

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

AIR PRODUCTS AND CHEMICALS, INC.,
Petitioner

v.

EVONIK OPERATIONS GMBH and EVONIK CORPORATION,
Patent Owner.

Case IPR2024-00611

Patent 10,471,380 B2

PRELIMINARY RESPONSE TO PETITION FOR *INTER PARTES*
REVIEW OF UNITED STATES PATENT NO. 10,471,380

TABLE OF CONTENTS

I.	INTRODUCTION	1
II.	SUMMARY OF THE TECHNOLOGY AND THE ‘380 PATENT	1
III.	THE PRIMARY ASSERTED REFERENCES.....	3
	A. Scholz, Marco et al., <i>Structural optimization of membrane-based biogas upgrading processes</i> , J. Membr. Sci., 474, 1–10 (“Scholz”)	3
	B. U.S. Patent No. 8,999,038 to Ungerank et al. (“Ungerank”).....	4
IV.	CLAIM CONSTRUCTION	5
V.	LEVEL OF ORDINARY SKILL IN THE ART	5
VI.	GROUND OF THE PETITIONER’S PROPOSED REJECTIONS	5
VII.	PETITIONER HAS MADE INCORRECT ASSUMPTIONS ABOUT THE LANGUAGE OF THE ‘380 PATENT AND THE MOTIVATIONS OF ONE OF ORDINARY SKILL IN ART, ALL OF WHICH ARE FATAL TO ITS OBVIOUSNESS ALLEGATIONS	8
	A. Petitioner Incorrectly Characterizes the Claims of the ‘380 Patent as Solving a “Problem” by Providing “Lower Cost, Lower Selectivity” Membranes	9
	B. Petitioner Incorrectly Correlates Membrane Selectivity to the Amount of Gas Needing to be Compressed or Recycled.....	13
	C. Petitioner Incorrectly Correlates Membrane Selectivity to Membrane Capacity	15
VIII.	GROUND 1: PETITIONER HAS FAILED TO ESTABLISH A LIKELIHOOD THAT CLAIMS 1–5, 7, 9 AND 11–23 ARE OBVIOUS IN VIEW OF UNGERANK AND SCHOLZ	18
	A. Ungerank and Scholz Do Not Teach What Petitioner Alleges That They Teach	19
	B. There is No Motivation to Combine Ungerank and Scholz as Alleged by the Petitioner.....	21

C.	The Combination of Ungerank and Scholz, Even if Motivated, Would Yield No Expectation of Success.....	27
IX.	GROUND 2: PETITIONER HAS FAILED TO ESTABLISH THAT CLAIMS 1–13, 16, 17, 21 AND 23 ARE OBVIOUS IN VIEW OF SCHOLZ	33
A.	Scholz Does Not Teach or Suggest Every Feature Recited in the Challenged Claims	34
B.	There is No Motivation to Modify the Teachings of Scholz in the Manner Asserted by the Petitioner	35
C.	The Proposed Modification of Scholz Yields No Expectation of Success, and Still is Not the Subject Matter of the Challenged Claims	41
X.	CONCLUSION.....	46

TABLE OF AUTHORITIES

	Page(s)
Cases	
<i>Apple, Inc. v. Contentguard Holdings, Inc.</i> , IPR2015-00355, Decision Denying Institution of Inter Partes Review, Paper 9 (PTAB June 26, 2015).....	6
<i>Broadcom Corp. v. Emulex Corp.</i> , 732 F.3d 1325 (Fed. Cir. 2013)	7
<i>Graham v. John Deere Co.</i> , 383 U.S. 1 (1966).....	6, 27
<i>In re Hedges</i> , 783 F.2d at 1041	25, 41
<i>Innogenetics, N.V. v. Abbott Lab 'ys.</i> , 512 F.3d 1363 (Fed. Cir. 2008)	7
<i>KSR Int'l Co. v. Teleflex Inc.</i> , 550 U.S. 398 (2007).....	6
<i>Otsuka Pharm. Co. v. Sandoz, Inc.</i> , 678 F.3d 1280 (Fed. Cir. 2012)	21, 32, 33, 44
<i>Pers. Web Techs., LLC v. Apple, Inc.</i> , 848 F.3d 987 (Fed. Cir. 2017)	7
<i>Stratoflex, Inc. v. Aeroquip Corp.</i> , 713 F.2d 1530 (Fed. Cir. 1983)	6
<i>Syntex (USA) LLC v. Apotex, Inc.</i> , 407 F.3d 1371 (Fed. Cir. 2005)	24, 25, 41
<i>Titanium Metals Corp. of America v. Banner</i> , 778 F.2d 775 (Fed. Cir. 1985)	30, 42
<i>In re Van Os</i> , 844 F.3d 1359 (Fed. Cir. 2017)	7

Statutes and Rules

35 U.S.C. § 103	21
35 U.S.C. §§ 311–319	1
35 U.S.C. § 314	1
37 C.F.R. § 42.107	1
37 C.F.R. § 42.108(c)	1

PATENT OWNER'S EXHIBIT LIST

Exhibit No.	Description
2001	Expert Declaration of Markus Ungerank in Support of Patent Owner's Preliminary Response to Petition for <i>Inter Partes</i> Review of United States Patent No. 10,471,380
2002	Curriculum Vitae of Markus Ungerank
2003	Membrane Plants, LINDE ENGINEERING, https://www.linde-engineering.com/en/process-plants/adsorption-and-membrane-plants/membrane-plants/index.html (last visited June 13, 2024).
2004	Charles L. Anderson & Anggiat Siahaan, <i>Case Study: Membrane CO₂ Removal From Natural Gas, Grissik Gas Plant, Sumatra, Indonesia</i> , https://catalysts.basf.com/files/pdf/Membrane-Protection_Medal-Article-Grissik.pdf .

I. INTRODUCTION

On February 23, 2024, Air Products and Chemicals Inc. (“Petitioner”) submitted a Petition for *Inter Partes Review* (“Petition”) of U.S. Patent No. 10,471,380 B2 to Priske (Exhibit AP-1001, “the ‘380 Patent”), challenging Claims 1–23 pursuant to 35 U.S.C. §§ 311–319 and 37 C.F.R. § 42 (“the Challenged Claims”). Patent Owner Evonik Operations GmbH and Evonik Corporation (“Patent Owner” or “Evonik”) hereby submits this Preliminary Response pursuant to 37 C.F.R. § 42.107.

In order for the Board to grant review of the Petition, Petitioner must prove that there is a reasonable likelihood that at least one of the challenged claims is unpatentable. 37 C.F.R. § 42.108(c); 35 U.S.C. § 314. Petitioner has not met this requirement, as it has failed to demonstrate a reasonable likelihood that it will prevail with respect to any of the Challenged Claims in its invalidity allegations, based on the references and obviousness grounds set forth in the Petition. Accordingly, the Board should deny the Petition.

II. SUMMARY OF THE TECHNOLOGY AND THE ‘380 PATENT

The ‘380 Patent issued from U.S. Patent Application No. 15/540,709 which is the U.S. National Stage application of International Patent Application No. PCT/EP2015/080925. The International Application has an International Filing

Date of December 22, 2015 and claims priority to European Patent Application No. 14200384, filed December 29, 2014.

The '380 Patent discloses and claims methods for separating gases from a crude gas stream comprising at least two components, with an apparatus comprising three stages: (1) a feed stream separation stage; (2) a retentate separation stage; and (3) a permeate separation stage (AP-1001).

Independent claim 1 of the '380 Patent (and accordingly, claims 2 through 23, which depend therefrom and incorporate its limitations) recites certain values for three features, that:

(i) the combined gas volume of the second permeate stream and the third retentate stream is from 60 to 100% of the volume of the crude gas stream (the **“recycle volume”** feature);

(ii) the total capacity of the gas separation membranes in the retentate separation stage is higher than the total capacity of the gas separation membranes in the feed stream separation stage, the total capacity being measured for nitrogen Grade 4.8 under standard conditions as defined in the description (the **“membrane capacity”** feature); and

(iii) the quotient of the pressure ratio over the permeate separation stage to the pressure ratio over the feed stream separation stage is in a range of from 0.5 to 8 (the “**pressure-ratio quotient**” feature)
(AP-1001, claim 1(i)–(iii).)¹

III. THE PRIMARY ASSERTED REFERENCES

A. **Scholz, Marco et al., *Structural optimization of membrane-based biogas upgrading processes*, J. Membr. Sci., 474, 1–10 (“Scholz”)**

Scholz (AP-1007) is directed to optimization of processes for separating carbon dioxide (CO₂) and methane (CH₄), for the purposes of upgrading biogas, as a renewable resource and contributor to the energy supply. (AP-1007 at Introduction.) Scholz examines several process parameters, including the number of stages and selectivity of the membranes, in order to achieve its desired ends of high gas purities and high recoveries. (AP-1007 at Abstract, 2.) Scholz ultimately concludes that the most “profitable” configurations, based on its boundary conditions, are: (i) three stage processes, using (ii) commercially available membranes with higher selectivities (60). (AP-1007 at Abstract.)

Important examples in Scholz, for the purposes of the present analysis, are the process configuration shown in Figure 5, which uses membranes having higher

¹ Unless otherwise indicated, all emphasis is added herein.

selectivity (60); and the process configuration shown in Figure 7, which uses membranes having lower selectivity (20). (AP-1007 at 5, 7.)

In presenting its findings, Scholz states that, while it has found that certain conditions (“feed gas conditions, product gas requirements and economic parameters such as product gas pressure and energy costs”) determine the optimal process configuration, these are identified “by applying the boundary conditions set here.” (AP-1007 at 2.) Scholz makes the following point: “This process configuration is *most likely not optimal for the entire range of parameters to be applied in biogas upgrading and boundary conditions have to be reviewed carefully.*” (AP-1007 at 2.) In other words, Scholz recognizes the limitations of its teachings—that the configurations it found optimal were highly dependent on the boundary conditions of its particular process configurations—and that many boundary conditions can be contemplated, far beyond the particular ones applied in Scholz’s processes.

B. U.S. Patent No. 8,999,038 to Ungerank et al. (“Ungerank”)

Ungerank (AP-1006) is directed to apparatuses for separating gases, comprising membrane separation stages; as well as to processes for separating gas mixtures through a chain of gas separation membrane modules. (AP-1006 at Abstract, claims 1, 12 and 34.) Ungerank relates to apparatuses and processes

configured to use highly selective gas separation membrane modules (having a gas selectivity of at least 30) configured such that there is an increase of concentration of a first gas in the feed stream compared to its concentration in the crude gas stream and, providing a recycled gas volume of less than 60% by volume of the crude gas stream. (AP-1006 at claims 1, 12 and 34.)

IV. CLAIM CONSTRUCTION

For the purposes of this Preliminary Response only, Patent Owner believes that claim construction is not required to resolve any issues.

V. LEVEL OF ORDINARY SKILL IN THE ART

For the purposes of this Preliminary Response only, Patent Owner utilizes Petitioner's proposed level of skill in the art: an individual with "a Master of Science degree in physical chemistry, chemistry, chemical engineering, or a related field, and at least three years of work experience in membrane gas-separation systems, including but not limited to biogas membrane separations." (Petition at 11; AP-1003, ¶¶ 56–60.)

VI. GROUNDS OF THE PETITIONER'S PROPOSED REJECTIONS

The Petition is directed to Claims 1–23 of the '380 Patent and proposes the following grounds of rejection against the Challenged Claims for institution of an *inter partes* review:

Ground 1: That claims 1-5, 7, 9 and 11-23 are obvious in view of Ungerank and Scholz; and

Ground 2: That claims 1-13, 16, 17, 21 and 23 are obvious in view of Scholz.

An obviousness analysis requires consideration of several factors including: (1) the scope and content of the prior art, (2) any differences between the claimed subject matter and the prior art, (3) the level of skill in the art, and (4) secondary considerations where in evidence. *See Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966); *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 406 (2007). The question is not whether the differences themselves would have been obvious, but whether the claimed invention as a whole would have been obvious. *Stratoflex, Inc. v. Aeroquip Corp.*, 713 F.2d 1530, 1537 (Fed. Cir. 1983).

The Board has held that failure to provide “some rational underpinning” to the modification or combination of “the purportedly known elements in the fashion claimed by the [Challenged Claims]” is fatal to a petition. *See, e.g., Apple, Inc. v. Contentguard Holdings, Inc.*, IPR2015-00355, Decision Denying Institution of Inter Partes Review, Paper 9 at 9–11 (PTAB June 26, 2015).

To determine that a claim is obvious, the Board must sufficiently explain and support a conclusion that:

- the cited references disclose all of the elements recited in the claim; and
- a person of ordinary skill in the art not only could have combined, but would also have been motivated to combine, all of the prior art references in the way the patent claims recite; and
- there is a reasonable expectation of success in the combination.

See Pers. Web Techs., LLC v. Apple, Inc., 848 F.3d 987, 994 (Fed. Cir. 2017).

The “motivation to combine” determination must be supported by a “plausible rational[e]” as to why the references would have worked together. *See Broadcom Corp. v. Emulex Corp.*, 732 F.3d 1325, 1335 (Fed. Cir. 2013). In the absence of an articulated plausible rationale, a “common sense” finding is no different than the conclusory statement “would have been obvious.” *In re Van Os*, 844 F.3d 1359, 1361 (Fed. Cir. 2017). Further, “knowledge of a problem and motivation to solve it are entirely different from motivation to combine particular references. . .” *Innogenetics, N.V. v. Abbott Lab ’ys.*, 512 F.3d 1363, 1373 (Fed. Cir. 2008). Thus, the motivation to combine is a distinct requirement, and cannot be merely collapsed into the identification of a problem.

Here, Petitioner does not, and cannot, establish a likelihood of success in its obviousness allegations against the Challenged Claims because, among other reasons, it relies on erroneous conclusions of its expert.

VII. PETITIONER HAS MADE INCORRECT ASSUMPTIONS ABOUT THE LANGUAGE OF THE ‘380 PATENT AND THE MOTIVATIONS OF ONE OF ORDINARY SKILL IN ART, ALL OF WHICH ARE FATAL TO ITS OBVIOUSNESS ALLEGATIONS

In attempting to justify its allegations of obviousness, Petitioner makes numerous factual errors, assumptions, and mischaracterizations of what one of ordinary skill in the art would be concerned with, and would be motivated to combine upon viewing Scholz and Ungerank; as well as the language of the claims and general disclosure of the ‘380 Patent. Because Petitioner’s asserted assumptions are crucial to its obviousness argument, these errors, assumptions, and mischaracterizations are fatal to its argument for obviousness. Primarily, Petitioner must establish that Scholz and Scholz plus Ungerank teach one of ordinary skill in the art to use low selectivity, low cost, membranes to optimize the separation of gases. Petitioner must establish this because it claims that is the purpose and goal of the ‘380 Patent. Petitioner’s argument goes: since the use of low selectivity, low cost, membranes is the goal of the ‘380 Patent, then the ‘380 Patent claims are obvious in light of Scholz and Ungerank. By understanding the facts of the ‘380 Patent and claims, it becomes clear that Petitioner has not sufficiently alleged a likelihood to prevail in its obviousness allegations.

A. Petitioner Incorrectly Characterizes the Claims of the ‘380 Patent as Solving a “Problem” by Providing “Lower Cost, Lower Selectivity” Membranes

In alleging that the claims of the ‘380 Patent are unpatentable, Petitioner builds a narrative that is based on a flawed basic premise that ultimately cannot stand.

Petitioner alleges that the ‘380 Patent solves a problem identified in the art “by using lower cost, lower-selectivity membranes.” (Petition at 7.) Petitioner requires this as the predicate for its ‘obviousness’ allegations and its ‘motivation to combine’ allegation. Through this characterization, Petitioner shows its fundamental misunderstanding of the disclosure of the ‘380 Patent and the state of the art of membrane separation systems. Contrary to Petitioner’s characterizations of the “problem” allegedly addressed by the ‘380 Patent, nowhere is it stated in the ‘380 Patent disclosure that: (1) lower selective, lower cost membranes should be used to minimize investment and maintenance costs (Petition at 1), or that: (2) using lower selectivity membranes leads to lower costs.

In further support of the erroneous assumption that Petitioner perpetuates throughout the Petition (and is the linchpin of its obviousness allegation, as will be discussed *infra*), Petitioner has submitted a Declaration of Dr. Richard W. Baker

(AP-1003), who states that “higher-selectivity membranes are more expensive than lower selectivity membranes.” (AP-1003, ¶ 81.)

However, this characterization is incorrect, and is neither taught nor suggested in the ‘380 Patent disclosure or in the art. No portion of the ‘380 Patent mentions anything about low-cost, lower selectivity membranes. In fact, *lower selectivity membranes are not necessarily cheaper than higher selectivity membranes*. They may or may not be less expensive in individual circumstances, and the ‘380 Patent does not propose that cost is tied to membrane selectivity. Thus, when Petitioner alleges that Evonik was focused on cheaper and lower selectivity membranes at the time that the technology leading to the ‘380 Patent was developed, this constitutes an error as to the motivations of the Patent Owner and to those of one skilled in the art.

Petitioner submits Dr. Baker’s Declaration to support the allegation that the features claimed in the ‘380 Patent would have been obvious to one of ordinary skill in the art. But reviewed more closely, the facts asserted in the Baker Declaration, many of which Evonik does not disagree with, actually establish the opposite—that these features are **not** obvious.

As one of ordinary skill in the art would know, use of lower selective membranes can actually be more expensive than use of higher selective

membranes. (*See* Ex. 2001, ¶ 48 (stating that there are many factors other than selectivity that can affect the cost of a membrane).) For example, lower selective membranes can require greater area in order to achieve a desired result; and this can result in a greater overall cost than a smaller amount of higher selective membrane. Overall, selectivity is not the only feature for determination of price. The Scholz reference itself, upon which Petitioner heavily relies for its obviousness allegations, shows no cost differentiation based on membrane selectivity – that is, the membranes in the simulation are a single price of 55 Euros per square meter, without differentiation based on membrane selectivity. (*See* AP-1007 at 4, Table 3.) If membrane selectivity were so crucial to cost, Scholz (who is focused on optimizing costs) would undoubtedly have differentiated cost based on membrane selectivity.

One accurate statement would be that costs for membranes can be reduced by using a lower number of modules, *i.e.*, by reducing the required ***membrane capacity***. This was described in the ‘380 Patent, not the use of lower selective membranes instead of higher selective membranes as alleged by Petitioner (and Dr. Baker (AP-1003, ¶ 82)). This is further borne out by the explicit recitation of membrane capacity in independent claim 1 of the ‘380 Patent.

Another accurate statement would be that higher selective membranes require less space and therefore can reduce the overall costs of gas separation, especially where space is a premium.

And another accurate statement would be that the methods as described and claimed in the '380 Patent, and never considered in Ungerank or Scholz, provide for a compact system that optimizes gas separation. This is crucial when space is limited regardless of the cost.

The claimed methods of the '380 Patent are non-obvious in that, among other reasons, they can achieve the recited features using membranes that have a wide range of membrane selectivity values. The methods recited in the '380 Patent claims are **unrelated to the selectivity of the membranes**; rather, they recite three features: namely, (a) recycle volume; (b) membrane capacity; and (c) pressure-ratio quotient. These features, as will be discussed in more detail, *infra*, were not taught or suggested by Scholz or Ungerank, either alone or in combination.

Thus, the Petition creates a false narrative by purposely mischaracterizing the aims of the '380 Patent to be “use of lower selective membranes” based on its assumption that lower selectivity equals lower costs. This mischaracterization enables the further mischaracterization of the motivations of one of ordinary skill in the art by Petitioner. Additionally, even if, as Petitioner seems to argue, that

spending money on energy is acceptable where energy is cheap, Petitioner does not account for the reality that investment and maintenance costs, as well as demands for space, are often more crucial in places where energy is cheap (*e.g.*, remote locations or offshore drilling platforms). This can offset any perceived energy savings from locating systems in such places.

Petitioner states the further assumption that, “higher-selectivity membranes can be cost-effective from an energy standpoint”, but where energy costs matter less, one is motivated to use lower selectivity membranes. (Petition at 7.) This flawed simplification of cost parameters again allows Petitioner to justify how obvious it was for the ‘380 Patent to use lower selectivity membranes, *i.e.*:

We want to run our plants as cheaply as possible. If we have a plant in an area where energy is cheap, then it doesn’t matter how much energy we use, because it won’t cost us more. Therefore, to save costs, we’ll use lower selectivity membranes which everyone knows are cheaper.

B. Petitioner Incorrectly Correlates Membrane Selectivity to the Amount of Gas Needing to be Compressed or Recycled

Petitioner mischaracterizes the ‘380 Patent language, while ignoring the actual language of the claims, in numerous instances in its Petition. For example, Petitioner says, “in three-stage systems, lower-selectivity membranes usually result in more gas needing to be compressed.” (Petition at 7.) This is an

overgeneralization leading to faulty reasoning as exemplified by the ‘380 Patent, Examples 1.1, 1.2, the Comparative Example and Reference Example 1, where membranes with a selectivity of 20 (lower) were used. Even though identical raw gas streams were separated in each of these Examples, the recycling rate varied between 49 and 98%. Thus, Petitioner’s statement here is not correct; the Examples in Ungerank show that many factors other than membrane selectivity can affect the amount of gas that needs to be compressed.

The Petition goes on to allege that “[h]ighly-selective membranes reduce the amount of gas that is recycled . . .” (Petition at 12–13.) This is also an over-generalization. For example, in the ‘380 Patent, in Examples 2 and 3, and Reference Examples 2 and 3, membranes with a selectivity of 45 (higher) were used. Even though identical raw gas streams were separated, the recycling rate of the gas varied between 41 and 77%. Examples 1 to 3 of Ungerank show that using identical membranes with identical selectivity to separate identical raw gas streams may still result in different recycling rates. Similarly, Scholz’s Figures 7(a) and 7(b) show the use of identical membranes to separate identical raw gas streams, but show different recycling rates of 51% and 135%. (AP-1007 at 7 (Figures 7(a) and 7(b)).) Again, Petitioner’s statement here is also not correct—that is, highly selective membranes do not necessarily reduce the amount of gas that is recycled

under all circumstances, and many other factors other than membrane selectivity can affect the amount of gas that is recycled.

Thus, Petitioner's language in the Petition clearly suggests a direct correlation between selectivity and both recycling rate and amount of gas that needs to be compressed. This is incorrect, as shown by the Examples referred to above, as well as by further examples of the '380 Patent and the Scholz publication. Contrary to Petitioner's assertion, many other factors besides the selectivity, including, for example, membrane area and pressure ratios, all influence the recycling rate and amount of gas that needs to be compressed.

C. Petitioner Incorrectly Correlates Membrane Selectivity to Membrane Capacity

The methods recited in the claims of the '380 Patent *are not tied to the selectivity of the membranes* as characterized by Petitioner. Petitioner's definition of "membrane capacity" is oversimplified and fundamentally incorrect. As set forth in the disclosure of the '380 Patent, "membrane capacity" is defined as, "the product of the membrane surface and the permeance of the membrane at operating temperature that is determined for nitrogen (Grade 4.8) under standard conditions." (AP-1001, Col. 2:53–68.) That is,

$$\text{Membrane Capacity} = \text{Membrane Surface Area} \times \text{Membrane Permeance}$$

Petitioner argues, based on this language in the ‘380 Patent, that if the Membrane Permeance is the same, then the term “Membrane Capacity” is simply dependent on the membrane surface area – “if membranes used in different stages have the same permeance, the stages’ capacity is equal to the ratio of the membranes’ areas Membrane area is therefore a proxy for ‘capacity’.” (Petition at 9–10.) While the first statement (before the ellipsis) is true, the second statement (after the ellipsis) is misleading since it suggests that membrane area is **always** a “proxy” for capacity. At best, membrane area can be said to be a “proxy” for capacity only in the limited instance where all membranes used in all stages of a multi-stage process have the same permeance, and where the operating temperature is identical. (AP 1001, Col. 3:1–10; Ex. 2001, ¶¶ 29–31.)

Petitioner requires that membrane area simply be a proxy for capacity since this assumption will lead one of ordinary skill to use limited disclosures of Scholz and limited disclosures of Scholz plus Ungerank, to optimize gas separation. But as will be seen, it becomes clear that Petitioner has carried this assumption all the way until the conclusions it reaches are completely wrong.

Membrane capacity cannot always be simply correlated with membrane area. One of ordinary skill in the art would know that there can be a difference of permeance that spans multiple orders of magnitude among different membrane

materials. Even with different samples of the same material, permeance depends on how thin the membranes' selective separation layers can be produced. This alone can give one or more additional orders of magnitude. (Ex. 2001, ¶¶ 29–31.)

Petitioner further asserts that “[c]apacity is not a term used in this industry; rather, membrane surface area is used.” (Petition at 9.) This is Petitioner’s further attempt to discredit Patent Owner’s use of the term, “membrane capacity.”

However, “membrane capacity” is in fact a known and used term in the industry, as Petitioner knows very well. (*See, e.g.*, Ex. 2003 at 3 (discussing the “[a]bility to tailor membrane capacity and selectivity to customer requirements”); Ex. 2004 at 73, 81 (discussing membrane capacity and Figure 12 showing “Membrane Capacity vs. Time”).)

Petitioner goes on to mischaracterize Scholz based on this oversimplification of what it (Petitioner) itself has determined to be “membrane capacity.” Primarily, Petitioner cites Figure 7 of Scholz for the unfounded proposition that, since Scholz teaches “optimization” of certain conditions, this must necessarily refer to divining out the particular membrane capacity features in Claim 1 of the ‘380 Patent. This is simply too large and unpredictable of a mental leap for an obviousness conclusion.

Simply stated, Petitioner has imagined a teaching of membrane selectivity in Scholz and Ungerank, that simply does not exist, and has taken that imagined

membrane selectivity teaching and used it to leap to the membrane capacity recitation in the Challenged Claims.

**VIII. GROUND 1: PETITIONER HAS FAILED TO ESTABLISH A
LIKELIHOOD THAT CLAIMS 1–5, 7, 9 AND 11–23 ARE OBVIOUS
IN VIEW OF UNGERANK AND SCHOLZ**

Claim 1 of the ‘380 Patent recites the three features mentioned above: (a) the **recycle volume** feature, (b) the **membrane capacity** feature, and (c) the **pressure-ratio quotient** feature.

Claims 2–5, 7, 9 and 11–23 depend from Claim 1, and recite further limitations, related to apparatus features (claims 2, 3 and 17); method steps (claim 4, 16 and 19–22); particular ratios of total capacity of the gas separation membranes in the retentate separation stage to the total capacity of the gas separation membranes in the feed stream separation stage (claim 5); particular ratios of the total capacity of the gas separation membranes in the permeate separation stage to the total capacity of the gas separation membranes in the feed stream separation stage (claim 7); particular values of the combined gas volume recycled with the second permeate stream and the third retentate stream (claim 9); particular pure gas selectivity of the gas separation membranes in the feed stream separation stage (claims 11 and 12); features of the gas separation membranes (claims 13–15 and 18); and features of the crude gas stream (claim 23).

A. Ungerank and Scholz Do Not Teach What Petitioner Alleges That They Teach

Petitioner has a fundamental misunderstanding between the meanings of “disclose” and “teach.” Petitioner admits that Ungerank **teaches** “using higher-selectivity membranes to reduce recycle volume.” (Petition at 15.) Yet the Petition relies entirely upon Ungerank’s Comparative Example 1. Petitioner also argues that Scholz teaches the most profitable process configuration for biogas separation. (Petition at 15.) Yet, the Petition relies entirely upon Figure 7 of Scholz. The problem with Petitioner’s arguments is that Ungerank teaches away from Comparative Example 1, and Scholz teaches away from Figure 7. Because of that, one of ordinary skill in the art would never combine the references in the manner Petitioner suggests, *i.e.*, why would one of ordinary skill take the failed examples from two references and combine them.

The actual teaching of Ungerank is repeated throughout its specification and is apparent in the claims. There are also numerous examples of Ungerank teaching one of ordinary skill away from using Comparative Example 1, *e.g.*,

- “The high selectivity of 45 compared to 20 in the comparative example therefore enables a more economically favorable process by a lower recompression of 31.2% rather than 86.7%.” (AP-1006, Col. 11:49–52 (Example 1));

- “The membranes used exhibit a high mixed gas selectivity for carbon dioxide over methane of 45. In contrast to the above example 2 (which used membranes with a gas selectivity of 45), less pressure is required (14.5 bar rather than 18.1 bar=80.1% of the pressure), and only 6.1% more double compression, which leads to a saving in compression work. (AP-1006, Col. 13:36–41 (Example 3)); and
- “In contrast to the above example 3, use of a vacuum pump on the permeate side of the retentate separation stage (2) gives a much cleaner retentate with the same compressor output (99.7% methane rather than 98.5%).” (AP-1006, Col. 14:39–43 (Example 4)).

In Scholz, the goal is to apply a structural optimization approach to determine the most profitable process layout. Therefore, Scholz’s teaching to one of ordinary skill is to use its process model “to identify the most profitable membrane based biogas upgrading system”. (AP-1007 at 2.) And what did Scholz find as the most profitable process layout? That is shown in Figure 5, which achieved an annual profit of approximately 73,300 Euro along with annual upgrading costs of approximately 78,158 Euro. One of ordinary skill would avoid the system taught in Figure 7 since it achieves an annual profit of only 62,000 Euro, while costing 90,000 Euro annually.

Since Scholz or Scholz plus Ungerank are relied upon by Petitioner to demonstrate a reasonable likelihood that at least one of the challenged claims is unpatentable under 35 U.S.C. § 103, Scholz or Scholz plus Ungerank, must teach that one of ordinary skill in the art would find it obvious to fit their teachings into the solution found by the ‘380 Patent. For the same reason a chemist of ordinary skill in the art would choose a lead compound for further development, one of ordinary skill in the present art would choose the successful embodiments to further develop—not the unsuccessful embodiments. When there is a panoply of variations and ranges available to one of ordinary skill, such a person will follow and develop those recommended and successful in the literature. *See, e.g., Otsuka Pharm. Co. v. Sandoz, Inc.*, 678 F.3d 1280, 1291–93 (Fed. Cir. 2012).

B. There is No Motivation to Combine Ungerank and Scholz as Alleged by the Petitioner

One of ordinary skill in the art would not have been motivated to combine Ungerank with Scholz. As mentioned above, Petitioner alleges that Ungerank Comparative Example 1 “discloses all the limitations of the ‘380 Patent’s claim 1 except the capacity limitation” (denoted by Petitioner as element [1f.ii]). (Petition at 14, 17.) Petitioner then looks to Scholz to cure this deficiency of Ungerank, stating that Scholz’s Figure 7 teaches that “membrane areas . . . are optimized.” (Petition at 18–19.) Petitioner’s reasoning is as follows: Since membrane capacity

is simply a function of membrane area, and Scholz teaches “optimization,” then it follows that the Challenged Claims are obvious in view of Ungerank and Scholz.

Petitioner goes on to state that, “Ungerank teaches using higher-selectivity membranes to reduce recycle volume so that the energy required can be reduced” and in doing so, it “discloses a Comparative Example that meets the ‘380 Patent’s objective of using lower-cost, lower-selectivity membranes in systems that operate at sites where energy is very cheap, where the focus is not on energy saving.”

(Petition at 14.) As stated above, this is of course based on Petitioner’s biased interpretation of the object of the ‘380 Patent and erroneous conclusions about the imagined correlation between membrane selectivity and lower cost. And as further stated above, the approach of Petitioner to re-construe and reduce the problem of the ‘380 Patent to simply: “*use low selective membranes to save costs*” is misleading and not justified. (AP-2001, ¶¶ 48–50.)

Scholz states, “Comparing two types of membrane material the process equipped with membrane materials with CO₂/CH₄ selectivity of 60 has higher profit and lower cost than the process with low selective membranes.” (AP-1007 at 9.) Clearly, Scholz teaches away from lower selective membranes for maximum economic profitability.

As discussed above, membrane capacity is not simply a function of membrane area in all instances, especially where the membrane permeance is not the same for all membranes in a multi-stage separation system. (Ex. 2001, ¶¶ 30–31.) Petitioner’s own expert, Dr. Baker, acknowledges this, as he admits that capacity and membrane area are proportional “in certain situations.” (AP-1003, ¶ 155.) This is a far cry from what Petitioner alleges in its Petition, which is that membrane area is a proxy for capacity. (Petition at 9–10.)

Ungerank and Scholz both teach that in their three stage processes, **higher selectivity membranes** are desirable. (AP-1006, Col. 9:14–15; AP-1007 at 5–6 (describing Figure 5); Ex. 2001, ¶¶ 42–43.) Scholz’s Figure 5 identifies membranes with **higher membrane selectivities** as the economic optimum, with the highest profit. For those reasons, one of ordinary skill in the art looking to optimize a system based on Ungerank (having higher selectivity membranes) would not start with Comparative Example 1 of Ungerank, which uses lower selectivity membranes, and is presented by Ungerank as having numerous disadvantages. (Ex. 2001, ¶¶ 41, 44–46.) The skilled artisan would furthermore not be motivated to combine the Comparative Example 1 of Ungerank (with its lower selectivity membranes) with any teaching of Scholz (which states that higher selectivity membranes are desirable), in his attempt to optimize such methods. Both Ungerank

and Scholz teach away from the concept of lower selectivity membranes, and for at least that reason, Ungerank Comparative Example 1 would not be the starting point to a skilled artisan. (*See* Ex. 2001, ¶¶ 41–46); *see also* *Syntex (USA) LLC v. Apotex, Inc.*, 407 F.3d 1371 (Fed. Cir. 2005) (a reference teaches away when it suggests that the developments flowing from its disclosures are unlikely, reasonably, to produce the objective of the applicant’s invention).

Scholz’s Figure 7 shows a process with lower selectivity (20) but teaches that it is less economically profitable. (*Compare* AP-1007 at 7 (Figure 7(a) showing a profit of €61966 and costs of €89485, and Figure 7(b) showing a profit of €5842 and costs of €145380) *with* AP-1007 at 5 (Figure 5 showing a profit of €73277 and costs of €78158).) Therefore, a skilled artisan looking for a desirable process would not look to combine the teachings of Scholz with those of Ungerank in the manner alleged by Petitioner.

Petitioner alleges that Scholz’s Figure 7 somehow cures the deficiencies of Ungerank by providing a process with the low membrane selectivity and membrane capacity limitations of Claim 1 of the ‘380 Patent. Petitioner also glosses over Ungerank’s and Scholz’s teaching away from lower membrane capacities, by arguing that “Scholz optimized and discussed systems with both higher-selectivity and lower-selectivity membranes” (Petition at 21), buttressed by

its erroneous assumption that lower selectivity membranes are cheaper and therefore desirable for that reason alone, separate from any teachings of Ungerank and Scholz. Since it is inconvenient to Petitioner's narrative that Ungerank and Scholz teach higher selectivity membranes, Petitioner argues that lower selectivity membranes will address the "new problem" of the '380 Patent – a "new problem" that Petitioner made up out of whole cloth. (Petition at 21.)

Petitioner goes on to allege that "[b]ecause Ungerank's Comparative Example 1 does not provide details on the membranes' areas (or their ratios), a POSITA would have found it obvious to combine Ungerank's teachings on three-stage systems with lower-selectivity membranes with Scholz's teachings in Figure 7 on optimized surface area ratios (proportional to the capacity ratios)." (Petition at 18.) This is incorrect. Scholz and Ungerank both would have motivated one of ordinary skill in the art to use high selectivity membranes. To assert otherwise would be contrary to the teachings of both Scholz and Ungerank. (*See* Ex. 2001, ¶¶ 46, 50); *see, e.g., In re Hedges*, 783 F.2d at 1041 ("[P]roceeding contrary to the accepted wisdom ... is 'strong evidence of unobviousness'"); *Syntex*, 407 F.3d at 1380 ("Under the proper legal standard, a reference will teach away when it suggests that the developments flowing from its disclosures are unlikely to produce the objective of the applicant's invention").

Even if, despite this teaching, one of ordinary skill in the art were somehow motivated to use a lower selectivity membrane, and to combine Ungerank's Comparative Example 1 with Scholz's Figure 7(a), both using membranes with a lower selectivity of 20, the result would be a process with a recycling rate of only 51%, which is outside the scope of claim 1 of the '380 Patent. It is clear that Petitioner is attempting to cherry pick the capacity ratios of Scholz's Figure 7(a) and add them to Ungerank Comparative Example 1 without any motivation for one of ordinary skill in the art to do so. It is also technically wrong to allege, as Petitioner does, that all parameters of Ungerank's Comparative Example 1, including the recycling ratio and pressure-ratio quotient therein, could be kept constant if simultaneously the membrane areas are chosen as in Scholz's Figure 7(a). Scholz's Figure 7(a) shows that if the membrane areas are not identical in all stages, the result is a recycling ratio and pressure-ratio quotient **different** from that of Ungerank's Comparative Example 1. Further, the optimization performed by Scholz in Figure 7(a) would not have motivated one of ordinary skill in the art to choose a recycling rate of 60 to 100% as recited in the Challenged Claims. Thus, there is clearly no motivation to combine Ungerank's Comparative Example 1 with Scholz's Figure 7(a).

Petitioner further alleges that the need for systems with “lower-selectivity, lower-cost membranes” has existed for a long time. (Petition at 20.)

Notwithstanding Petitioner’s erroneous assertion that lower selectivity membranes are necessarily lower cost, this information merely confirms statements in the ‘380 Patent about the real problem and objectives of the ‘380 Patent, and further emphasizes the inventiveness of the ‘380 Patent. As Petitioner is undoubtedly aware, the existence of a long felt but unsolved needs, and failure of others, can be used to rebut an obviousness allegation. *See Graham v. John Deere Co.*, 383 U.S. 1, 17, 148 U.S.P.Q. 459, 467 (1966). Further, the fact that a problem existed (as Petitioner acknowledges that it does) does not mean in any way that the subject matter of the ‘380 Patent is a “predictable technical solution” as alleged by Petitioner, for at least the reasons already set forth herein.

C. The Combination of Ungerank and Scholz, Even if Motivated, Would Yield No Expectation of Success

Next, even assuming that a combination of Ungerank and Scholz were motivated – that is, assuming that one of ordinary skill in the art did start with Ungerank Comparative Example 1 (contrary to all teachings of Ungerank), and looked to Scholz’s Figure 7 to cure the defects thereof (contrary to all teachings of Scholz), such combination would lead to no expectation of success, and would not constitute the subject matter of Claim 1 of the ‘380 Patent.

In support of its allegation that a skilled artisan would have combined Ungerank and Scholz, Petitioner states that, “Ungerank taught using higher selectivity membranes to minimize operating costs (AP-1006, Col. 3:10–13, 9:9–14), but with necessarily increased initial investment costs for higher-selectivity membranes. That is, Ungerank shows that skilled artisans understood the tradeoffs between selectivity and costs involved when choosing membranes.” (Petition at 21.) However, Petitioner has oversimplified this analysis. In fact, as Ungerank himself states in his Declaration, “even if initial investment cost is less, over time, the operational costs would make such option less economically viable. As such, using lower-selectivity membranes is, in my opinion, inconsistent with the teachings of Ungerank.” (Ex. 2001, ¶ 49.) Further, as discussed above, and confirmed by Scholz Table 3, *higher selectivity membranes are not necessarily more expensive than lower selectivity membranes*. Thus, a skilled artisan would not rely upon Petitioner’s phantom theory of “tradeoffs between selectivity and costs” when choosing membranes; and this fact eviscerates Petitioner’s argument of motivation to combine and expectation of success.

Instead, the required membrane capacity would be decisive to one of ordinary skill in the art. Scholz and Ungerank simply do not speak to membrane capacity, much less how to optimize it. As discussed above, Petitioner’s statement

that “capacity is a function of membrane area” is simply untrue, an oversimplification, and misleading.

Even if, as Petitioner alleges, one of ordinary skill in the art would be motivated to “integrate Scholz’s disclosure in Figure 7 regarding ‘optimized’ surface areas” (and thus, allegedly, membrane capacities) “into Ungerank’s three-stage systems” such “optimization” mentioned by Scholz is not the optimization of the three conditions recited in claim 1 of the ‘380 Patent: the (a) the recycle volume; (b) the membrane capacity; and (c) the pressure-ratio quotient.

Additionally, any combination of Ungerank and Scholz would lead to no expectation of success, and still would not be within the scope of Claim 1. First, the system shown in Figure 7 of Scholz results in a recycling rate of 51%, which is outside of the scope of Claims 1 and 9 of the ‘380 Patent. Further, the process of Scholz’s Figure 7(b) results in a recycling rate of 135%, which is also outside the scope of Claims 1 and 9. In addition, the quotient of the pressure ratio over the permeate separation stage to the pressure ratio over the feed stream stage is 0.42, which is again outside of the scope of Claims 1 and 9.

Petitioner acknowledges this, but then alleges that because the processes of Figures 7(a) and 7(b) result in a 51% recycling rate and a 135% recycling rate respectively, then somehow the range claimed in the ‘380 Patent would be obvious

because it falls between these two values of 51% and 135% – that is, one of ordinary skill in the art could merely “vary the recycle percentages to achieve a recycle percentage within the claimed range.” (Petition at 47.)

Petitioner cites *Titanium Metals Corp. of America v. Banner*, 778 F.2d 775, 781–83 (Fed. Cir. 1985) for the proposition that prior art can render a claim obvious where the prior art discloses single points, not ranges, and the claimed amount falls within the two single amounts disclosed by the prior art.” (Petition at 46–47.) However, *Titanium Metals* does not apply here, as the facts of that case are very different from those in this instance.

First, in *Titanium Metals*, the challenged claims recited 0.2–0.4% molybdenum and 0.6–0.9% nickel, and the prior art Example contained 0.25% molybdenum and 0.75% nickel; both values of the prior art were within the ranges claimed by the patentee. *See Titanium Metals*, 778 F.2d at 781. In contrast, in the present case, both the 51% and 135% recycling rates shown in Scholz are **outside** of the range claimed in the Challenged Claims, which is 60 to 100%. It would not have been obvious to achieve the 60 to 100% range between the two points of Scholz. Petitioner attempts to argue around this point by alleging that one of ordinary skill in the art “would have had other reasons to vary the recycle percentages.” (Petition at 47.) However, the range claimed in Claim 1 of the ‘380

Patent, 60 to 100%, could not be achieved in such a straightforward and linear manner as alleged by Petitioner. Primarily, Petitioner appears to be alleging that only the membrane capacity ratio limitation [1 f.ii] would have to be optimized within a range between the values given in Scholz's Figure 7(a) and Figure 7(b).

This is an incorrect assumption. Even if one of ordinary skill in the art were to attempt both processes of Figure 7(a) and one of 7(b), Petitioner has shown no correlation between the membrane capacity and feature [1 f.iii] – the quotient of the pressure ratio over the permeate separation stage to the pressure ratio over the feed stream stage – which in Scholz's Figure 7(b) is 0.42, outside of the scope of Claims 1 and 9 of the '380 Patent. Further, the system of Scholz's Figure 7(b) is by far the most costly, and the lowest profitable configuration shown by Scholz. (AP-1007 at 7 (showing paltry profit of €5842 versus very high costs of €145380).) If one of ordinary skill in the art were to try to optimize the system of Figure 7(a) of Scholz, such skilled artisan would, at best, have optimized it in the direction of Figure 5 (which teaches a high selectivity membrane as more economically desirable). The process with the results in Scholz's Figure 5 show the lowest investment cost and highest profit, but a recycling rate of 24%, which is far lower than recited in claim 1 of the '380 Patent. The costs of the processes in Figure 7(a) and 7(b) are higher, and the profit is lower, and membranes with lower selectivity are used. Thus, while

Petitioner alleges that one of ordinary skill in the art would be motivated to use a low selectivity membrane (citing Scholz's Figure 7), Petitioner has ignored the fact that Scholz says Figure 7 is less profitable and therefore *teaches away* from the process described in Scholz's Figure 7.

Thus, the analysis made by Petitioner is based on random cherry picking of different parameters and features, from different processes, in a forced manner to try to arrive at the Challenged Claims, ignoring the overall teachings of Ungerank and Scholz, and hiding important statements and findings of Ungerank and Scholz. This is the very definition of impermissible hindsight analysis. *See, e.g., Otsuka*, 678 F.3d at 1296 (characterizing defendant's obviousness arguments as a "a poster child for impermissible hindsight reasoning" where "[t]aken as a whole. . . the prior art taught away from using [the related compound] as a starting point for further . . . research").

In fact, Scholz's Figure 7 already takes into account the teachings of Ungerank. Based on the disclosure of Scholz, the process described in Figure 7 is very similar to Ungerank's Comparative Example 1, substituted with lower selectivity membranes (selectivity of 20) rather than higher selectivity membranes (selectivity of 60). Even Petitioner remarks that, "Scholz's Figure 7 systems were similar in many respects to Ungerank's CE1." (Petition at 29.)

Thus, assuming that Scholz put his own ideas into the known process described by Ungerank's Comparative Example 1, the results were, as described in Scholz, not successful. Even with the knowledge of Ungerank, Scholz was not able to achieve a method exhibiting all of the features of the Challenged Claims. If, following Petitioner's reasoning, one of ordinary skill still wanted to use a lower selectivity membrane in spite of Ungerank and Scholz's teachings toward higher selectivities, Scholz's Figure 7 shows the result of such an attempt. The outcome of Figure 7(a) and 7(b) (using lower selectivity membranes) is still not the recited methods of the Challenged Claims – for example, it is still outside of the recycling rates claimed in Claim 1 of the '380 Patent (51.58% and 129.9%). Thus, the subject matter of the Challenged Claims is still not achieved, and Petitioner's obviousness arguments are "a poster child for impermissible hindsight reasoning." *Otsuka*, 678 F.3d at 1296.

IX. GROUND 2: PETITIONER HAS FAILED TO ESTABLISH THAT CLAIMS 1–13, 16, 17, 21 AND 23 ARE OBVIOUS IN VIEW OF SCHOLZ

Claim 1 of the '380 Patent recites the three features: (a) the recycle volume feature, (b) the membrane capacity feature, and (c) the pressure-ratio quotient feature.

Claims 2–13, 16, 17, 21 and 23 depend from Claim 1, and recite further limitations, related to apparatus features (claims 2, 3, 17 and 21); method steps (claims 4, 16 and 21); particular ratios of total capacity of the gas separation membranes in the retentate separation stage to the total capacity of the gas separation membranes in the feed stream separation stage (claim 5 and 6); particular ratios of the total capacity of the gas separation membranes in the permeate separation stage to the total capacity of the gas separation membranes in the feed stream separation stage (claims 7 and 8); particular values of the combined gas volume recycled with the second permeate stream and the third retentate stream (claim 9); particular pressure-ratio quotients (claim 10), particular pure gas selectivity of the gas separation membranes in the feed stream separation stage (claims 11 and 12); features of the gas separation membranes (claim 13); and features of the crude gas stream (claim 23).

It is clear from the Petition that Petitioner is unable to establish an argument that any of these Challenged Claims are obvious in view of Scholz alone.

A. Scholz Does Not Teach or Suggest Every Feature Recited in the Challenged Claims

Scholz does not teach or suggest every feature recited in the Challenged Claims. In the Petition, Petitioner alleges that the claims are obvious in view of Scholz alone, “[e]ven without relying on Ungerank.” (Petition at 42.) However,

this is clearly not the case. In the Petition, Petitioner attempts to gloss over the significant differences between Scholz and the Challenged Claims by emphasizing the fact that Scholz also shows a “three stage membrane process” (Petition at 43), but ignoring the portions of Scholz that clearly teach away from the recitations in the Challenged Claims. Importantly, Scholz does not teach or suggest the three features discussed above in the Challenged Claims – the **recycle volume** feature, the **membrane capacity** feature, and the **pressure-ratio quotient** feature. Rather, Petitioner tries to divine teachings from the disclosure of Scholz, which clearly does not teach what Petitioner alleges it teaches. Scholz does not or consider at least these three features to be boundary conditions for its optimization method; in fact, as discussed above, Scholz does not even consider membrane capacity in its optimization. As discussed above, Scholz does not teach or suggest all of the features recited in the Challenged Claims, and any proposed modification of Scholz still does not achieve all of these recited features.

B. There is No Motivation to Modify the Teachings of Scholz in the Manner Asserted by the Petitioner

Petitioner alleges that Claims 1–13, 16, 17, 21 and 23 would be obvious based on the teachings of Scholz alone. But as discussed above, Petitioner’s allegations are based on fundamental misinterpretations of the motivations of skilled artisans, including the mistaken assumption that one of ordinary skill in the

art would believe that lower selectivity membranes are necessarily cheaper than higher selectivity membranes; as well as an erroneous interpretation of the meaning of the term “membrane capacity.” Consequently, Petitioner’s allegations of obviousness cannot stand.

Evonik’s interpretation is, without question, clearly backed up by the straightforward intrinsic evidence present in the disclosure of the ‘380 Patent. As discussed therein, an advantage of the technology recited in the ‘380 Patent is that it permits the user to reduce costs by reducing the membrane capacity – that is, by reducing the number of membrane modules – not by reducing the *selectivity* of the membranes as alleged by Petitioner. For example, costs can be lowered by using high selectivity membranes and reducing the membrane capacity. Costs can also be lowered by reducing the space necessary for the membranes—which can be critical in circumstances such as off-shore systems.

Another advantage of the technology recited in the ‘380 Patent is that it permits the user to reduce the space requirements of systems that utilize the recited methods. In particular, by reducing membrane capacity, the methods recited can be practiced in locations where space is a premium or where minimizing the amount of space a system takes up is crucial – for example, offshore, or in an enclosed or limited space such as with a portable system. Such advantages are significant

whether related to their ability to lower costs, or as an advantage on their own, separate from the reduction of costs.

The examples in the '380 Patent show that the inventive methods lead to a reduced number of modules (and accordingly, lower membrane capacity) compared to known methods. This is completely unrelated to the concept of membrane selectivity, and Scholz is completely silent as to reduction of costs or reduction of space required in this manner.

First, there is no teaching in Scholz to optimize the particular parameters that the Challenged Claims optimize in the '380 Patent – namely, (a) the **recycle volume** feature, (b) the **membrane capacity** feature, and (c) the **pressure-ratio quotient** feature.

Petitioner alleges that Scholz applied “a structural optimization approach to biogas upgrading processes” including “the most profitable process configuration”; and that Scholz found that “lower-selectivity membranes increase the amount of retained gas species which permeates through the membranes resulting in increased compression duty.” (Petition at 15.)

However, this is an incomplete interpretation of what Scholz actually teaches. Scholz specifically recognizes that, “[i]n general, feed gas conditions, product gas conditions and economic parameters such as product gas pressure and

energy costs considerably determine the optimal process configuration.” (AP-1007 at 3.) Scholz goes on to admit that, “the optimal process configuration presented here, is identified by applying the boundary conditions set here. This process configuration is most likely *not optimal for the entire range of parameters* to be applied in biogas upgrading[,] and boundary conditions have to be reviewed carefully.” (AP-1007 at 2.)

Scholz admits the limitations of the process configurations that it deems optimal in its specific process, and explicitly states that different boundary conditions can affect optimal process configurations in many other processes. And contrary to Petitioner’s assertion, Scholz does not provide any teaching as to which particular different boundary conditions should be optimized, from among a near-infinite number of potential boundary conditions, as is typical in any chemical process. Simply put, Scholz provides no guidance as to what different boundary conditions should be varied to optimize such process configurations – and certainly does not provide a teaching or suggestion to optimize the combination of: (a) recycling ratio, (b) membrane capacity and (c) pressure-ratio quotient, as recited in the claims of the ‘380 Patent.

Scholz did not optimize membrane capacities, nor does Scholz motivate one of ordinary skill in the art to do so. Instead Scholz focuses on the other boundary conditions listed in the reference – the operational costs, and the investment costs.

Scholz freely admits that its results might not be the optimal configuration for the entire range of parameters. Thus, one of ordinary skill in the art reviewing Scholz might have known from Scholz that further optimization might be possible, but would not have gotten any idea of **what boundary conditions would have had to be optimized, or how**. There was neither a motivation nor a reasonable expectation of success to optimize membrane capacities and membrane capacity ratios of the different separation stages in combination with recycling rates and pressure ratios as claimed in the claims of the ‘380 Patent.

In fact, Scholz teaches away from the selection of these particular boundary conditions recited in the claims of the ‘380 Patent. Scholz section 2.2 states, “The energetic optimum can be fairly different from the economic optimum. In this study we determined the most profitable process configuration taking both, the operational costs, mainly caused by electrical energy consumption, and investment costs for the compression equipment and the membrane modules into account.”

Thus, Scholz confirms that it does not consider the membrane capacities and ratios of membrane capacities as boundary conditions, as mentioned above.

Most significantly, Scholz states, “Comparing two types of membrane material the process equipped with membrane materials with CO₂/CH₄ selectivity of 60 has higher profit and lower cost than the process with low selective membranes.” (AP-1007 at 9.)

This final conclusion of Scholz has been ignored by Petitioner. Scholz clearly stated its belief that the highest profitability is reached with high selective membranes. This is the opposite of what Petitioner tries to conclude from Scholz. Thus, one of ordinary skill in the art, knowing the conclusion of Scholz, would not have selected a lower selectivity membrane, but rather, would have tried to further optimize the Scholz methods using higher selectivity membranes (as Scholz teaches these to be most beneficial), and certainly would not focus on the three features recited in the Challenged Claims, or to find a method that works across a range of membrane capacities.

The example of Scholz with the lowest investment costs is Figure 5 and not Figure 7. Figure 5 also has the highest profit. The process of Figure 5 of Scholz, however, has a recycling rate of 24% which is far below what is recited in the Challenged Claims ‘380 Patent.

In contrast, Figures 7(a) and 7(b) show higher costs and lower profit, with membranes having lower selectivity. Thus, Scholz teaches away from a

modification from higher selective membranes to lower selective membranes, and one of ordinary skill in the art would not have been motivated in the matter asserted by Petitioner. *See, e.g., In re Hedges*, 783 F.2d 1038, 1041 (Fed. Cir. 1986) (“[P]roceeding contrary to the accepted wisdom ... is ‘strong evidence of unobviousness’”); *Syntex*, 407 F.3d at 1380 (“Under the proper legal standard, a reference will teach away when it suggests that the developments flowing from its disclosures are unlikely to produce the objective of the applicant's invention”).

C. The Proposed Modification of Scholz Yields No Expectation of Success, and Still is Not the Subject Matter of the Challenged Claims

Any modification of Scholz, even if motivated (which, as Patent Owner has demonstrated here, is clearly not the case) would lead to no expectation of success and still not be within the scope of the Challenged Claims. First, the system shown in Figure 7 of Scholz results in a recycling rate of 51%, which again is outside of the scope of Claims 1 and 9 of the ‘380 Patent. Further, the process of Scholz’s Figure 7(b) results in a recycling rate of 135%, which is also outside the scope of Claims 1 and 9. In addition, the quotient of the pressure ratio over the permeate separation stage to the pressure ratio over the feed stream stage is 0.42, which is also outside of the scope of Claims 1 and 9.

Petitioner acknowledges this, but then alleges that because the processes of Figures 7(a) and 7(b) result in a 51% recycling rate and a 135% recycling rate respectively, then somehow the range claimed in the '380 Patent would be obvious because it falls between these two values of 51% and 135% – that is, one of ordinary skill in the art could merely “vary the recycle percentages to achieve a recycle percentage within the claimed range.” (Petition at 47.)

Petitioner cites *Titanium Metals Corp. of America v. Banner*, 778 F.2d 775, 781–83 (Fed. Cir. 1985), for the proposition that prior art can render a claim obvious where the prior art discloses single points, not ranges, and the claimed amount falls within the two single amounts disclosed by the prior art.” (Petition at 46–47.) However, Petitioner’s analysis here is incomplete and ignores important facts.

The range claimed in the Challenged Claims, 60 to 100%, could not be achieved in such a straightforward and linear manner as alleged by Petitioner. Primarily, Petitioner alleges that only the membrane capacity ratio limitation [1f.ii] would have to be optimized within a range between the values given in Scholz’s Figure 7(a) and Figure 7(b).

This is an absolutely incorrect assumption. Even if one of ordinary skill in the art were to attempt both processes of Figure 7(a) and one of 7(b), Petitioner has

shown no correlation between the membrane capacity and feature [1f.iii] – the quotient of the pressure ratio over the permeate separation stage to the pressure ratio over the feed stream stage – which in Scholz’s Figure 7(b) is 0.42, outside of the scope of Claims 1 and 9 of the ‘380 Patent. Further, as discussed above, the system of Scholz’s Figure 7(b) is by far the most costly, and the lowest profitable configuration shown by Scholz. (AP-1007 at 7 (showing paltry profit of €5842 versus very high costs of €145380).) If one of ordinary skill in the art were to try to optimize the system of Figure 7(a) of Scholz, such skilled artisan would, at best, have optimized it in the direction of Figure 5 (which teaches a high selectivity membrane as more economically desirable). As discussed above, the process with the results in Scholz’s Figure 5 show the lowest investment cost and highest profit, but a recycling rate of 24%, which is far lower than recited in the Challenged Claims. The costs of the processes in Figure 7(a) and 7(b) are higher, and the profit is lower, and membranes with lower selectivity are used. Thus, while Petitioner alleges that one of ordinary skill in the art would be motivated to use a low selectivity membrane (Petition at 49 (citing AP-1003, ¶¶ 137–142; AP-1007, Figure 7)), Petitioner has ignored that fact that Scholz says Figure 7 is less profitable and therefore itself *teaches away* from optimizing the process described in Scholz’s Figure 7.

Thus, the analysis made by Petitioner is based on hindsight and cherry picking parameters and features in a manner to arrive at the Challenged Claims, ignoring the overall teaching of Scholz and failing to mention important statements and findings of Scholz. This is the very definition of impermissible hindsight analysis. *See, e.g., Otsuka*, 678 F.3d at 1296 (characterizing defendant’s obviousness arguments as a “a poster child for impermissible hindsight reasoning” where “[t]aken as a whole. . . the prior art taught away from using [the related compound] as a starting point for further . . . research”).

Further, as can be seen from the module costs in Table 3 of Scholz, Scholz itself presumes a single cost for membranes, without regard to whether such membranes are higher selectivity or lower selectivity. This fact alone proves Patent Owner’s argument – if selectivity were tied to cost, then Scholz (as a reference that is highly focused on minimizing cost and maximizing profit) would certainly have provided a breakdown of membrane cost based on selectivity. The fact that Scholz does not provide such a delineation is compelling evidence that one of ordinary skill in the art would not presume that lower selective membranes would be cheaper.

The Petition cites Scholz’s Figure 7(a) as being “very similar to the configuration in the ‘380 Patent’s Figure 1.” (Petition at 15–16.) Petitioner goes on to allege that, “Scholz’s Figure 7 three-stage systems use lower-selectivity

membranes that meet the capacity ratio limitation [1f.ii] by virtue of the simple fact that the membrane areas in their retentate stream separation stages are larger than the membrane areas in their feed stream separation stages. As Scholz explains, the membrane areas (and thus their ratios) in Figure 7 “are optimized.” (Petition at 18.) However, this is a mischaracterization of what Figure 7 of Scholz actually teaches. In its Petition, Petitioner neglects to mention that the recycling rate shown in Scholz’s Figure 7(a) is 51% – this is outside of the scope of the claims of the ‘380 Patent. In other words, regardless of what size membranes are allegedly taught by Scholz, overall Scholz teaches away from the limitations of claim 1.

The Abstract of Scholz says that its method “determines the most profitable process layout including membrane areas and pressures required.” (AP-1007 at Abstract.) Thus, Scholz “determined” the membrane areas “required” but nowhere stated that membrane areas were optimized. Instead, Scholz uses other boundary conditions for optimization, as stated above.

Thus, Petitioner has failed in its Gound 2 allegations, and cannot establish that the Challenged Claims are obvious in view of Scholz.

X. CONCLUSION

For the foregoing reasons, the Board should deny institution.

Respectfully submitted,

Dated: June 14, 2024

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CERTIFICATE OF WORD COUNT

Pursuant to 37 C.F.R. § 42.24(d), the undersigned certifies that the foregoing document contains 9,961 words, excluding the portions exempted under 37 C.F.R. § 42.24(a), which is under the limit of 14,000 words set by 37 C.F.R. § 42.24(b)(1), as measured by the word-processing system used to prepare this paper.

Dated: June 14, 2024

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CERTIFICATE OF SERVICE (37 C.F.R. § 42.6(e))

The undersigned hereby certifies that the above document was served on June 14, 2024, by filing this document through the Patent Trial and Appeal Case Tracking System (P-TACTS), as well as delivering a copy via electronic mail upon the following attorneys of record for Petitioners:

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