濃縮の透過ガスをさらに分離膜によって二酸化炭素を分離してメタンガスを回収することから、メタンガスの回収率を飛躍的に向上することができる。このように、高回収率で高濃度のメタンガスを得ることができ、例えば、メタンガスの含有率が60%未満の混合ガスや、混合ガス中に空気等の不純ガスが混入するような環境であっても高回収率で高濃度のメタンガスを得ることができる。また、メタンガスを高回収率で回収した後の排ガスとして高濃度の二酸化炭素ガスを得ることができ、二酸化炭素回収装置としての機能も同時に発揮する。

【0046】

また、本実施形態の燃料ガスの製造装置および方法は、あらかじめバイオガスに対して高熱量ガスを添加してバイオガスと高熱量ガスとの混合ガスとし、この混合ガスから二酸化炭素を分離してメタンガスと高熱量ガスを濃縮する。このようにすることにより、あらかじめバイオガスに対する混合比率を定めて高熱量ガスを添加することにより、メタンガスと高熱量ガスが所定比率で混合された所定熱量の燃料ガスを得ることができ、このように、バイオガスを原料として十分な熱量で安定した品質の燃料ガスを簡単な制御で得ることができる。

【0047】

また、上記第2濃縮装置12または工程の透過ガスおよび回収装置13の非透過ガスを第1濃縮装置11または工程の導入側に還流させる場合には、第2濃縮装置12または工程において透過した二酸化炭素およびメタンガスを第1濃縮装置11または工程に再び導

入するとともに、回収装置13で透過しなかったメタンガスを第1濃縮装置11または工程に再び導入し、メタンガスの濃縮濃度および回収率を向上することができる。

【0048】

また、上記第1濃縮装置11または工程と第2濃縮装置12または工程の分離膜の面積が略等しい場合には、上記第1濃縮装置11または工程と第2濃縮装置12または工程の分離膜の面積を略等しくすることにより、第1濃縮装置11と第2濃縮装置12に同じ分離膜の濃縮装置を用いることができて設備効率面で有利である。また、第1濃縮装置11または工程の導入圧と第2濃縮装置12または工程の導入圧との差が少ないため、分離膜の面積を略等しくすることで第1濃縮装置11または工程も第2濃縮装置12または工程も略同等の濃縮性能が発揮され、メタンガスの濃縮濃度および回収率を向上することができる。

【0049】

また、上記回収装置13または工程の分離膜の面積を第1濃縮装置11または工程の分離膜の面積よりも小さくした場合には、回収装置13または工程の分離膜をメタンガスがより透過し難くなり、メタンガスの回収効率を向上することができる。

【0050】

また、上記回収装置13または工程における分離膜の透過前後の差圧を0.1MPa以下とした場合には、回収装置13または工程の分離膜をメタンガスがより透過し難くなり、メタンガスの回収効率を向上することができる。

【0051】

また、上記添加手段は、第1濃縮装置11または工程に導入するガスを昇圧する昇圧手段である圧縮機6の上流においてバイオガスに対して高熱量ガスを添加する場合には、低圧なバイオガスに対して高熱量ガスを添加できて高熱量ガスの液化を防ぐ。これにより、分離膜透過後のメタンガスと高熱量ガスの混合比率の変動を防止し、安定した品質の燃料ガスを簡単な制御で得ることができる。

【実施例】

【0052】

上記燃料ガス製造装置を用い、メタンガス55～60%、窒素ガス5%、残り二酸化炭素の混合ガスからメタンガスの濃縮を行なった。実施例として上述したメタンガス濃縮装置1を使用して濃縮した例を示し、比較例1として第1濃縮装置11だけで濃縮した例、比較例2として第1濃縮装置11および第2濃縮装置12で濃縮した例を示す。なお、それぞれ混合ガスの導入圧力を0.6MPa、0.65MPa、0.7MPaと変化させ、さらにそれぞれ精製ガスの流量を4m³/Hr、5m³/Hr、6m³/Hrと変化させた。それぞれのときのメタンガスの回収率を下記の表1に示す。なお、流量は、製品ガス導出路16に設けた図示しないバルブの開閉により調節し、導入圧力は、各流量のときの圧縮機6の回転数によって調節を行った。

【0053】

【表1】

段数	圧力 (MPa)	流量(m ³ /hr)		
		4	5	6
		回収率(%)	回収率(%)	回収率(%)
比較例1	0.6	64	66	69
	0.65	63	67	71
	0.7	62	68	71
比較例2	0.6	66	70	77
	0.65	66	66	72
	0.7	63	72	76
実施例	0.6	99	99	99
	0.65	99	99	99
	0.7	99	99	—

【0054】

上記表1からわかるように、実施例の回収率はいずれも99%以上と比較例1、2よりも高い値を示した。

【0055】

また、上記実施例について、混合ガスの導入圧力を0.6MPa、0.65MPa、0.7MPaと変化させ、さらにそれぞれ精製ガスの流量を4m³/Hr、5m³/Hr、6m³/Hrと変化させたときの濃縮ガスのメタンガス濃度の測定結果を下記表2に示す。

【0056】

【表2】

圧力(Mpa)	精製ガス流量(m ³ /hr)		
	4	5	6
0.6	89.5%	86.0%	83.6%
0.65	89.9%	87.3%	84.0%
0.7	91.0%	87.4%	—

【0057】

上記表2は、バイオガスプラントから発生するガスを原料に用いており、メタンと二酸化炭素以外に空気が含まれているため、生成ガス中に窒素ガスが混入し、実測値としては90%以下程度の値をとる。そこで、空気に起因する窒素ガスを考慮しないメタンガス濃度を算出した。

【0058】

まず、混合ガスの導入圧力を0.6MPaで、精製ガスの流量を1m³/Hrと6m³/Hrのときの精製ガスの組成を測定した。その結果を下記の表3に示す。表3には原料ガスの組成の測定結果も示している。

【0059】

【表3】

精製圧力 (MPa)	精製ガス流量 (m ³ /hr)	精製ガス組成				
		CH ₄ (%)	CO ₂ (%)	N ₂ (%)	O ₂ (%)	Total(%)
0.6	1	95.29	0.00	4.71	0.00	100
0.6	6	82.72	5.63	11.65	0.00	100
原料ガス組成		58.37	34.73	5.52	1.38	100

【0060】

上記表3によれば、混合ガスの導入圧力を0.6MPaにおいて、精製ガス流量が1m³/Hrのときは、メタン濃度95.29%、窒素濃度4.71%であり、精製ガス流量

が $6\text{ m}^3/\text{Hr}$ のときは、メタン濃度 82.72% 、窒素濃度 11.65% であった。

【0061】

この結果に基づいて、精製ガス流量を変化させたときの分離膜の分離性能としてメタン濃度と残留窒素濃度との関係をプロットしたのが図2の線図であり、この直線から、メタン濃度と残留窒素濃度の間に下記の式(1)の関係が成り立つことがわかる。

$$y(\text{残留窒素濃度}) = -0.5521x(\text{メタン濃度}) + 57.32 \cdots (1)$$

【0062】

そして、上記式(1)に上記表2の実測値を当てはめてそれぞれの精製ガスにおける残留窒素濃度および残留二酸化炭素濃度を算出した値を下記の表4に示す。なお、透過ガス成分の透過速度は下記の式(2)で表されることから、透過ガス成分の分圧差が変われば分離性能も変わることとなる。しかしながら、分離膜のガスの透過係数はガス成分に応じた固有値であることから、精製ガスのメタン濃度が同一であれば、混合ガスの導入圧力が変化しても、分離膜の分離性能に対する影響は極めて小さいと考えられる。したがって、導入圧力 0.65 MPa および 0.7 MPa の実測値にも上記式(1)を適用した。

$$F = \{P \cdot (P_1 - P_2)\} / L \cdots (2)$$

F: ガス成分の透過速度

P: ガス成分の透過係数

$P_1 - P_2$: 透過ガス成分の分圧差

L: 分離膜の厚み

【0063】

【表4】

流量(m^3/hr)	4			5			6		
圧力(Mpa)	CH ₄ (%)	CO ₂ (%)	N ₂ (%)	CH ₄ (%)	CO ₂ (%)	N ₂ (%)	CH ₄ (%)	CO ₂ (%)	N ₂ (%)
0.6	89.5	2.6	7.9	86.0	4.2	9.8	83.6	5.2	11.2
0.65	89.9	2.4	7.7	87.3	3.6	9.1	84.0	5.1	10.9
0.7	91.0	1.9	7.1	87.4	3.5	9.1	—	—	—

【0064】

さらに、上記表4の結果から、残留窒素を考慮しないメタンガス濃度を算出した結果を下記の表5に示す。

【0065】

【表5】

流量(m^3/hr)	4		5		6	
圧力(Mpa)	CH ₄ (%)	CO ₂ (%)	CH ₄ (%)	CO ₂ (%)	CH ₄ (%)	CO ₂ (%)
0.6	97.2	2.8	95.4	4.6	94.1	5.9
0.65	97.4	2.6	96.1	3.9	94.3	5.7
0.7	97.9	2.1	96.1	3.9	—	—

【0066】

上記表5の結果からわかるとおり、実施例のメタンガスの精製能力として、空気を含まない原料ガスであれば、 94% 以上のメタンガス濃度になるまでメタンを濃縮することが可能であることがわかる。このように、実施例の燃料ガス製造装置によれば、十分なメタンガス分離性能を確保しながら、 99% 以上の高い回収率でメタンガスを回収することができる。

【図面の簡単な説明】

【0067】

【図1】本発明が適用されたメタンガス濃縮装置および燃料ガス製造装置の一実施形態を示す図である。

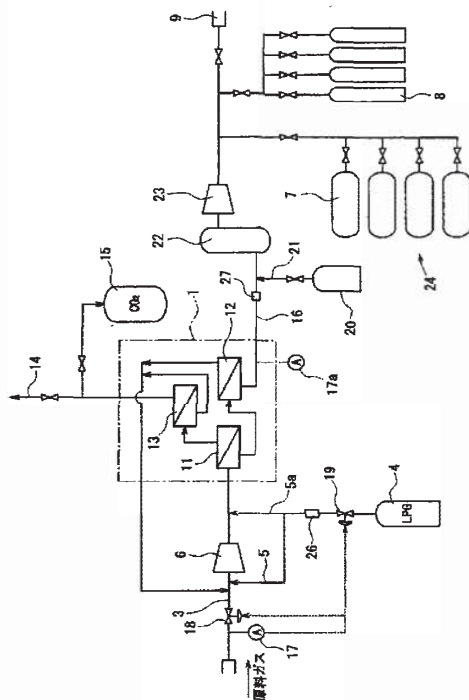
【図2】分離膜の分離性能としてメタン濃度と残留窒素濃度との関係をプロットした線図である。

【符号の説明】

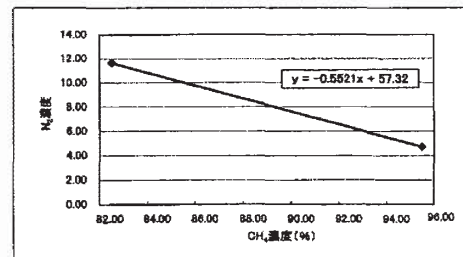
【0068】

- 1：メタンガス濃縮装置
- 3：原料ガス導入路
- 4：LPGボンベ
- 5：プロパンガス添加路
- 5a：プロパンガス添加路
- 6：圧縮機
- 7：高圧タンク
- 8：燃料ボンベ
- 9：供給ノズル
- 11：第1濃縮装置
- 12：第2濃縮装置
- 13：回収装置
- 14：排出路
- 15：二酸化炭素タンク
- 16：製品ガス導出路
- 17：濃度検知器
- 17a：濃度検知器
- 18：原料弁
- 19：プロパン弁
- 20：付臭ガスボンベ
- 21：付臭ガス添加路
- 22：バッファタンク
- 23：圧縮機
- 24：高圧ガスタンクユニット
- 26：流量調節器
- 27：流量調節器

【図1】



【図2】



(72)発明者 金井 誠

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Fターム(参考) 4D006 GA41 KA52 KA54 KA55 KA56 KA66 KE12P KE14P KE22Q MB04
MC04 MC05 MC18 MC30 MC58 MC62 MC63 PA03 PB18 PB64
PB68

Electronic Patent Application Fee Transmittal				
Application Number:		13807831		
Filing Date:		31-Dec-2012		
Title of Invention:		PROCESS FOR SEPARATION OF GASES		
First Named Inventor/Applicant Name:		Markus Ungerank		
Filer:		Marvin Jay Spivak/Melissa Mann		
Attorney Docket Number:		408824US99PCT		
Filed as Large Entity				
U.S. National Stage under 35 USC 371 Filing Fees				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Miscellaneous:				
Submission- Information Disclosure Stmt	1806	1	180	180
Total in USD (\$)				180

Electronic Acknowledgement Receipt	
EFS ID:	19915117
Application Number:	13807831
International Application Number:	
Confirmation Number:	4142
Title of Invention:	PROCESS FOR SEPARATION OF GASES
First Named Inventor/Applicant Name:	Markus Ungerank
Customer Number:	22850
Filer:	Marvin Jay Spivak/Melissa Mann
Filer Authorized By:	Marvin Jay Spivak
Attorney Docket Number:	408824US99PCT
Receipt Date:	20-AUG-2014
Filing Date:	31-DEC-2012
Time Stamp:	14:25:45
Application Type:	U.S. National Stage under 35 USC 371

Payment information:

Submitted with Payment	yes
Payment Type	Credit Card
Payment was successfully received in RAM	\$180
RAM confirmation Number	617
Deposit Account	
Authorized User	

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
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1		408824USIDS.pdf	1772170 f4d40dc61e1b041f174f5b4d886bf006f5d16da9	yes	40
	Multipart Description/PDF files in .zip description				
	Document Description		Start	End	
	Transmittal Letter		1	1	
	Information Disclosure Statement (IDS) Form (SB08)		2	2	
	Foreign Reference		3	40	
Warnings:					
Information:					
2	Fee Worksheet (SB06)	fee-info.pdf	30382 0df0714ae02d9cfcc0e463940a15533131e580a9	no	2
Warnings:					
Information:					
Total Files Size (in bytes):			1802552		
This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503. <u>New Applications Under 35 U.S.C. 111</u> If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application. <u>National Stage of an International Application under 35 U.S.C. 371</u> If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course. <u>New International Application Filed with the USPTO as a Receiving Office</u> If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.					

Docket No. 408824US99PCT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

IN RE APPLICATION OF: Markus UNGERANK, et al.

SERIAL NO: 13/807,831

GAU: 1772

FILED: December 31, 2012

EXAMINER: Jason M. GREENE

FOR: PROCESS FOR SEPARATION OF GASES

INFORMATION DISCLOSURE STATEMENT UNDER 37 CFR 1.97

COMMISSIONER FOR PATENTS
ALEXANDRIA, VIRGINIA 22313

Commissioner:

Applicant(s) wish to disclose the following information.

REFERENCES

- ☒ The applicant(s) wish to make of record the reference(s) listed on the attached form PTO-1449 and/or accompanying documents from a corresponding foreign application. Copies of the listed reference(s) are attached, where required, as are either statements of relevancy or any readily available partial or full English translations of pertinent portions of any non-English language reference(s).
- ☒ Credit card payment is being made online (if electronically filed), or is attached hereto (if paper filed), in the amount required under 37 CFR §1.17(p).

RELATED CASES

- ☐ Attached is a list of applicant's pending application(s), published application(s) or issued patent(s) which may be related to the present application. In accordance with the waiver of 37 CFR 1.98 dated September 21, 2004, copies of the cited pending applications are not provided. Cited published and/or issued patents, if any, are listed on the attached PTO form 1449.
- ☐ Credit card payment is being made online (if electronically filed), or is attached hereto (if paper filed), in the amount required under 37 CFR §1.17(p).

CERTIFICATION

- ☐ Each item of information contained in this information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of this statement.
- ☐ No item of information contained in this information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application and, to the knowledge of the undersigned, having made reasonable inquiry, was known to any individual designated in 37 CFR §1.56(c) more than three months prior to the filing of this statement.

DEPOSIT ACCOUNT

- ☒ Please charge any additional fees for the papers being filed herewith and for which no payment is enclosed herewith, or credit any overpayment to deposit account number 15-0030.

Respectfully submitted,

OBLON, SPIVAK, McCLELLAND,
MAIER & NEUSTADT, L.L.P.



Richard L. Treanor
Registration No. 36,379

Customer Number

22850

Tel. (703) 413-3000
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(OSMMN 02/12)

Stefan U. Koschmieder, Ph.D.
Registration No. 50,238

Craig Feinberg
Registration No. 62, 116



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

NOTICE OF ALLOWANCE AND FEE(S) DUE

22850 7590 10/20/2014
OBLON, SPIVAK, MCCLELLAND MAIER & NEUSTADT, L.L.P.
1940 DUKE STREET
ALEXANDRIA, VA 22314

EXAMINER

GREENE, JASON M

ART UNIT

PAPER NUMBER

1772

DATE MAILED: 10/20/2014

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/807,831	12/31/2012	Markus Ungerank	408824US99PCT	4142

TITLE OF INVENTION: PROCESS FOR SEPARATION OF GASES

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	\$960	\$0	\$0	\$960	01/20/2015

THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. PROSECUTION ON THE MERITS IS CLOSED. THIS NOTICE OF ALLOWANCE IS NOT A GRANT OF PATENT RIGHTS. THIS APPLICATION IS SUBJECT TO WITHDRAWAL FROM ISSUE AT THE INITIATIVE OF THE OFFICE OR UPON PETITION BY THE APPLICANT. SEE 37 CFR 1.313 AND MPEP 1308.

THE ISSUE FEE AND PUBLICATION FEE (IF REQUIRED) MUST BE PAID WITHIN THREE MONTHS FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. THIS STATUTORY PERIOD CANNOT BE EXTENDED. SEE 35 U.S.C. 151. THE ISSUE FEE DUE INDICATED ABOVE DOES NOT REFLECT A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE IN THIS APPLICATION. IF AN ISSUE FEE HAS PREVIOUSLY BEEN PAID IN THIS APPLICATION (AS SHOWN ABOVE), THE RETURN OF PART B OF THIS FORM WILL BE CONSIDERED A REQUEST TO REAPPLY THE PREVIOUSLY PAID ISSUE FEE TOWARD THE ISSUE FEE NOW DUE.

HOW TO REPLY TO THIS NOTICE:

I. Review the ENTITY STATUS shown above. If the ENTITY STATUS is shown as SMALL or MICRO, verify whether entitlement to that entity status still applies.

If the ENTITY STATUS is the same as shown above, pay the TOTAL FEE(S) DUE shown above.

If the ENTITY STATUS is changed from that shown above, on PART B - FEE(S) TRANSMITTAL, complete section number 5 titled "Change in Entity Status (from status indicated above)".

For purposes of this notice, small entity fees are 1/2 the amount of undiscounted fees, and micro entity fees are 1/2 the amount of small entity fees.

II. PART B - FEE(S) TRANSMITTAL, or its equivalent, must be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). If you are charging the fee(s) to your deposit account, section "4b" of Part B - Fee(s) Transmittal should be completed and an extra copy of the form should be submitted. If an equivalent of Part B is filed, a request to reapply a previously paid issue fee must be clearly made, and delays in processing may occur due to the difficulty in recognizing the paper as an equivalent of Part B.

III. All communications regarding this application must give the application number. Please direct all communications prior to issuance to Mail Stop ISSUE FEE unless advised to the contrary.

IMPORTANT REMINDER: Utility patents issuing on applications filed on or after Dec. 12, 1980 may require payment of maintenance fees. It is patentee's responsibility to ensure timely payment of maintenance fees when due.

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), to: **Mail** **Mail Stop ISSUE FEE**
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450
or Fax **(571)-273-2885**

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

22850 7590 10/20/2014

OBLON, SPIVAK, MCCLELLAND MAIER & NEUSTADT, L.L.P.
 1940 DUKE STREET
 ALEXANDRIA, VA 22314

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below.

(Depositor's name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/807,831	12/31/2012	Markus Ungerank	408824US99PCT	4142

TITLE OF INVENTION: PROCESS FOR SEPARATION OF GASES

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	\$960	\$0	\$0	\$960	01/20/2015

EXAMINER	ART UNIT	CLASS-SUBCLASS
GREENE, JASON M	1772	095-051000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).

- ☐ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.
- ☐ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list

- (1) The names of up to 3 registered patent attorneys or agents OR, alternatively, 1 _____
- (2) The name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed. 2 _____
- 3 _____

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE

(B) RESIDENCE: (CITY and STATE OR COUNTRY)

Please check the appropriate assignee category or categories (will not be printed on the patent): ☐ Individual ☐ Corporation or other private group entity ☐ Government

4a. The following fee(s) are submitted:

- ☐ Issue Fee
- ☐ Publication Fee (No small entity discount permitted)
- ☐ Advance Order - # of Copies _____

4b. Payment of Fee(s): (Please first reapply any previously paid issue fee shown above)

- ☐ A check is enclosed.
- ☐ Payment by credit card. Form PTO-2038 is attached.
- ☐ The Director is hereby authorized to charge the required fee(s), any deficiency, or credits any overpayment, to Deposit Account Number _____ (enclose an extra copy of this form).

5. Change in Entity Status (from status indicated above)

- ☐ Applicant certifying micro entity status. See 37 CFR 1.29
- ☐ Applicant asserting small entity status. See 37 CFR 1.27
- ☐ Applicant changing to regular undiscounted fee status.

NOTE: Absent a valid certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.

NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.

NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

NOTE: This form must be signed in accordance with 37 CFR 1.31 and 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature _____

Date _____

Typed or printed name _____

Registration No. _____



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/807,831	12/31/2012	Markus Ungerank	408824US99PCT	4142
22850	7590	10/20/2014	EXAMINER	
OBLON, SPIVAK, MCCLELLAND MAIER & NEUSTADT, L.L.P.			GREENE, JASON M	
1940 DUKE STREET			ART UNIT	
ALEXANDRIA, VA 22314			PAPER NUMBER	

1772

DATE MAILED: 10/20/2014

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b) (Applications filed on or after May 29, 2000)

The Office has discontinued providing a Patent Term Adjustment (PTA) calculation with the Notice of Allowance.

Section 1(h)(2) of the AIA Technical Corrections Act amended 35 U.S.C. 154(b)(3)(B)(i) to eliminate the requirement that the Office provide a patent term adjustment determination with the notice of allowance. See Revisions to Patent Term Adjustment, 78 Fed. Reg. 19416, 19417 (Apr. 1, 2013). Therefore, the Office is no longer providing an initial patent term adjustment determination with the notice of allowance. The Office will continue to provide a patent term adjustment determination with the Issue Notification Letter that is mailed to applicant approximately three weeks prior to the issue date of the patent, and will include the patent term adjustment on the patent. Any request for reconsideration of the patent term adjustment determination (or reinstatement of patent term adjustment) should follow the process outlined in 37 CFR 1.705.

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at 1-(888)-786-0101 or (571)-272-4200.

OMB Clearance and PRA Burden Statement for PTOL-85 Part B

The Paperwork Reduction Act (PRA) of 1995 requires Federal agencies to obtain Office of Management and Budget approval before requesting most types of information from the public. When OMB approves an agency request to collect information from the public, OMB (i) provides a valid OMB Control Number and expiration date for the agency to display on the instrument that will be used to collect the information and (ii) requires the agency to inform the public about the OMB Control Number's legal significance in accordance with 5 CFR 1320.5(b).

The information collected by PTOL-85 Part B is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450. Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Notice of Allowability	Application No. 13/807,831	Applicant(s) UNGERANK ET AL.	
	Examiner Jason M. Greene	Art Unit 1772	AIA (First Inventor to File) Status No

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to Applicants' reply filed 1 August 2014.
☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.
2. ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.
3. ☒ The allowed claim(s) is/are 1-58. As a result of the allowed claim(s), you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov.
4. ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

Certified copies:

- a) ☒ All b) ☐ Some *c) ☐ None of the:
 1. ☒ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

* Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.

THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.
Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).
6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

- | | |
|--|--|
| <ol style="list-style-type: none"> 1. ☐ Notice of References Cited (PTO-892) 2. ☒ Information Disclosure Statements (PTO/SB/08),
Paper No./Mail Date <u>8/20/14</u> 3. ☐ Examiner's Comment Regarding Requirement for Deposit
of Biological Material 4. ☐ Interview Summary (PTO-413),
Paper No./Mail Date _____. | <ol style="list-style-type: none"> 5. ☒ Examiner's Amendment/Comment 6. ☐ Examiner's Statement of Reasons for Allowance 7. ☒ Other <u>Detailed Action</u>. |
|--|--|

DETAILED ACTION

1. The present application is being examined under the pre-AIA first to invent provisions.

Response to Amendment

Response to Arguments

2. Applicant's arguments, see page 19, line 1 to page 27, line 25, filed 1 August 2014, with respect to the 35 USC 102 and 103 rejections of claims 1-20 have been fully considered and are persuasive. The 35 USC 102 and 103 rejections of claims 1-20 have been withdrawn.

Allowable Subject Matter

3. Claims 1-58 are allowed.

EXAMINER'S AMENDMENT

4. An examiner's amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided

by 37 CFR 1.312. To ensure consideration of such an amendment, it MUST be submitted no later than the payment of the issue fee.

5. The application has been amended as follows:

Renumber original claim 10 as claim 15.

Renumber original claims 11-15 as claims 10-14.

In original claim 10, renumbered as claim 15, rewrite the phrase "The apparatus of" at line 1 as --The process of--.

In claim 35, rewrite the phrase "The apparatus of" at line 1 as --The process of--.

Conclusion

6. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jason M. Greene whose telephone number is (571)272-1157. The examiner can normally be reached on Monday - Friday (8:00 AM to 4:30 PM).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Insuk Bullock can be reached on (571) 272-5954. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Jason M. Greene/
Primary Examiner, Art Unit 1772

jmg
October 15, 2014

Issue Classification 	Application/Control No. 13807831	Applicant(s)/Patent Under Reexamination UNGERANK ET AL.	
	Examiner JASON M GREENE	Art Unit 1772	

CPC					
Symbol				Type	Version
B01D	53	/	225	F	2013-01-01
B01D	53	/	226	I	2013-01-01
B01D	53	/	227	I	2013-01-01
C10L	3	/	104	I	2013-01-01
B01D	2256	/	24	A	2013-01-01
B01D	2257	/	504	A	2013-01-01
Y02C	10	/	10	A	2013-01-01
		/			
		/			
		/			
		/			
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		/			

CPC Combination Sets						
Symbol			Type	Set	Ranking	Version
		/				
		/				

NONE		Total Claims Allowed:	
(Assistant Examiner)	(Date)	58	
/JASON M GREENE/ Primary Examiner.Art Unit 1772	10/15/2014	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	11

Issue Classification 	Application/Control No. 13807831	Applicant(s)/Patent Under Reexamination UNGERANK ET AL.
	Examiner JASON M GREENE	Art Unit 1772

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47															
Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original
1	1	17	17	33	33	49	49								
2	2	18	18	34	34	50	50								
3	3	19	19	35	35	51	51								
4	4	20	20	36	36	52	52								
5	5	21	21	37	37	53	53								
6	6	22	22	38	38	54	54								
7	7	23	23	39	39	55	55								
8	8	24	24	40	40	56	56								
9	9	25	25	41	41	57	57								
15	10	26	26	42	42	58	58								
10	11	27	27	43	43										
11	12	28	28	44	44										
12	13	29	29	45	45										
13	14	30	30	46	46										
14	15	31	31	47	47										
16	16	32	32	48	48										

NONE (Assistant Examiner) _____ (Date) _____		Total Claims Allowed: 58	
/JASON M GREENE/ Primary Examiner.Art Unit 1772 (Primary Examiner) _____ (Date) _____		10/15/2014 (Date) _____	O.G. Print Claim(s) 1 O.G. Print Figure 11

EAST Search History**EAST Search History (Interference)**

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	12	96/9.ccls. and (three third) with stage\$1	US-PGPUB; UPAD	OR	OFF	2014/10/15 15:15
L2	15	95/47,51.ccls. and (three third) with stage\$1	US-PGPUB; UPAD	OR	OFF	2014/10/15 15:16
L3	1	(96/4-14 95/45-56).ccls. and multistage\$1 with compressor\$1	US-PGPUB; UPAD	OR	OFF	2014/10/15 15:17
L4	30	b01d53/226.cpc. and (three third) with (permeate\$1 retentate\$1)	US-PGPUB; UPAD	OR	OFF	2014/10/15 15:17
L5	45	(96/4-14 95/45-56).ccls. and pressure with reduc\$5 with valve\$1	US-PGPUB; UPAD	OR	OFF	2014/10/15 15:17

10/ 15/ 2014 3:18:38 PM**C:\Users\jgreene1\Documents\EAST\Workspaces\13807831.wsp**

<i>Index of Claims</i> 	Application/Control No. 13807831	Applicant(s)/Patent Under Reexamination UNGERANK ET AL.
	Examiner JASON M GREENE	Art Unit 1772

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

☐ Claims renumbered in the same order as presented by applicant				☐ CPA		☐ T.D.		☐ R.1.47	
CLAIM		DATE							
Final	Original	05/27/2014	10/15/2014						
1	1	✓	=						
2	2	✓	=						
3	3	✓	=						
4	4	✓	=						
5	5	✓	=						
6	6	✓	=						
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32	32		=						
33	33		=						
34	34		=						
35	35		=						
36	36		=						

<i>Index of Claims</i> 	Application/Control No. 13807831	Applicant(s)/Patent Under Reexamination UNGERANK ET AL.
	Examiner JASON M GREENE	Art Unit 1772

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

☐ Claims renumbered in the same order as presented by applicant
 ☐ CPA
 ☐ T.D.
 ☐ R.1.47

CLAIM		DATE									
Final	Original	05/27/2014	10/15/2014								
37	37		=								
38	38		=								
39	39		=								
40	40		=								
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55	55		=								
56	56		=								
57	57		=								
58	58		=								

Receipt date: 08/20/2014

13807831 - GAU: 1772

SHEET 1 OF 1

Form PTO 1449 (Modified)		U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE		ATTY DOCKET NO. 408824US99PCT		SERIAL NO. 13/807,831	
LIST OF REFERENCES CITED BY APPLICANT				APPLICANT Markus UNGERANK, et al.			
				FILING DATE December 31, 2012		GROUP 1772	
U.S. PATENT DOCUMENTS							
EXAMINER INITIAL		DOCUMENT NUMBER	DATE	NAME	CLASS	SUB CLASS	FILING DATE IF APPROPRIATE
	AA						
	AB						
	AC						
	AD						
	AE						
	AF						
	AG						
	AH						
	AI						
	AJ						
	AK						
	AL						
	AM						
	AN						
FOREIGN PATENT DOCUMENTS							
		DOCUMENT NUMBER	DATE	COUNTRY	TRANSLATION YES NO		
/JMG/	AO	JP 2009-242773 A	10/22/2009	JAPAN (with English abstract and unedited computer generated English translation)	X		
	AP						
	AQ						
	AR						
	AS						
	AT						
	AU						
	AV						
OTHER REFERENCES (Including Author, Title, Date, Pertinent Pages, etc.)							
	AW						
	AX						
	AY						
	AZ					☐ Additional References sheet(s) attached	
Examiner	/Jason M. Greene/				Date considered	10/15/2014	
*Examiner: Initial if reference is considered, whether or not citation is in conformance with MPEP 609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.							

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /JMG/

Search Notes 	Application/Control No. 13807831	Applicant(s)/Patent Under Reexamination UNGERANK ET AL.
	Examiner JASON M GREENE	Art Unit 1772

CPC- SEARCHED		
Symbol	Date	Examiner

CPC COMBINATION SETS - SEARCHED		
Symbol	Date	Examiner

US CLASSIFICATION SEARCHED			
Class	Subclass	Date	Examiner
95	45, 47, 51, 55	5/27/14	JMG
96	4, 7, 9, 10, 14	5/27/14	JMG
	Updated Search	10/15/14	JMG

SEARCH NOTES		
Search Notes	Date	Examiner
PALM inventor name search	5/27/14	JMG
EAST text search	5/27/14	JMG

INTERFERENCE SEARCH			
US Class/ CPC Symbol	US Subclass / CPC Group	Date	Examiner
95	45, 47, 51	10/15/14	JMG
96	4, 7, 9, 10, 14	10/15/14	JMG
	EAST interference text search	10/15/14	JMG

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Docket No.: 408824US99PCT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

IN RE APPLICATION OF: Markus UNGERANK, et al.

SERIAL NO: 13/807,831

GAU: 1772

FILED: December 31, 2012

EXAMINER: J.M. GREENE

FOR: PROCESS FOR SEPARATION OF GASES

REQUEST FOR CONTINUED EXAMINATION (RCE) TRANSMITTAL

COMMISSIONER FOR PATENTS
ALEXANDRIA, VIRGINIA 22313

Commissioner:

This is a Request for Continued Examination (RCE) under 37 C.F.R. §1.114 of the above-identified application.

Submission required under 37 C.F.R. §1.114

Previously Submitted:

- ☐ Consider the amendment(s)/reply under 37 C.F.R. §1.116 previously filed on
- ☐ Consider the arguments in the Appeal Brief or Reply Brief previously filed on

Enclosed:

- ☐ Amendment/Reply
- ☒ Information Disclosure Statement (IDS)/PTO Form 1449 – Third Party Observation with (2) Cited References
- ☐ Track 1 Prioritized Examination
- ☐ Other:

FEES	RATE	CALCULATIONS
☐ Suspension of action on the above-identified application is requested under 37 C.F.R. §1.103(c) for a period of months.	\$140.00	\$0.00
☒ RCE Fee required under 37 C.F.R. §1.17(e) - 1st request	\$1,200.00	\$1,200.00
☐		\$0.00
☐		\$0.00
TOTAL OF ABOVE CALCULATIONS:		\$1,200.00
☐ REDUCTION BY 50% FOR FILING AS SMALL ENTITY		\$0.00
TOTAL:		\$1,200.00

- ☒ Credit card payment is being made online (if electronically filed), or is attached hereto (if paper filed), in the amount of **\$1,200.00**.
- ☒ Please charge any additional Fees for the papers being filed herewith and for which no payment is enclosed herewith, or credit any overpayment to Deposit Account No. **15-0030**.
- ☒ If these papers are not considered timely filed by the Patent and Trademark Office, then a petition is hereby made under 37 CFR 1.136, and any additional fees required under 37 CFR 1.136 for any necessary extension of time may be charged to Deposit Account No. **15-0030**.

Respectfully Submitted,

OBLON, SPIVAK, McCLELLAND,
MAIER & NEUSTADT, L.L.P.

Richard L. Treanor

Registration No. 36,379

Customer Number

22850

Tel. (703) 413-3000
Fax. (703) 413-2220
(OSMMN 12/11)

Docket No. 408824US99PCT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

IN RE APPLICATION OF: Markus UNGERANK, et al.

SERIAL NO: 13/807,831

GAU: 1772

FILED: December 31, 2012

EXAMINER: J.M. GREENE

FOR: PROCESS FOR SEPARATION OF GASES

INFORMATION DISCLOSURE STATEMENT UNDER 37 CFR 1.97

COMMISSIONER FOR PATENTS
ALEXANDRIA, VIRGINIA 22313

Commissioner:

Applicant(s) wish to disclose the following information.

REFERENCES

- ☒ The applicant(s) wish to make of record the reference(s) listed on the attached form PTO-1449 and/or accompanying documents from a corresponding foreign application. Copies of the listed reference(s) are attached, where required, as are either statements of relevancy or any readily available partial or full English translations of pertinent portions of any non-English language reference(s).
- ☐ Credit card payment is being made online (if electronically filed), or is attached hereto (if paper filed), in the amount required under 37 CFR §1.17(p).

RELATED CASES

- ☐ Attached is a list of applicant's pending application(s), published application(s) or issued patent(s) which may be related to the present application. In accordance with the waiver of 37 CFR 1.98 dated September 21, 2004, copies of the cited pending applications are not provided. Cited published and/or issued patents, if any, are listed on the attached PTO form 1449.
- ☐ Credit card payment is being made online (if electronically filed), or is attached hereto (if paper filed), in the amount required under 37 CFR §1.17(p).

CERTIFICATION

- ☐ Each item of information contained in this information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of this statement.
- ☐ No item of information contained in this information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application and, to the knowledge of the undersigned, having made reasonable inquiry, was known to any individual designated in 37 CFR §1.56(c) more than three months prior to the filing of this statement.

DEPOSIT ACCOUNT

- ☒ Please charge any additional fees for the papers being filed herewith and for which no payment is enclosed herewith, or credit any overpayment to deposit account number 15-0030.

Respectfully submitted,

OBLON, SPIVAK, McCLELLAND,
MAIER & NEUSTADT, L.L.P.

Richard L. Treanor

Registration No. 36,379

Customer Number

22850

Tel. (703) 413-3000
Fax. (703) 413-2220
(OSMMN 02/12)

Form PTO 1449 (Modified)		U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE		ATTY DOCKET NO. 408824US99PCT		SERIAL NO. 13/807,831	
LIST OF REFERENCES CITED BY APPLICANT				APPLICANT Markus UNGERANK, et al.			
				FILING DATE December 31, 2012		GROUP 1772	
U.S. PATENT DOCUMENTS							
EXAMINER INITIAL		DOCUMENT NUMBER	DATE	NAME	CLASS	SUB CLASS	FILING DATE IF APPROPRIATE
	AA	5,591,250	01-07-1997	STERN ET AL.			
	AB						
	AC						
	AD						
	AE						
	AF						
	AG						
	AH						
	AI						
	AJ						
	AK						
	AL						
	AM						
	AN						
FOREIGN PATENT DOCUMENTS							
		DOCUMENT NUMBER	DATE	COUNTRY	TRANSLATION		
					YES	NO	
	AO						
	AP						
	AQ						
	AR						
	AS						
	AT						
	AU						
	AV						
OTHER REFERENCES (Including Author, Title, Date, Pertinent Pages, etc.)							
	AW	Third Party Observation against corresponding European Patent Application No. 11722404.8-2113, dated June 6, 2014.					
	AX	Mathews J. Thundiyil et al., "Effect of Permeate Pressure on the Mixed Gas Permeation of Carbon Dioxide and Methane in a Glassy Polyimide," <i>Journal of Membrane Science</i> , 152 (1999) pages 29-40.					
	AY						
	AZ					☐ Additional References sheet(s) attached	
Examiner					Date considered		
*Examiner: Initial if reference is considered, whether or not citation is in conformance with MPEP 609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.							

Electronic Patent Application Fee Transmittal				
Application Number:		13807831		
Filing Date:		31-Dec-2012		
Title of Invention:		PROCESS FOR SEPARATION OF GASES		
First Named Inventor/Applicant Name:		Markus Ungerank		
Filer:		Marvin Jay Spivak/JACQUELINE TAYLOR		
Attorney Docket Number:		408824US99PCT		
Filed as Large Entity				
U.S. National Stage under 35 USC 371 Filing Fees				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Miscellaneous:				
Request for Continued Examination	1801	1	1200	1200
Total in USD (\$)				1200

Electronic Acknowledgement Receipt	
EFS ID:	20647718
Application Number:	13807831
International Application Number:	
Confirmation Number:	4142
Title of Invention:	PROCESS FOR SEPARATION OF GASES
First Named Inventor/Applicant Name:	Markus Ungerank
Customer Number:	22850
Filer:	Marvin Jay Spivak/JACQUELINE TAYLOR
Filer Authorized By:	Marvin Jay Spivak
Attorney Docket Number:	408824US99PCT
Receipt Date:	10-NOV-2014
Filing Date:	31-DEC-2012
Time Stamp:	11:37:06
Application Type:	U.S. National Stage under 35 USC 371

Payment information:

Submitted with Payment	yes
Payment Type	Credit Card
Payment was successfully received in RAM	\$1200
RAM confirmation Number	8448
Deposit Account	
Authorized User	

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
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1		408826USRCE.pdf	1623362 b5348538361988ff29209a68522ac386b3dd90de	yes	26
Multipart Description/PDF files in .zip description					
	Document Description	Start	End		
	Request for Continued Examination (RCE)	1	1		
	Transmittal Letter	2	2		
	Information Disclosure Statement (IDS) Form (SB08)	3	3		
	Non Patent Literature	4	14		
	Non Patent Literature	15	26		
Warnings:					
Information:					
2	Fee Worksheet (SB06)	fee-info.pdf	30433 0642bf042fa41441af0500c6fb1b3b5086aa31b1	no	2
Warnings:					
Information:					
Total Files Size (in bytes):			1653795		
This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503. <u>New Applications Under 35 U.S.C. 111</u> If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application. <u>National Stage of an International Application under 35 U.S.C. 371</u> If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course. <u>New International Application Filed with the USPTO as a Receiving Office</u> If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.					



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

NOTICE OF ALLOWANCE AND FEE(S) DUE

22850 7590 11/21/2014
OBLON, SPIVAK, MCCLELLAND MAIER & NEUSTADT, L.L.P.
1940 DUKE STREET
ALEXANDRIA, VA 22314

EXAMINER

GREENE, JASON M

ART UNIT

PAPER NUMBER

1772

DATE MAILED: 11/21/2014

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/807,831	12/31/2012	Markus Ungerank	408824US99PCT	4142

TITLE OF INVENTION: PROCESS FOR SEPARATION OF GASES

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	\$960	\$0	\$0	\$960	02/23/2015

THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. PROSECUTION ON THE MERITS IS CLOSED. THIS NOTICE OF ALLOWANCE IS NOT A GRANT OF PATENT RIGHTS. THIS APPLICATION IS SUBJECT TO WITHDRAWAL FROM ISSUE AT THE INITIATIVE OF THE OFFICE OR UPON PETITION BY THE APPLICANT. SEE 37 CFR 1.313 AND MPEP 1308.

THE ISSUE FEE AND PUBLICATION FEE (IF REQUIRED) MUST BE PAID WITHIN THREE MONTHS FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. THIS STATUTORY PERIOD CANNOT BE EXTENDED. SEE 35 U.S.C. 151. THE ISSUE FEE DUE INDICATED ABOVE DOES NOT REFLECT A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE IN THIS APPLICATION. IF AN ISSUE FEE HAS PREVIOUSLY BEEN PAID IN THIS APPLICATION (AS SHOWN ABOVE), THE RETURN OF PART B OF THIS FORM WILL BE CONSIDERED A REQUEST TO REAPPLY THE PREVIOUSLY PAID ISSUE FEE TOWARD THE ISSUE FEE NOW DUE.

HOW TO REPLY TO THIS NOTICE:

I. Review the ENTITY STATUS shown above. If the ENTITY STATUS is shown as SMALL or MICRO, verify whether entitlement to that entity status still applies.

If the ENTITY STATUS is the same as shown above, pay the TOTAL FEE(S) DUE shown above.

If the ENTITY STATUS is changed from that shown above, on PART B - FEE(S) TRANSMITTAL, complete section number 5 titled "Change in Entity Status (from status indicated above)".

For purposes of this notice, small entity fees are 1/2 the amount of undiscounted fees, and micro entity fees are 1/2 the amount of small entity fees.

II. PART B - FEE(S) TRANSMITTAL, or its equivalent, must be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). If you are charging the fee(s) to your deposit account, section "4b" of Part B - Fee(s) Transmittal should be completed and an extra copy of the form should be submitted. If an equivalent of Part B is filed, a request to reapply a previously paid issue fee must be clearly made, and delays in processing may occur due to the difficulty in recognizing the paper as an equivalent of Part B.

III. All communications regarding this application must give the application number. Please direct all communications prior to issuance to Mail Stop ISSUE FEE unless advised to the contrary.

IMPORTANT REMINDER: Utility patents issuing on applications filed on or after Dec. 12, 1980 may require payment of maintenance fees. It is patentee's responsibility to ensure timely payment of maintenance fees when due.

PART B - FEE(S) TRANSMITTAL

**Complete and send this form, together with applicable fee(s), to: Mail Mail Stop ISSUE FEE
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450
or Fax (571)-273-2885**

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

22850 7590 11/21/2014

OBLON, SPIVAK, MCCLELLAND MAIER & NEUSTADT, L.L.P.
1940 DUKE STREET
ALEXANDRIA, VA 22314

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below.

(Depositor's name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/807,831	12/31/2012	Markus Ungerank	408824US99PCT	4142

TITLE OF INVENTION: PROCESS FOR SEPARATION OF GASES

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	\$960	\$0	\$0	\$960	02/23/2015

EXAMINER	ART UNIT	CLASS-SUBCLASS
GREENE, JASON M	1772	095-051000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).

- ☐ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.
- ☐ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list

- (1) The names of up to 3 registered patent attorneys or agents OR, alternatively, 1 _____
- (2) The name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed. 2 _____
- 3 _____

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE

(B) RESIDENCE: (CITY and STATE OR COUNTRY)

Please check the appropriate assignee category or categories (will not be printed on the patent): ☐ Individual ☐ Corporation or other private group entity ☐ Government

4a. The following fee(s) are submitted:

- ☐ Issue Fee
- ☐ Publication Fee (No small entity discount permitted)
- ☐ Advance Order - # of Copies _____

4b. Payment of Fee(s): (Please first reapply any previously paid issue fee shown above)

- ☐ A check is enclosed.
- ☐ Payment by credit card. Form PTO-2038 is attached.
- ☐ The director is hereby authorized to charge the required fee(s), any deficiency, or credits any overpayment, to Deposit Account Number _____ (enclose an extra copy of this form).

5. Change in Entity Status (from status indicated above)

- ☐ Applicant certifying micro entity status. See 37 CFR 1.29
- ☐ Applicant asserting small entity status. See 37 CFR 1.27
- ☐ Applicant changing to regular undiscounted fee status.

NOTE: Absent a valid certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.

NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.

NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

NOTE: This form must be signed in accordance with 37 CFR 1.31 and 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature _____

Date _____

Typed or printed name _____

Registration No. _____



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/807,831	12/31/2012	Markus Ungerank	408824US99PCT	4142
22850	7590	11/21/2014	EXAMINER	
OBLON, SPIVAK, MCCLELLAND MAIER & NEUSTADT, L.L.P. 1940 DUKE STREET ALEXANDRIA, VA 22314			GREENE, JASON M	
			ART UNIT	PAPER NUMBER

1772

DATE MAILED: 11/21/2014

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b) (Applications filed on or after May 29, 2000)

The Office has discontinued providing a Patent Term Adjustment (PTA) calculation with the Notice of Allowance.

Section 1(h)(2) of the AIA Technical Corrections Act amended 35 U.S.C. 154(b)(3)(B)(i) to eliminate the requirement that the Office provide a patent term adjustment determination with the notice of allowance. See Revisions to Patent Term Adjustment, 78 Fed. Reg. 19416, 19417 (Apr. 1, 2013). Therefore, the Office is no longer providing an initial patent term adjustment determination with the notice of allowance. The Office will continue to provide a patent term adjustment determination with the Issue Notification Letter that is mailed to applicant approximately three weeks prior to the issue date of the patent, and will include the patent term adjustment on the patent. Any request for reconsideration of the patent term adjustment determination (or reinstatement of patent term adjustment) should follow the process outlined in 37 CFR 1.705.

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at 1-(888)-786-0101 or (571)-272-4200.

OMB Clearance and PRA Burden Statement for PTOL-85 Part B

The Paperwork Reduction Act (PRA) of 1995 requires Federal agencies to obtain Office of Management and Budget approval before requesting most types of information from the public. When OMB approves an agency request to collect information from the public, OMB (i) provides a valid OMB Control Number and expiration date for the agency to display on the instrument that will be used to collect the information and (ii) requires the agency to inform the public about the OMB Control Number's legal significance in accordance with 5 CFR 1320.5(b).

The information collected by PTOL-85 Part B is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450. Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Notice of Allowability	Application No. 13/807,831	Applicant(s) UNGERANK ET AL.	
	Examiner Jason M. Greene	Art Unit 1772	AIA (First Inventor to File) Status No

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to the RCE and IDS filed 10 November 2014.
☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.
2. ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.
3. ☒ The allowed claim(s) is/are 1-58. As a result of the allowed claim(s), you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov.
4. ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

Certified copies:

- a) ☒ All b) ☐ Some *c) ☐ None of the:
 1. ☒ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

* Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.

THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.
Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).
6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

- | | |
|---|---|
| <ol style="list-style-type: none"> 1. ☐ Notice of References Cited (PTO-892) 2. ☒ Information Disclosure Statements (PTO/SB/08),
Paper No./Mail Date <u>11/10/14</u> 3. ☐ Examiner's Comment Regarding Requirement for Deposit
of Biological Material 4. ☐ Interview Summary (PTO-413),
Paper No./Mail Date _____. | <ol style="list-style-type: none"> 5. ☐ Examiner's Amendment/Comment 6. ☐ Examiner's Statement of Reasons for Allowance 7. ☒ Other <u>Detailed Action</u>. |
|---|---|

DETAILED ACTION

1. The present application is being examined under the pre-AIA first to invent provisions.

Continued Examination Under 37 CFR 1.114

2. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after allowance or after an Office action under *Ex Parte Quayle*, 25 USPQ 74, 453 O.G. 213 (Comm'r Pat. 1935). Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, prosecution in this application has been reopened pursuant to 37 CFR 1.114. Applicant's submission filed on 10 November 2014 has been entered.

Allowable Subject Matter

3. Claims 1-58 are allowed.

Conclusion

4. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jason M. Greene whose telephone number is (571)272-1157. The examiner can normally be reached on Monday - Friday (8:00 AM to 4:30 PM).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Insuk Bullock can be reached on (571) 272-5954. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Jason M. Greene/
Primary Examiner, Art Unit 1772

jmg
November 14, 2014

Issue Classification 	Application/Control No. 13807831	Applicant(s)/Patent Under Reexamination UNGERANK ET AL.
	Examiner JASON M GREENE	Art Unit 1772

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47															
Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original
1	1	17	17	33	33	49	49								
2	2	18	18	34	34	50	50								
3	3	19	19	35	35	51	51								
4	4	20	20	36	36	52	52								
5	5	21	21	37	37	53	53								
6	6	22	22	38	38	54	54								
7	7	23	23	39	39	55	55								
8	8	24	24	40	40	56	56								
9	9	25	25	41	41	57	57								
15	10	26	26	42	42	58	58								
10	11	27	27	43	43										
11	12	28	28	44	44										
12	13	29	29	45	45										
13	14	30	30	46	46										
14	15	31	31	47	47										
16	16	32	32	48	48										

NONE (Assistant Examiner) _____ (Date) _____		Total Claims Allowed: 58	
/JASON M GREENE/ Primary Examiner, Art Unit 1772 (Primary Examiner) _____ (Date) _____		11/14/2014 (Date) _____	O.G. Print Claim(s) 1 O.G. Print Figure 11

Search Notes 	Application/Control No. 13807831	Applicant(s)/Patent Under Reexamination UNGERANK ET AL.
	Examiner JASON M GREENE	Art Unit 1772

CPC- SEARCHED		
Symbol	Date	Examiner

CPC COMBINATION SETS - SEARCHED		
Symbol	Date	Examiner

US CLASSIFICATION SEARCHED			
Class	Subclass	Date	Examiner
95	45, 47, 51, 55	5/27/14	JMG
96	4, 7, 9, 10, 14	5/27/14	JMG
	Updated Search	10/15/14	JMG
	Updated Search	11/14/14	JMG

SEARCH NOTES		
Search Notes	Date	Examiner
PALM inventor name search	5/27/14	JMG
EAST text search	5/27/14	JMG

INTERFERENCE SEARCH			
US Class/ CPC Symbol	US Subclass / CPC Group	Date	Examiner
95	45, 47, 51	10/15/14	JMG
96	4, 7, 9, 10, 14	10/15/14	JMG
	EAST interference text search	10/15/14	JMG

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Receipt date: 11/10/2014

13807831 - GAU: 1772

SHEET 1 OF 1

Form PTO 1449 (Modified)		U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE		ATTY DOCKET NO. 408824US99PCT		SERIAL NO. 13/807,831	
LIST OF REFERENCES CITED BY APPLICANT				APPLICANT Markus UNGERANK, et al.			
				FILING DATE December 31, 2012		GROUP 1772	
U.S. PATENT DOCUMENTS							
EXAMINER INITIAL		DOCUMENT NUMBER	DATE	NAME	CLASS	SUB CLASS	FILING DATE IF APPROPRIATE
/JMG/	AA	5,591,250	01-07-1997	STERN ET AL.			
	AB						
	AC						
	AD						
	AE						
	AF						
	AG						
	AH						
	AI						
	AJ						
	AK						
	AL						
	AM						
	AN						
FOREIGN PATENT DOCUMENTS							
		DOCUMENT NUMBER	DATE	COUNTRY	TRANSLATION YES NO		
	AO						
	AP						
	AQ						
	AR						
	AS						
	AT						
	AU						
	AV						
OTHER REFERENCES (Including Author, Title, Date, Pertinent Pages, etc.)							
/JMG/	AW	Third Party Observation against corresponding European Patent Application No. 11722404.8-2113, dated June 6, 2014.					
/JMG/	AX	Mathews J. Thundiyil et al., "Effect of Permeate Pressure on the Mixed Gas Permeation of Carbon Dioxide and Methane in a Glassy Polyimide," <i>Journal of Membrane Science</i> , 152 (1999) pages 29-40.					
	AY						
	AZ					☐ Additional References sheet(s) attached	
Examiner	/Jason M. Greene/				Date considered	11/14/2014	
*Examiner: Initial if reference is considered, whether or not citation is in conformance with MPEP 609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.							

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /JMG/

<i>Index of Claims</i> 	Application/Control No. 13807831	Applicant(s)/Patent Under Reexamination UNGERANK ET AL.
	Examiner JASON M GREENE	Art Unit 1772

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

☐ Claims renumbered in the same order as presented by applicant		☐ CPA		☐ T.D.		☐ R.1.47			
CLAIM		DATE							
Final	Original	05/27/2014	10/15/2014	11/14/2014					
1	1	✓	=	=					
2	2	✓	=	=					
3	3	✓	=	=					
4	4	✓	=	=					
5	5	✓	=	=					
6	6	✓	=	=					
7	7	✓	=	=					
8	8	✓	=	=					
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31	31		=	=					
32	32		=	=					
33	33		=	=					
34	34		=	=					
35	35		=	=					
36	36		=	=					

<i>Index of Claims</i> 	Application/Control No. 13807831	Applicant(s)/Patent Under Reexamination UNGERANK ET AL.
	Examiner JASON M GREENE	Art Unit 1772

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

☐ Claims renumbered in the same order as presented by applicant										☐ CPA										☐ T.D.										☐ R.1.47									
CLAIM		DATE																																					
Final	Original	05/27/2014	10/15/2014	11/14/2014																																			
37	37		=	=																																			
38	38		=	=																																			
39	39		=	=																																			
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UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
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P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/807,831	12/31/2012	Markus Ungerank	408824US99PCT	4142

22850	7590	01/05/2015
OBLON, SPIVAK, MCCLELLAND MAIER & NEUSTADT, L.L.P.		
1940 DUKE STREET		
ALEXANDRIA, VA 22314		

EXAMINER
GREENE, JASON M

ART UNIT	PAPER NUMBER
1772	

NOTIFICATION DATE	DELIVERY MODE
01/05/2015	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

patentdocket@oblon.com
oblonpat@oblon.com
ahudgens@oblon.com



UNITED STATES PATENT AND TRADEMARK OFFICE

Commissioner for Patents
United States Patent and Trademark Office
P.O. Box 1450
Alexandria, VA 22313-1450
www.uspto.gov

Application No. : 13807831
Applicant : Ungerank
Filing Date : 12/31/2012
Date Mailed : 01/05/2015

NOTICE TO FILE CORRECTED APPLICATION PAPERS

Notice of Allowance Mailed

This application has been accorded an Allowance Date and is being prepared for issuance. The application, however, is incomplete for the reasons below.

Applicant is given two (2) months from the mail date of this Notice within which to respond. This time period for reply is extendable under 37 CFR 1.136(a) for only TWO additional MONTHS.

The informalities requiring correction are indicated in the attachment(s). If the informality pertains to the abstract, specification (including claims) or drawings, the informality must be corrected with an amendment in compliance with 37 CFR 1.121 (or, if the application is a reissue application, 37 CFR 1.173). Such an amendment may be filed after payment of the issue fee if limited to correction of informalities noted herein. See Waiver of 37 CFR 1.312 for Documents Required by the Office of Patent Publication, 1280 Off. Gaz. Patent Office 918 (March 23, 2004). In addition, if the informality is not corrected until after payment of the issue fee, for purposes of 35 U.S.C. 154(b)(1)(iv), "all outstanding requirements" will be considered to have been satisfied when the informality has been corrected. A failure to respond within the above-identified time period will result in the application being ABANDONED.

See attachment(s).

*A copy of this notice **MUST** be returned with the reply. Please address response to
"Mail Stop Issue Fee, Commissioner for Patents,
P.O. Box 1450, Alexandria, VA 22313-1450".*

/Brian Green/
Publication Branch
Office of Data Management
(571) 272-4200

IDENTIFICATION OF DRAWING DEFICIENCIES

- ☐ There is a hole or the image thereof within the illustration. FIG(s)
- ☐ The illustration is penetrated or traversed by a solid or broken line that is not intended to be part of the drawing, such as a dark line caused by a flaw in the copying process. FIG(s)
- ☐ An ink stamp or the image thereof obscures part of the illustration. FIG(s)
- ☐ The drawing is marred by black smudges, obliterations, or fax/copier marks (for example, speckles or dots in a substantial portion of the drawing). FIG(s)
- ☐ Figure numbers are duplicated or missing. FIG(s)
- ☐ Drawing sheet or figure is missing. FIG(s)
- ☐ Numbers, letters, or reference characters in the drawing have been crossed out or are illegibly handwritten. FIG(s)
- ☒ The character of the lines, numbers, and letters is poor. FIG(s) 11
- ☐ The drawing's background shows that the original drawing was made on graph paper or other paper with a pattern or decoration. FIG(s)
- ☐ The FIG. number label is placed in a location that causes the drawing to be read upside down. FIG(s)
- ☐ Data, a reference number, or part of the drawing is truncated or missing, or a lead line has no reference number. FIG(s)
- ☐ The drawing and/or the FIG. label contain(s) foreign language. FIG(s)
- ☐ This utility application contains a photograph of a view that is capable of being illustrated as a line drawing. FIG(s)
- ☐ A petition under 37 CFR 1.84(a)(2) to accept color drawings has been granted, but the brief description of the drawings in the specification does not contain (or has not been amended to contain) the paragraph required by 37 CFR 1.84(a)(2)(iii).
- ☐ This reissue application contains amended drawings that are not labeled as "Amended" as required by 37 CFR 1.173(b)(3). FIG(s)
- ☐ OTHER:
- ☐ COMMENTS:

DATE ALLOWED: November 21, 2014

OBLON

ATTORNEYS AT LAW

COMMISSIONER FOR PATENTS
ALEXANDRIA, VIRGINIA 22313

Docket No.: 408824US99PCT

RE: Application Serial No.: 13/807,831
Inventor: Markus UNGERANK, et al.
Filing Date: December 31, 2012
For: PROCESS FOR SEPARATION OF GASES
Group 1772
Examiner: GREENE, JASON M

Commissioner:

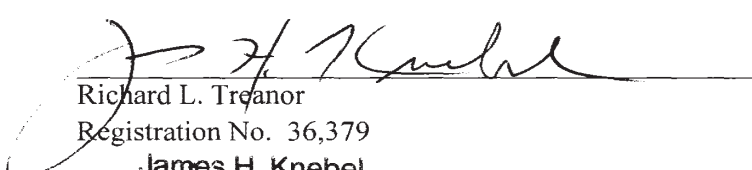
Attached hereto for filing are the following papers:

Copy of Notice to File Corrected Application Papers (After Notice of Allowance Mailed)
Letter Submitting Replacement Drawing Sheet(s)
Replacement Drawing Sheet

Our online credit card payment in the amount of **\$0.00** is being made covering any required fees. In the event any variance exists between the amount enclosed and the Patent Office charges for filing the above-noted documents, including any fees required under 37 C.F.R. 1.136 for any necessary Extension of Time to make the filing of the attached documents timely, please charge or credit the difference to our Deposit Account No. 15-0030. Further, if these papers are not considered timely filed, then a petition is hereby made under 37 C.F.R. 1.136 for the necessary extension of time.

Respectfully submitted,

OBLON, McCLELLAND, MAIER
& NEUSTADT, L.L.P.


Richard L. Treanor
Registration No. 36,379

James H. Knebel
Registration No. 22,630
Stefan U. Koschmieder, Ph.D.
Registration No. 50,238

Customer Number

22850

(703) 413-3000 (phone)
(703) 413-2220 (fax)
(OMMN 01/10)

OBLON, McCLELLAND, MAIER & NEUSTADT, L.L.P.
1940 DUKE STREET ■ ALEXANDRIA, VIRGINIA 22314 ■ U.S.A.
TELEPHONE: 703-413-3000 ■ FACSIMILE: 703-413-2220 ■ WWW.OBLON.COM



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www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/807,831	12/31/2012	Markus Ungerank	408824US99PCT	4142
22850 7590 01/05/2015 OBLON, SPIVAK, MCCLELLAND MAIER & NEUSTADT, L.L.P. 1940 DUKE STREET ALEXANDRIA, VA 22314			EXAMINER GREENE, JASON M	
			ART UNIT	PAPER NUMBER
			1772	
			NOTIFICATION DATE	DELIVERY MODE
			01/05/2015	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

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ahudgens@oblon.com



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Alexandria, VA 22313-1450
www.uspto.gov

Application No. : 13807831
Applicant : Ungerank
Filing Date : 12/31/2012
Date Mailed : 01/05/2015

NOTICE TO FILE CORRECTED APPLICATION PAPERS

Notice of Allowance Mailed

This application has been accorded an Allowance Date and is being prepared for issuance. The application, however, is incomplete for the reasons below.

Applicant is given two (2) months from the mail date of this Notice within which to respond. This time period for reply is extendable under 37 CFR 1.136(a) for only TWO additional MONTHS.

The informalities requiring correction are indicated in the attachment(s). If the informality pertains to the abstract, specification (including claims) or drawings, the informality must be corrected with an amendment in compliance with 37 CFR 1.121 (or, if the application is a reissue application, 37 CFR 1.173). Such an amendment may be filed after payment of the issue fee if limited to correction of informalities noted herein. See Waiver of 37 CFR 1.312 for Documents Required by the Office of Patent Publication, 1280 Off. Gaz. Patent Office 918 (March 23, 2004). In addition, if the informality is not corrected until after payment of the issue fee, for purposes of 35 U.S.C. 154(b)(1)(iv), "all outstanding requirements" will be considered to have been satisfied when the informality has been corrected. A failure to respond within the above-identified time period will result in the application being ABANDONED.

See attachment(s).

*A copy of this notice **MUST** be returned with the reply. Please address response to
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P.O. Box 1450, Alexandria, VA 22313-1450".*

/Brian Green/
Publication Branch
Office of Data Management
(571) 272-4200

IDENTIFICATION OF DRAWING DEFICIENCIES

- ☐ There is a hole or the image thereof within the illustration. FIG(s)
- ☐ The illustration is penetrated or traversed by a solid or broken line that is not intended to be part of the drawing, such as a dark line caused by a flaw in the copying process. FIG(s)
- ☐ An ink stamp or the image thereof obscures part of the illustration. FIG(s)
- ☐ The drawing is marred by black smudges, obliterations, or fax/copier marks (for example, speckles or dots in a substantial portion of the drawing). FIG(s)
- ☐ Figure numbers are duplicated or missing. FIG(s)
- ☐ Drawing sheet or figure is missing. FIG(s)
- ☐ Numbers, letters, or reference characters in the drawing have been crossed out or are illegibly handwritten. FIG(s)
- ☒ The character of the lines, numbers, and letters is poor. FIG(s) 11
- ☐ The drawing's background shows that the original drawing was made on graph paper or other paper with a pattern or decoration. FIG(s)
- ☐ The FIG. number label is placed in a location that causes the drawing to be read upside down. FIG(s)
- ☐ Data, a reference number, or part of the drawing is truncated or missing, or a lead line has no reference number. FIG(s)
- ☐ The drawing and/or the FIG. label contain(s) foreign language. FIG(s)
- ☐ This utility application contains a photograph of a view that is capable of being illustrated as a line drawing. FIG(s)
- ☐ A petition under 37 CFR 1.84(a)(2) to accept color drawings has been granted, but the brief description of the drawings in the specification does not contain (or has not been amended to contain) the paragraph required by 37 CFR 1.84(a)(2)(iii).
- ☐ This reissue application contains amended drawings that are not labeled as "Amended" as required by 37 CFR 1.173(b)(3). FIG(s)
- ☐ OTHER:
- ☐ COMMENTS:

Docket No.: 408824US99PCT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

IN RE APPLICATION: Markus UNGERANK, et al.

SERIAL NO.: 13/807,831

GAU: 1772

FILED: December 31, 2012

EXAMINER: GREENE, JASON M

FOR: PROCESS FOR SEPARATION OF GASES

LETTER SUBMITTING REPLACEMENT DRAWING SHEET(S)

COMMISSIONER FOR PATENTS
Alexandria, VA 22313

Commissioner:

Responsive to the below indicated communication, the following drawing sheets are submitted herewith:

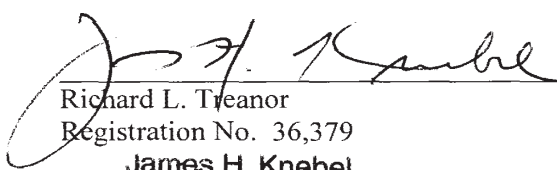
- | | |
|---|---|
| ☒ <u>1</u> Replacement Drawing Sheets | ☐ _____ New Drawing Sheets |
| ☐ _____ Annotated Drawing Sheets | ☐ _____ Color Photographs/Drawing Sheets |
|
 | |
| ☐ Official Action dated _____ | |
| ☐ Notice of Allowance/Issue Fee dated _____ | |
| ☒ Other Notice to File Corrected Application Papers (After NOA Mailed) dated <u>January 5, 2015</u> | |

The changes and/or modifications made include the following:

Replacement Figures 10 -11 are submitted to meet USPTO requirements. No new matter is added.

Respectfully Submitted,

OBLON, McCLELLAND, MAIER
& NEUSTADT, L.L.P.


Richard L. Treanor
Registration No. 36,379

James H. Knebel
Registration No. 22,630
Stefan U. Koschmieder, Ph.D.
Registration No. 50,238

Customer Number

22850

Tel. (703) 413-3000
Fax. (703) 413-2220
(OMMN 11/09)

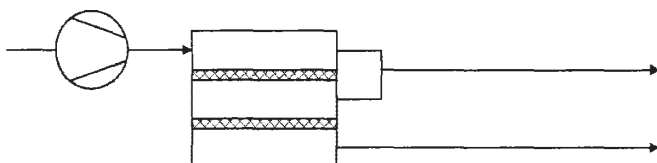


Fig. 10: Connection arrangement with internal staged arrangement for permeate

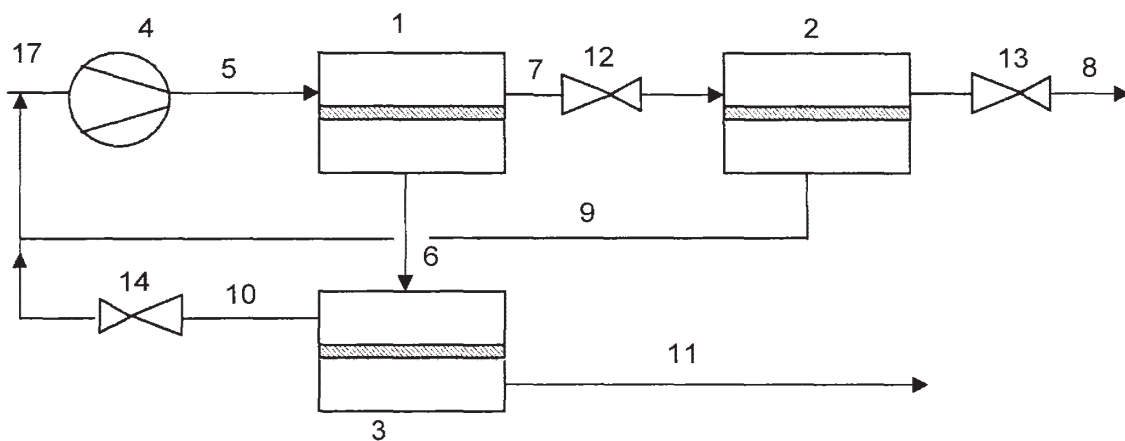


Fig. 11: Illustrative connection arrangement of several membrane modules according to invention

Electronic Acknowledgement Receipt	
EFS ID:	21229843
Application Number:	13807831
International Application Number:	
Confirmation Number:	4142
Title of Invention:	PROCESS FOR SEPARATION OF GASES
First Named Inventor/Applicant Name:	Markus Ungerank
Customer Number:	22850
Filer:	Bradley Davis Lytle/Bryant Carrillo
Filer Authorized By:	Bradley Davis Lytle
Attorney Docket Number:	408824US99PCT
Receipt Date:	16-JAN-2015
Filing Date:	31-DEC-2012
Time Stamp:	12:43:47
Application Type:	U.S. National Stage under 35 USC 371

Payment information:

Submitted with Payment		no			
File Listing:					
Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		408824USNFCAP.pdf	180545	yes	6
			2826dd94f3d00cc4b63ac37c31d053f6f3f87c2a		

Multipart Description/PDF files in .zip description			
Document Description		Start	End
Post Allowance Communication - Incoming		1	4
Post Allowance Communication - Incoming		5	5
Drawings-other than black and white line drawings		6	6

Warnings:

Information:

Total Files Size (in bytes):	180545
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This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

SCORE Placeholder Sheet for IFW Content

Application Number: 13807831

Document Date: 01/16/2015

The presence of this form in the IFW record indicates that the following document type was received in electronic format on the date identified above. This content is stored in the SCORE database.

Since this was an electronic submission, there is no physical artifact folder, no artifact folder is recorded in PALM, and no paper documents or physical media exist. The TIFF images in the IFW record were created from the original documents that are stored in SCORE.

- Drawing

At the time of document entry (noted above):

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- External customers may access SCORE content via PAIR using the Supplemental Content tab.

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), to: **Mail** Mail Stop ISSUE FEE
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P.O. Box 1450
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INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below.

(Depositor's name)
(Signature)
(Date)

CUSTOMER NUMBER
22850

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/807,831	12/31/2012	Markus Ungerank	408824US99PCT	4142

TITLE OF INVENTION: PROCESS FOR SEPARATION OF GASES

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	\$960	\$0	\$0	\$960	02/23/2015

EXAMINER	ART UNIT	CLASS-SUBCLASS
GREENE, JASON M	1772	095-051000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).
☐ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.
☐ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list
(1) The names of up to 3 registered patent attorneys or agents OR, alternatively,
(2) The name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

1 Oblon, McClelland,
2 Maier & Neustadt, L.L.P.
3 _____

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE

(B) RESIDENCE: (CITY and STATE OR COUNTRY)

Evonik Fibres GmbH

Schörfling am Attersee, AUSTRIA

Please check the appropriate assignee category or categories (will not be printed on the patent): ☐ Individual ☒ Corporation or other private group entity ☐ Government

4a. The following fee(s) are submitted:

- ☒ Issue Fee
☐ Publication Fee (No small entity discount permitted)
☐ Advance Order - # of Copies _____

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5. Change in Entity Status (from status indicated above)

- ☐ Applicant certifying micro entity status. See 37 CFR 1.29
☐ Applicant asserting small entity status. See 37 CFR 1.27
☐ Applicant changing to regular undiscounted fee status.

NOTE: Absent a valid certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.

NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.

NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

NOTE: This form must be signed in accordance with 37 CFR 1.31 and 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature _____

Date 2/12/15

Typed or printed name _____

James D. Hamilton

Registration No. 28,421

Electronic Patent Application Fee Transmittal				
Application Number:		13807831		
Filing Date:		31-Dec-2012		
Title of Invention:		PROCESS FOR SEPARATION OF GASES		
First Named Inventor/Applicant Name:		Markus Ungerank		
Filer:		Bradley Davis Lytle/Mimi Chanthaphone		
Attorney Docket Number:		408824US99PCT		
Filed as Large Entity				
Filing Fees for U.S. National Stage under 35 USC 371				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Utility Appl Issue Fee	1501	1	960	960

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Extension-of-Time:				
Miscellaneous:				
Total in USD (\$)				960

Electronic Acknowledgement Receipt	
EFS ID:	21495314
Application Number:	13807831
International Application Number:	
Confirmation Number:	4142
Title of Invention:	PROCESS FOR SEPARATION OF GASES
First Named Inventor/Applicant Name:	Markus Ungerank
Customer Number:	22850
Filer:	Bradley Davis Lytle/Mimi Chanthaphone
Filer Authorized By:	Bradley Davis Lytle
Attorney Docket Number:	408824US99PCT
Receipt Date:	13-FEB-2015
Filing Date:	31-DEC-2012
Time Stamp:	13:01:04
Application Type:	U.S. National Stage under 35 USC 371

Payment information:

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Payment Type	Credit Card
Payment was successfully received in RAM	\$ 960
RAM confirmation Number	10301
Deposit Account	
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Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Issue Fee Payment (PTO-85B)	408824USISSUEFEE.pdf	74483 49b0911e7efc7a9c97b1e09dbd71bbf0dda35ebb	no	1
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Total Files Size (in bytes):			105257		
This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503. <u>New Applications Under 35 U.S.C. 111</u> If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application. <u>National Stage of an International Application under 35 U.S.C. 371</u> If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course. <u>New International Application Filed with the USPTO as a Receiving Office</u> If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.					



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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/807,831	12/31/2012	Markus Ungerank	408824US99PCT	4142
22850 7590 03/02/2015 OBLON, MCCLELLAND, MAIER & NEUSTADT, L.L.P. 1940 DUKE STREET ALEXANDRIA, VA 22314			EXAMINER GREENE, JASON M	
			ART UNIT 1772	PAPER NUMBER
			NOTIFICATION DATE 03/02/2015	DELIVERY MODE ELECTRONIC

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Application No. : 13807831
Applicant : Ungerank
Filing Date : 12/31/2012
Date Mailed : 03/02/2015

NOTICE TO FILE CORRECTED APPLICATION PAPERS

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See attachment(s).

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P.O. Box 1450, Alexandria, VA 22313-1450".*

/Marty Willis/
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Office of Data Management
(571) 272-4200

IDENTIFICATION OF DRAWING DEFICIENCIES

- ☐ There is a hole or the image thereof within the illustration. FIG(s)
- ☐ The illustration is penetrated or traversed by a solid or broken line that is not intended to be part of the drawing, such as a dark line caused by a flaw in the copying process. FIG(s)
- ☐ An ink stamp or the image thereof obscures part of the illustration. FIG(s)
- ☐ The drawing is marred by black smudges, obliterations, or fax/copier marks (for example, speckles or dots in a substantial portion of the drawing). FIG(s)
- ☐ Figure numbers are duplicated or missing. FIG(s)
- ☐ Drawing sheet or figure is missing. FIG(s)
- ☐ Numbers, letters, or reference characters in the drawing have been crossed out or are illegibly handwritten. FIG(s)
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- ☐ The FIG. number label is placed in a location that causes the drawing to be read upside down. FIG(s)
- ☐ Data, a reference number, or part of the drawing is truncated or missing, or a lead line has no reference number. FIG(s)
- ☐ The drawing and/or the FIG. label contain(s) foreign language. FIG(s)
- ☐ This utility application contains a photograph of a view that is capable of being illustrated as a line drawing. FIG(s)
- ☐ A petition under 37 CFR 1.84(a)(2) to accept color drawings has been granted, but the brief description of the drawings in the specification does not contain (or has not been amended to contain) the paragraph required by 37 CFR 1.84(a)(2)(iii).
- ☐ This reissue application contains added and/or amended drawings that are not labeled as "New" or "Amended" or "Canceled" as required by 37 CFR 1.173(b)(3). FIG(s)
- ☐ This Design reissue application contains a drawing that is labeled as "Canceled" but is not surrounded by brackets, or a drawing that is surrounded by brackets but is not labeled as "Canceled." See 37 CFR 1.173(b)(3). FIG(s)
- ☒ OTHER: Thank you for the very timely 1-16-15 Response to the 1-5-15 Notice re: Fig. 11.
- ☒ COMMENTS:
Replacement Sheet 5/5 submitted on 1-16-15 contains improved versions of Figs. 10 and 11 that are of excellent image quality. The 1-16-15 submission is fully responsive to the 1-5-15 requirement. However, it has been discovered that Fig. 11 was not the only original 12-31-12 drawing with poor image quality. In particular, Figs. 1, 5, 6, 8 and 9 have some lines that are so faint that they are, effectively, partially missing. The remaining figures -- 2, 3, 4 and 7 -- are not as bad as those, but they are still less clear and distinct than new Figs. 10 and 11.
Please correct.

Allowed: November 21, 2014

OBLON

Docket No.: 408824US99PCT

ATTORNEYS AT LAW

COMMISSIONER FOR PATENTS
ALEXANDRIA, VIRGINIA 22313

RE: Application Serial No.: 13/807,831
Applicants: Markus UNGERANK, et al.
Filing Date: December 31, 2012
For: PROCESS FOR SEPARATION OF GASES
Group Art Unit: 1772
Examiner: Greene, Jason M.

Commissioner:

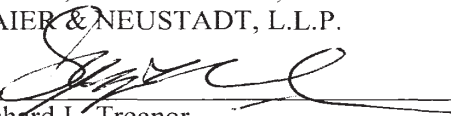
Attached hereto for filing are the following papers:

**Notice to file Corrected Application Papers Notice of Allowance Mailed
Letter Submitting Replacement Drawing Sheets
Replacement Drawing Sheets (4)**

Credit card payment is being made online (if electronically filed), or is attached hereto (if paper filed), in the amount of -0-- to cover any required fees. In the event any variance exists between the amount enclosed and the Patent Office charges for filing the above-noted documents, including any fees required under 37 C.F.R. 1.136 for any necessary Extension of Time to make the filing of the attached documents timely, please charge or credit the difference to our Deposit Account No. **15-0030**. Further, if these papers are not considered timely filed, then a petition is hereby made under 37 C.F.R. 1.136 for the necessary extension of time.

Respectfully submitted,

OBLON, McCLELLAND,
MAIER & NEUSTADT, L.L.P.


Richard L. Treanor

Registration No. 36,379

Customer Number

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(703) 413-3000 (phone)
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(OMMN 02/12)

Sylvia Hsu-Chen Yip
Registration No. 72,926

OBLON, McCLELLAND, MAIER & NEUSTADT, L.L.P.
1940 DUKE STREET ■ ALEXANDRIA, VIRGINIA 22314 ■ U.S.A.
TELEPHONE: 703-413-3000 ■ FACSIMILE: 703-413-2220 ■ WWW.OBLON.COM



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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/807,831	12/31/2012	Markus Ungerank	408824US99PCT	4142
22850 7590 03/02/2015 OBLON, MCCLELLAND, MAIER & NEUSTADT, L.L.P. 1940 DUKE STREET ALEXANDRIA, VA 22314			EXAMINER GREENE, JASON M	
			ART UNIT 1772	PAPER NUMBER
			NOTIFICATION DATE 03/02/2015	DELIVERY MODE ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

patentdocket@oblon.com
oblonpat@oblon.com
ahudgens@oblon.com



UNITED STATES PATENT AND TRADEMARK OFFICE

Commissioner for Patents
United States Patent and Trademark Office
P.O. Box 1450
Alexandria, VA 22313-1450
www.uspto.gov

Application No. : 13807831
Applicant : Ungerank
Filing Date : 12/31/2012
Date Mailed : 03/02/2015

NOTICE TO FILE CORRECTED APPLICATION PAPERS

Notice of Allowance Mailed

This application has been accorded an Allowance Date and is being prepared for issuance. The application, however, is incomplete for the reasons below.

Applicant is given two (2) months from the mail date of this Notice within which to respond. This time period for reply is extendable under 37 CFR 1.136(a) for only TWO additional MONTHS.

The informalities requiring correction are indicated in the attachment(s). If the informality pertains to the abstract, specification (including claims) or drawings, the informality must be corrected with an amendment in compliance with 37 CFR 1.121 (or, if the application is a reissue application, 37 CFR 1.173). Such an amendment may be filed after payment of the issue fee if limited to correction of informalities noted herein. See Waiver of 37 CFR 1.312 for Documents Required by the Office of Patent Publication, 1280 Off. Gaz. Patent Office 918 (March 23, 2004). In addition, if the informality is not corrected until after payment of the issue fee, for purposes of 35 U.S.C. 154(b)(1)(iv), "all outstanding requirements" will be considered to have been satisfied when the informality has been corrected. A failure to respond within the above-identified time period will result in the application being ABANDONED.

See attachment(s).

*A copy of this notice **MUST** be returned with the reply. Please address response to
"Mail Stop Issue Fee, Commissioner for Patents,
P.O. Box 1450, Alexandria, VA 22313-1450".*

/Marty Willis/
Publication Branch
Office of Data Management
(571) 272-4200

IDENTIFICATION OF DRAWING DEFICIENCIES

- ☐ There is a hole or the image thereof within the illustration. FIG(s)
- ☐ The illustration is penetrated or traversed by a solid or broken line that is not intended to be part of the drawing, such as a dark line caused by a flaw in the copying process. FIG(s)
- ☐ An ink stamp or the image thereof obscures part of the illustration. FIG(s)
- ☐ The drawing is marred by black smudges, obliterations, or fax/copier marks (for example, speckles or dots in a substantial portion of the drawing). FIG(s)
- ☐ Figure numbers are duplicated or missing. FIG(s)
- ☐ Drawing sheet or figure is missing. FIG(s)
- ☐ Numbers, letters, or reference characters in the drawing have been crossed out or are illegibly handwritten. FIG(s)
- ☒ The character of the lines, numbers, and letters is poor. FIG(s) 1, 5, 6, 8 and 9
- ☐ The drawing's background shows that the original drawing was made on graph paper or other paper with a pattern or decoration. FIG(s)
- ☐ The FIG. number label is placed in a location that causes the drawing to be read upside down. FIG(s)
- ☐ Data, a reference number, or part of the drawing is truncated or missing, or a lead line has no reference number. FIG(s)
- ☐ The drawing and/or the FIG. label contain(s) foreign language. FIG(s)
- ☐ This utility application contains a photograph of a view that is capable of being illustrated as a line drawing. FIG(s)
- ☐ A petition under 37 CFR 1.84(a)(2) to accept color drawings has been granted, but the brief description of the drawings in the specification does not contain (or has not been amended to contain) the paragraph required by 37 CFR 1.84(a)(2)(iii).
- ☐ This reissue application contains added and/or amended drawings that are not labeled as "New" or "Amended" or "Canceled" as required by 37 CFR 1.173(b)(3). FIG(s)
- ☐ This Design reissue application contains a drawing that is labeled as "Canceled" but is not surrounded by brackets, or a drawing that is surrounded by brackets but is not labeled as "Canceled." See 37 CFR 1.173(b)(3). FIG(s)
- ☒ OTHER: Thank you for the very timely 1-16-15 Response to the 1-5-15 Notice re: Fig. 11.
- ☒ COMMENTS:
Replacement Sheet 5/5 submitted on 1-16-15 contains improved versions of Figs. 10 and 11 that are of excellent image quality. The 1-16-15 submission is fully responsive to the 1-5-15 requirement. However, it has been discovered that Fig. 11 was not the only original 12-31-12 drawing with poor image quality. In particular, Figs. 1, 5, 6, 8 and 9 have some lines that are so faint that they are, effectively, partially missing. The remaining figures -- 2, 3, 4 and 7 -- are not as bad as those, but they are still less clear and distinct than new Figs. 10 and 11.
Please correct.

Docket No.: 408824US99PCT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

IN RE APPLICATION: Markus UNGERANK, et al.

SERIAL NO.: 13/807,831

GAU: 1772

FILED: December 31, 2012

EXAMINER: GREENE, JASON M

FOR: PROCESS FOR SEPARATION OF GASES

LETTER SUBMITTING REPLACEMENT DRAWING SHEET(S)

COMMISSIONER FOR PATENTS
Alexandria, VA 22313

Commissioner:

Responsive to the below indicated communication, the following drawing sheets are submitted herewith:

- | | |
|--|---|
| ☒ 4 Replacement Drawing Sheets | ☐ _____ New Drawing Sheets |
| ☐ _____ Annotated Drawing Sheets | ☐ _____ Color Photographs/Drawing Sheets |
|
 | |
| ☐ Official Action dated _____ | |
| ☐ Notice of Allowance/Issue Fee dated _____ | |
| ☒ Other Notice to File Corrected Application Papers dated <u>March 2, 2015</u> | |

The changes and/or modifications made include the following:

Replacement Figures 1-9 are submitted to meet USPTO requirements. No new matter is added.

Respectfully Submitted,

OBLON, McCLELLAND,
MAIER & NEUSTADT, L.L.P.



Richard L. Treanor
Registration No. 36,379

Customer Number
22850
Tel. (703) 413-3000
Fax. (703) 413-2220
(OMMN 11/09)

Sylvia Hsu-Chen Yip
Registration No. 72,926

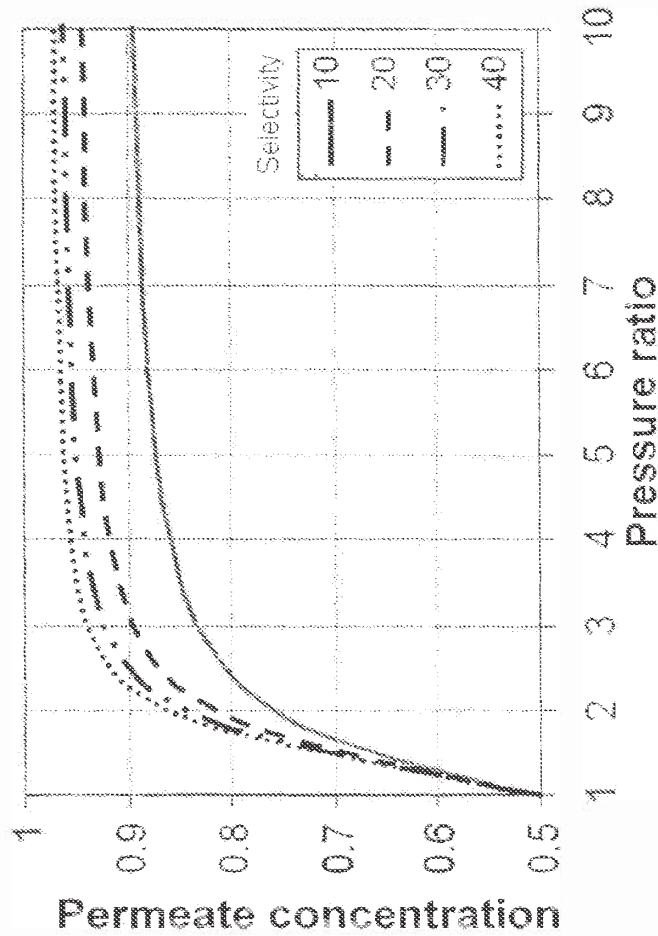


Fig. 1: Influence of the pressure ratio and of the selectivity on the separation outcome

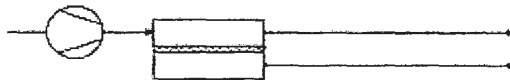


Fig. 2: One-stage membrane separation stage without recycling

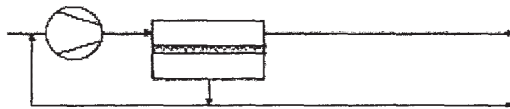


Fig. 3: One-stage membrane separation stage with recycling

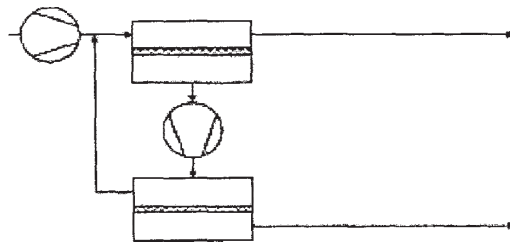


Fig. 4: Two-stage membrane separation stage with recompression and recycling

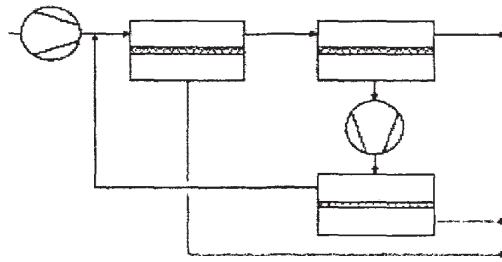


Fig. 5: Staged arrangement for retentate and permeate with recompression and recycling in the second retentate stage upstream of the first retentate stage

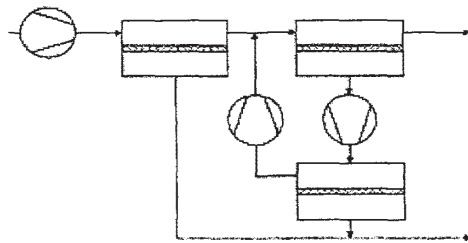


Fig. 6: Staged arrangement for retentate and permeate with recompression and recycling in the second retentate stage upstream of the second retentate stage

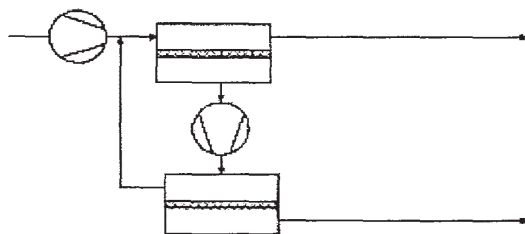


Fig. 7: Staged arrangement for permeate with recompression

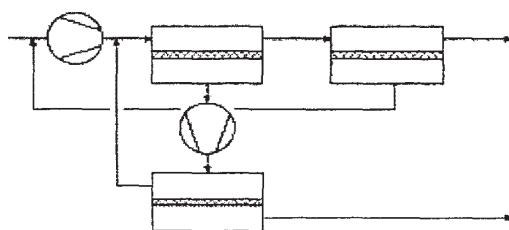


Fig. 8: Staged arrangement for retentate with permeate recycling from the second stage and staged arrangement for permeate with recompression

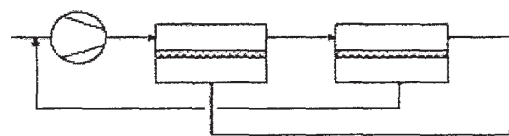


Fig. 9: Staged arrangement for retentate with permeate recycling from the second stage

Electronic Acknowledgement Receipt	
EFS ID:	21742116
Application Number:	13807831
International Application Number:	
Confirmation Number:	4142
Title of Invention:	PROCESS FOR SEPARATION OF GASES
First Named Inventor/Applicant Name:	Markus Ungerank
Customer Number:	22850
Filer:	Bradley Davis Lytle/Bryant Carrillo
Filer Authorized By:	Bradley Davis Lytle
Attorney Docket Number:	408824US99PCT
Receipt Date:	11-MAR-2015
Filing Date:	31-DEC-2012
Time Stamp:	17:08:15
Application Type:	U.S. National Stage under 35 USC 371

Payment information:

Submitted with Payment		no			
File Listing:					
Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		408824USNFCAP.pdf	320449	yes	9
			9e72b5b9bafc1eb7a10aa7fd0e8ded64d4bb7dba		

	Multipart Description/PDF files in .zip description		
	Document Description	Start	End
	Post Allowance Communication - Incoming	1	4
	Post Allowance Communication - Incoming	5	5
	Drawings-only black and white line drawings	6	9
Warnings:			
Information:			
Total Files Size (in bytes):		320449	
This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503. <u>New Applications Under 35 U.S.C. 111</u> If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application. <u>National Stage of an International Application under 35 U.S.C. 371</u> If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course. <u>New International Application Filed with the USPTO as a Receiving Office</u> If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.			



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APPLICATION NO.	ISSUE DATE	PATENT NO.	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/807,831	04/07/2015	8999038	408824US99PCT	4142

22850 7590 03/18/2015
OBLON, MCCLELLAND, MAIER & NEUSTADT, L.L.P.
1940 DUKE STREET
ALEXANDRIA, VA 22314

ISSUE NOTIFICATION

The projected patent number and issue date are specified above.

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b) (application filed on or after May 29, 2000)

The Patent Term Adjustment is 0 day(s). Any patent to issue from the above-identified application will include an indication of the adjustment on the front page.

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (<http://pair.uspto.gov>).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Application Assistance Unit (AAU) of the Office of Data Management (ODM) at (571)-272-4200.

APPLICANT(s) (Please see PAIR WEB site <http://pair.uspto.gov> for additional applicants):

Markus Ungerank, Perg, AUSTRIA;
Goetz Baumgarten, Haltern am See, GERMANY;
Markus Priske, Duesseldorf, GERMANY;
Harald Roegl, Wallern an der Trattnach, AUSTRIA;

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CHANGE OF CORRESPONDENCE ADDRESS Patent Address to: Mail Stop Post Issue Commissioner for Patents P.O. Box 1450 Alexandria, VA 22313-1450	Patent Number	8,999,038
	Issue Date	April 7, 2015
	Application Number	13/807,831
	Filing Date	December 31, 2012
	First Named Inventor	M. Ungerank et al.
	Attorney Docket Number	87046-002

Please change the Correspondence Address for the above-identified patent to:

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I am the:

☒ Patentee.

☒ If the Patentee was not the applicant for patent (37 CFR 1.42), then a Statement under 37 CFR 3.73(c) (Form PTO/AIA/96 or equivalent) is enclosed or was filed on _____. See 37 CFR 3.71.

☐ Attorney or agent of record. Registration Number _____.

☐ Patent practitioner acting in a representative capacity whose correspondence address is the correspondence address of record. Notice has been given to the patentee or owner. Registration Number _____.

Signature 

Typed or Printed Name Carl Kumpe

Date July 30, 2021 Telephone _____

NOTE: This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4(d) for signature requirements and certifications. Submit multiple forms if more than one signature is required, see below*.

☐ *Total of _____ forms are submitted.

This collection of information is required by 37 CFR 1.33. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 3 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Mail Stop Post Issue, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

Privacy Act Statement

The **Privacy Act of 1974 (P.L. 93-579)** requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (*i.e.*, GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Electronic Acknowledgement Receipt	
EFS ID:	43390508
Application Number:	13807831
International Application Number:	
Confirmation Number:	4142
Title of Invention:	PROCESS FOR SEPARATION OF GASES
First Named Inventor/Applicant Name:	Markus Ungerank
Customer Number:	22850
Filer:	Amy Beth Goldsmith/Susan Formicola
Filer Authorized By:	Amy Beth Goldsmith
Attorney Docket Number:	408824US99PCT
Receipt Date:	30-JUL-2021
Filing Date:	31-DEC-2012
Time Stamp:	14:20:05
Application Type:	U.S. National Stage under 35 USC 371

Payment information:

Submitted with Payment	no				
File Listing:					
Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Assignee showing of ownership per 37 CFR 3.73	02450915.PDF	134787 5840dccc7d42dc62140d3a25ce8299f9ecb4b073f	no	3
Warnings:					

Information:					
2	Change of Address	02451782.PDF	252560	no	2
			47ffefcc3d091d373114d18713dcd730d6c20ea		
Warnings:					
Information:					
Total Files Size (in bytes):				387347	
This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503. <u>New Applications Under 35 U.S.C. 111</u> If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application. <u>National Stage of an International Application under 35 U.S.C. 371</u> If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course. <u>New International Application Filed with the USPTO as a Receiving Office</u> If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.					

STATEMENT UNDER 37 CFR 3.73(c)

Applicant/Patent Owner: EVONIK FIBRES GMBH
Application No./Patent No.: 8,999,038 Filed/Issue Date: 04/07/2015
Titled: PROCESS FOR SEPARATION OF GASES
EVONIK FIBRES GMBH, a Limited Liability Company
(Name of Assignee) (Type of Assignee, e.g., corporation, partnership, university, government agency, etc.)

states that, for the patent application/patent identified above, it is (choose **one** of options 1, 2, 3 or 4 below):

1. ☒ The assignee of the entire right, title, and interest.
2. ☐ An assignee of less than the entire right, title, and interest (check applicable box):
- ☐ The extent (by percentage) of its ownership interest is ____%. Additional Statement(s) by the owners holding the balance of the interest must be submitted to account for 100% of the ownership interest.
- ☐ There are unspecified percentages of ownership. The other parties, including inventors, who together own the entire right, title and interest are:

Additional Statement(s) by the owner(s) holding the balance of the interest must be submitted to account for the entire right, title, and interest.

3. ☐ The assignee of an undivided interest in the entirety (a complete assignment from one of the joint inventors was made). The other parties, including inventors, who together own the entire right, title, and interest are:

Additional Statement(s) by the owner(s) holding the balance of the interest must be submitted to account for the entire right, title, and interest.

4. ☐ The recipient, via a court proceeding or the like (e.g., bankruptcy, probate), of an undivided interest in the entirety (a complete transfer of ownership interest was made). The certified document(s) showing the transfer is attached.

The interest identified in option 1, 2 or 3 above (not option 4) is evidenced by either (choose **one** of options A or B below):

- A. ☒ An assignment from the inventor(s) of the patent application/patent identified above. The assignment was recorded in the United States Patent and Trademark Office at Reel 029586, Frame 0083, or for which a copy thereof is attached.
- B. ☐ A chain of title from the inventor(s), of the patent application/patent identified above, to the current assignee as follows:

1. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at
Reel _____, Frame _____, or for which a copy thereof is attached.

2. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at
Reel _____, Frame _____, or for which a copy thereof is attached.

[Page 1 of 2]

This collection of information is required by 37 CFR 3.73(b). The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

STATEMENT UNDER 37 CFR 3.73(c)

3. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at
Reel _____, Frame _____, or for which a copy thereof is attached.

4. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at
Reel _____, Frame _____, or for which a copy thereof is attached.

5. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at
Reel _____, Frame _____, or for which a copy thereof is attached.

6. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at
Reel _____, Frame _____, or for which a copy thereof is attached.

☐ Additional documents in the chain of title are listed on a supplemental sheet(s).

☒ As required by 37 CFR 3.73(c)(1)(i), the documentary evidence of the chain of title from the original owner to the assignee was, or concurrently is being, submitted for recordation pursuant to 37 CFR 3.11.

[NOTE: A separate copy (i.e., a true copy of the original assignment document(s)) must be submitted to Assignment Division in accordance with 37 CFR Part 3, to record the assignment in the records of the USPTO. See MPEP 302.08]

The undersigned (whose title is supplied below) is authorized to act on behalf of the assignee.

/Philip Braginsky/

Signature

Philip Braginsky

Printed or Typed Name

July 30, 2021

Date

40,527

Title or Registration Number

Privacy Act Statement

The **Privacy Act of 1974 (P.L. 93-579)** requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
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5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (*i.e.*, GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.