

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

SCOUT ENERGY MANAGEMENT, LLC, and
CHEVRON U.S.A. INC.,
Petitioners,

v.

PILOT INTELLECTUAL PROPERTY, LLC,
Patent Owner.

Case IPR2024-00385
Patent 8,505,332 B1

**PATENT OWNER'S
PRELIMINARY RESPONSE**

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William Wesley Carnes, Sr., Inc. v. Seaboard Int’l Inc., IPR2019-00133, Paper 10 (PTAB May 8, 2019).....	57, 59

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EXHIBIT LIST

Exhibit	Description
2001	Declaration of Trevor Bors
2002	<i>Curriculum Vitae</i> of Trevor Bors
2003	U.S. Patent No. 4,529,411 (“Goddin”)
2004	Table of Similarities (demonstrating similarities between Goddin ‘411 Patent Fig. 11 and Three-Column Ryan/Holmes Process)
2005	GPA Engineering Data Book (12th Ed. 2006, FPS version)
2006	U.S. Patent No. 4,318,723 (“Cryogenic Distillative Separation of Acid Gases from Methane”)
2007	U.S. Patent No. 4,462,814 (“Distillative Separations of Gas Mixtures Containing Methane, Carbon Dioxide and Other Components”)
2008	Holmes AS, Ryan JM, Price BC, Styring RE. Process Improves Acid Gas Separation. <i>Hydrocarbon Processing</i> 1982; 61:131–136
2009	Hannah Kent-Webb PhD, Best Practices for Biological Sample Storage and Management. <i>Biocompare</i> . (Oct. 2022)
2010	Vortex Expansion Devices for High Temperature Cryogenics. Proceedings of The 26 th Intersociety Energy Convention Engineering Conference (1991)
2011	Penflex Engineering Bulletin #113 (including table from The American Society of Materials “ASM Specialty Handbook: Stainless Steels,” published in 1994)

2012	Hydrate Formation in Chevron Mabee Unit for NGL Recovery and CO ₂ Purification for EOR (Submitted to Gas Processors Association 2017)
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I. INTRODUCTION

Three of the four prior art references relied upon by Petitioners in their six grounds asserting obviousness describe a cryogenic distillation process known as the Ryan/Holmes process. Aycaguer, Soldati, and Ryan each describe configurations of the Ryan/Holmes process, while Arand is relied upon only to propose definitions for the claim terms Natural Gas Liquids (“NGL”) and heavy hydrocarbons. In other words, all six of the grounds asserted in the Petition rely upon the basic assertion that the Ryan/Holmes process renders obvious the challenged claims of the Prim ‘332 Patent.

The Ryan/Holmes Process “Teaches Away” from the Prim ‘332 Patent Process

Ryan/Holmes is a cryogenic distillation process developed in the late 1970’s and early 80’s to improve the process of separating methane and ethane from carbon dioxide recycle streams in enhanced oil recovery (“EOR”) operations. The Ryan/Holmes process uses hydrocarbon solvents (“additives”), and an extensive amount of process equipment (up to four distillation columns), to solve two particular problems in the separation of methane and ethane from carbon dioxide recycle streams. The Ryan/Holmes additives avoid carbon dioxide freezing (solidification) in the separation of methane from carbon dioxide, and allow for the separation of ethane from carbon dioxide, by eliminating the formation of what is

known as the ethane-carbon dioxide “azeotrope” which otherwise would preclude a separation of ethane from carbon dioxide.

While the Ryan/Holmes process uses additives and extensive process equipment to improve the process of separating methane and ethane from carbon dioxide recycle streams, the innovative process described and claimed in the ‘332 Patent improves the process of recovering NGLs from carbon dioxide recycle streams by “disregarding the recovery” of methane and ethane from the carbon dioxide recycle stream, to recover NGLs “with relatively little process equipment or energy.”¹

The purpose, process, and result of implementation of the Ryan/Holmes process is to separate methane and ethane from carbon dioxide recycle streams, using additives and extensive processing equipment, to produce methane and ethane for sales. The Prim ‘332 invention goes in the opposite direction by NOT using additives or extensive processing equipment to separate methane and ethane from carbon dioxide recycle streams. This innovative process leaves all (or almost all) of the methane and ethane in the carbon dioxide recycle streams, to produce NGLs, having little to no methane and ethane, while using significantly less process equipment and energy, and thereby recovers NGLs with significantly less costs.

¹ (EX1001 at 4:55-60.)

Considering that the Prim ‘332 process conserves costs by “disregarding the recovery” of methane and ethane from the carbon dioxide recycle stream, it would make no sense for a person of ordinary skill in the art to use the Ryan/Holmes methane/ethane recovery process as a starting point to modify or combine it with other teachings to develop the Prim ‘332 Patent process. The Ryan/Holmes process focus on recovery of methane and ethane would lead a person of ordinary skill in the art in a direction divergent from the path that was taken by Prim to develop the ‘332 Patent process. The Ryan/Holmes process and the Prim ‘332 Patent process go in opposite directions for recovering salable components of carbon dioxide recycle streams.

The Ryan/Holmes process thereby “teaches away” from the Prim ‘332 Patent process. A person of ordinary skill in the art would not be motivated to modify or combine the Ryan/Holmes process with other teachings to develop the Prim ‘332 Patent process. The Ryan/Holmes process therefore cannot be the basis for an obviousness finding as asserted by Petitioners in each of their six obviousness grounds.

Discretionary Denial under 35 U.S.C. 325(d)

The Ryan/Holmes Process is the Same Art Previously Considered during Prosecution, which was Materially Addressed, and the Challenged Claims were Amended to Distinguish the ‘332 Patent Process from the Ryan/Holmes Process, as Confirmed in the Notice of Allowance

There were three Office Actions issued by the Examiner during prosecution of the ‘332 Patent, three Responses to those Office Actions, two Examiner Interviews, and a Notice of Allowance including a Notice of Allowability setting forth the Examiner’s reasons for allowance.

Beginning with the second Office Action, the Examiner cited U.S. Patent No. 4,529,411 (“Goddin”) (EX2003) as the basis for rejecting application claims, including those that ultimately issued as the challenged claims in this matter.

Responses to the second and third Office Actions argued against the Goddin-based rejections, and the two Examiner Interview summaries reflect the Examiner’s suggestions to amend claims to overcome the rejections by adding negative limitations to distinguish the ‘332 Patent claims from Goddin. Amendments were made to distinguish the ‘332 Patent claims from Goddin, and the Examiner confirmed those distinctions and patentability in the reasons for allowance.

The Goddin patent describes two alternative processes for CO₂ removal, including a first stage using membranes for removal of CO₂, and a second stage using either: 1) cryogenic distillation; or 2) CO₂ solution absorption.²

In Goddin's first alternative, the second stage is the Ryan/Holmes cryogenic distillation process.³ In response to the Examiner's rejections, amendments were made to the '332 Patent claims specifically to distinguish the claimed invention from the Ryan/Holmes process, including the negative limitations suggested by the Examiner to specify that the '332 Patent process does not use cryogenic conditions, membranes, or CO₂ recovery solvents.

As confirmed by the Examiner in the reasons for allowance set forth in the Notice of Allowability, these amendments distinguished the '332 Patent process from the Ryan/Holmes cryogenic distillation process, and led to the issuance of the challenged claims, after the Examiner meaningfully addressed the Ryan/Holmes prior art.

The Petition ignores the fact that Ryan/Holmes art asserted in the Petition is the same as, or cumulative to, the Ryan/Holmes art that the Examiner previously

² (EX2003 at 7:24-33 ("CO₂ is further removed from the hydrocarbon enriched process stream by cryogenic fractionation and/or by CO₂ solution absorption.")).

³ *See infra*, Section VI(B); Ex. 2004, Table of Similarities (demonstrating similarities between Goddin '411 Patent Figure 11 and Three-Column Ryan/Holmes Process).

considered during prosecution of the ‘332 Patent, and makes no attempt to establish, or even argue, that the Examiner erred in evaluating the Ryan/Holmes art asserted in the Petition and previously considered during prosecution. The Board therefore should exercise its discretion under Section 325(d) to deny institution because the same art asserted in the Petition, the Ryan/Holmes cryogenic distillation process, was meaningfully addressed by the Examiner during prosecution.

Furthermore, the Board should not allow Petitioner any requested additional briefing, because Petitioners could have and should have anticipated this issue, but instead chose not to address it in the Petition, devoting just one paragraph and three sentences to make nothing more than a conclusory assertion that discretionary denial is “unwarranted.”⁴

Petitioner Has Failed to Show That Any Claim Is Obvious Over the Prior Art

The six grounds in the Petition challenge Claims 1-4 and 6-7. Claims 2-4 and 6-7 are dependent claims, each of which depend from independent Claim 1. Claim 1 includes negative limitations to distinguish the claimed invention from the Ryan/Holmes process, specifying that the Prim ‘332 Patent process does not use cryogenic conditions or CO₂ recovery solvents.

⁴ Petition at 90.

The Ryan/Holmes process asserted as the primary basis for each of the six obviousness grounds in the Petition uses cryogenic conditions and CO₂ recovery solvents.

In addition, challenged Claim 4 recites the Prim process “disregarding the recovery” of methane and ethane from the carbon dioxide recycle stream, by specifically requiring that “the sweet NGL rich stream comprises ... no more than 1 molar percent ethane.” Challenged Claim 7 further recites the Prim process “disregarding the recovery” of methane and ethane from the carbon dioxide recycle stream, by specifically requiring that “the sour NGL rich stream comprises ... no more than 5 molar percent ethane.”

Considering the Ryan/Holmes process focus on the recovery of methane and ethane, it should be no surprise that the sweet NGL rich stream in the Ryan/Holmes process comprises more than 1 molar percent ethane, and the sour NGL rich stream in the Ryan/Holmes process comprises more than 5 molar percent ethane. Therefore, even if the Ryan/Holmes cryogenic distillation process asserted as the primary basis for each of the six obviousness grounds in the Petition did not “teach away” from the Prim ‘332 Patent process, and if one thus somehow could find a motivation to modify or combine the Ryan/Holmes process with other teachings to arrive at the Prim process, the asserted combinations do not render the challenges Claims unpatentable as obvious.

Petitioners therefore have failed to meet their burden to establish a likelihood of prevailing on any of their asserted obviousness challenges to Claim 1-4 and 6-7 of the Prim '332 Patent.

II. OVERVIEW OF THE PRIM '332 PATENT PROCESS

The Prim '332 Patent describes a process whereby fluids produced from an Enhanced Oil Recovery ("EOR") field "the hydrocarbon feed stream" (EX1001 at 1:38) are first separated into a liquid stream, the "heavy hydrocarbon rich stream" (*id.* 1:39), and a vapor stream, the "carbon dioxide recycle stream" (*id.* 1:40). The liquid stream contains oil (heavy hydrocarbon), and the vapor stream includes carbon dioxide, methane, ethane, NGL's, hydrogen sulfide, helium, and nitrogen, that is, everything included at *id.* 2:61-65 except for the heavy hydrocarbon removed in the above separation. This stream is then processed using a distillation separation to produce an overhead stream which contains virtually all of the methane, virtually all of the ethane, most of the CO₂, over 90% of the H₂S, and about 30% of the C₃₊ liquids. The bottom product consists of soluble amounts of methane and ethane, less than 10% of the H₂S and about 70% of the C₃₊ liquids. The recovery level of the C₃₊ liquids is dependent upon the economic decision process described in Method 400 of EX1001 8:48 to 10:21. Because this stream contains H₂S as well as CO₂ it is referred to as the "sour NGL rich stream" and is further processed to remove the H₂S

and CO₂. This sour NGL rich stream is then treated to separate the sweet NGL rich stream from the acid gas stream. The sweet NGL rich stream consists of C₃-C₈ hydrocarbons. (EX2001, Section VI.)

The purpose of this process as the title “Natural Gas Liquid Recovery Process” would imply is to make a marketable NGL stream that is suitable for sale. It is not to separate a methane stream for use as fuel or for sale, and it is not to make ethane, either as a single component or as part of the natural gas liquids stream. (EX2001, Section VI.)

Prior to May 18, 2007 (the priority date) a POSITA would have had limited choices for a process to recover natural gas liquids from an EOR project. Although other options may have been available at the time, the most common were a Mechanical Refrigeration Unit (MRU) or the Ryan/Holmes process. Although an MRU is a widely accepted method to separate hydrocarbons based on their relative boiling points, separations involving CO₂ are much more difficult. The use of an MRU is relatively simple and quite inexpensive to build, but the recovery of natural gas liquids is limited to C₄+. Another known process available at the time would have been the Ryan/Holmes process, which is described extensively below. (EX2001, Section VI.)

The main deciding factor for a POSITA in the decision of which type of facility to build would have been the economics. The economics would have been

based on the forecasted revenues from the sale of product, less operating cost and less an allowance for the recovery of the initial capital cost. When considering the forecasted revenues not only would the volume of product been important, but also the price of the product. A POSITA would have known that the local price of products can vary significantly based on the presence of infrastructure and availability of capacity and market. For example, some areas may not have access to a pipeline capable of transporting ethane. Since ethane has a very high vapor pressure, it is impractical to move by truck or rail. Other areas may have pipeline constraints which make the transportation cost of methane higher than the value of the product, making the recovery of methane uneconomic. Incidentally, a low price of methane in an area can be a further benefit to a plant which does not recover methane since purchased fuel can be a significant part of the operating expense. (EX2001, Section VI.)

The Prim '332 Patent invention provides a middle ground for the POSITA to consider. If the potential revenue stream for the plant is insufficient to support the higher capital cost of a Ryan/Holmes facility, but the POSITA wanted to recover more products than an MRU is capable of, the Prim invention could be considered. (EX2001, Section VI.)

III. SUMMARY OF THE '332 PATENT

A. Brief Description

The '332 Patent relates to a method of recovering and processing natural gas liquids from an oil and natural gas feed stream. (EX1001, Abstract, 2:22-28.) The patent describes a processing method that requires three hydrocarbon separations. (*Id.* at FIG. 1, FIG.2.) The first separation occurs at separator 102, where the heavy hydrocarbons 154 are removed from the hydrocarbon feed stream 152 derived from subterranean formation 114:

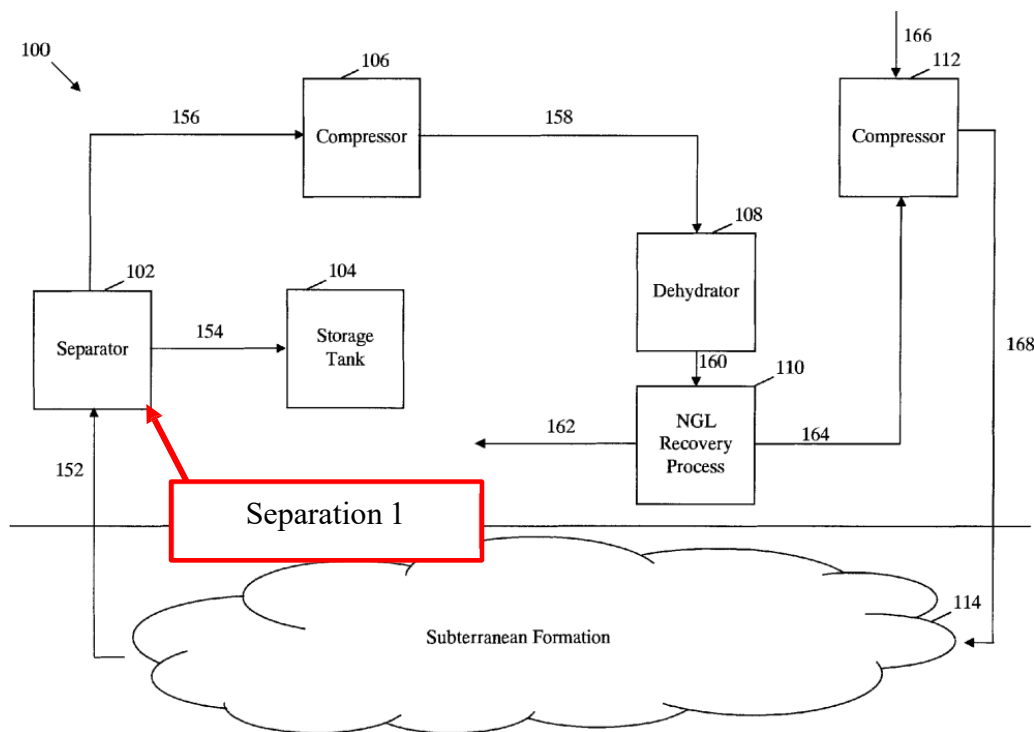


FIG. 1

(*Id.* at FIG. 1 (annotated, future annotations also in red).) The heavy hydrocarbons are shunted to a storage tank 104, while the remaining carbon dioxide (CO₂), hydrogen sulfide (H₂S), and lighter hydrocarbons (i.e., the carbon dioxide

recycle stream 156) are compressed at compressor 106 and dehydrated at dehydrator 108. This dehydrated carbon dioxide recycle stream 160 is passed into the NGL recovery process 110.

The second and third separations occur during the NGL recovery process:

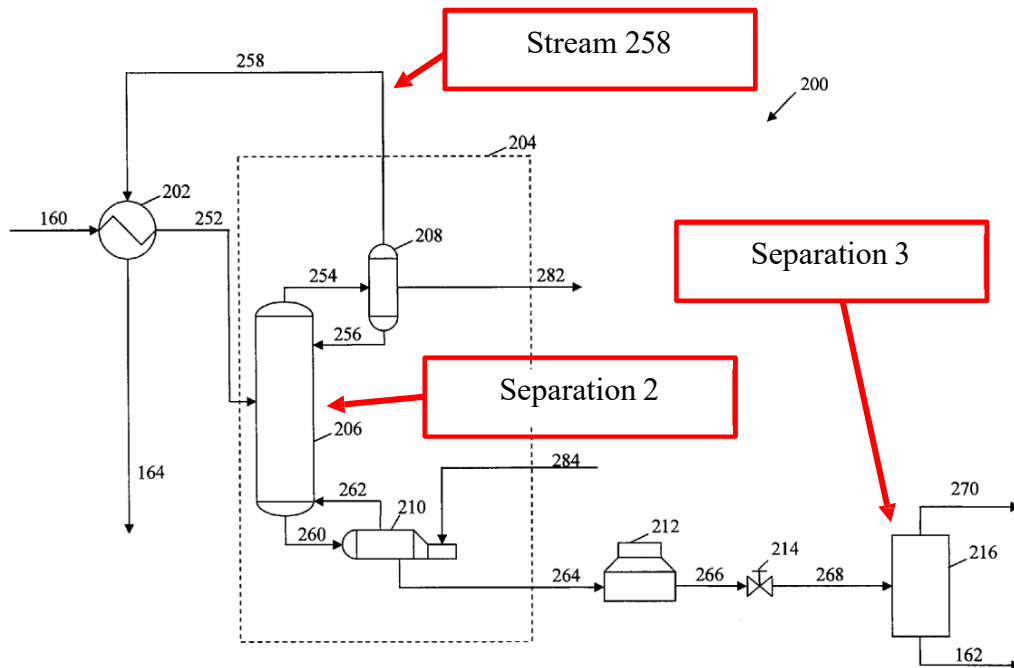


FIG. 2

(*Id.* at FIG. 2 (annotated).) The dehydrated carbon dioxide recycle stream 160 is passed to column 206 for separation. (*Id.* at FIG. 2, 7:1-6.) Column 206 separates stream 160 into a purified carbon dioxide stream 258 and a sour NGL rich stream 264. (*Id.* at FIG. 2, 7:6-10, 7:21-24.) The sour NGL rich stream 264 is passed to separator 216, which separates the sour NGL rich stream into a sweet NGL rich stream 162 and an acid gas stream 270. (*Id.*, 7:51-52, 61-62, FIG. 2.)

B. Summary of the Prosecution

The '332 Patent was filed as Application No. 12/122,336 (the "'336 Application") on May 16, 2008 ("U.S. Filing Date"). The '336 Application claims priority to Provisional Application No. 60/938,726, filed May 18, 2007 ("Priority Date").⁵

There were three Office Actions issued by the Examiner during prosecution of the '332 Patent,⁶ three Responses to those Office Actions,⁷ two Examiner Interviews,⁸ and a Notice of Allowance including a Notice of Allowability setting forth the Examiner's reasons for allowance.⁹

Beginning with the second Office Action, the Examiner cited U.S. Patent No. 4,529,411 ("Goddin") (EX2003) as the basis for rejecting application claims, including those that ultimately issued as the challenged claims in this matter.¹⁰

Responses to the second and third Office Actions argued against the Goddin-based rejections,¹¹ and the two Examiner Interview summaries reflect the

⁵ (EX1003 at 2.)

⁶ (*Id.* at 92-114 (10/27/2011), 138-65 (06/29/2012), 193-229 (02/21/2013).)

⁷ (*Id.* at 115-137 (01/19/2012), 170-92 (09/10/2012), 234-62 (04/11/2013).)

⁸ (*Id.* at 166-69 (08/29/2012), 230-33 (03/25/2013).)

⁹ (*Id.* at 263-300 (05/08/2013).)

¹⁰ (*Id.* at 138-65 (06/29/2012).)

¹¹ (*Id.* at 170-92 (09/10/2012), 234-62 (04/11/2013).)

Examiner's suggestions to amend claims to overcome the rejections by adding negative limitations to distinguish the '332 Patent claims from Goddin.¹² Amendments were made to distinguish the '332 Patent claims from Goddin, and the Examiner confirmed those distinctions and patentability in the reasons for allowance.¹³

The Goddin patent describes two alternative processes for CO₂ removal, including a first stage using membranes for removal of CO₂, and a second stage using either: 1) cryogenic distillation; or 2) CO₂ solution absorption.¹⁴

In Goddin's first alternative, the second stage is the Ryan/Holmes cryogenic distillation process.¹⁵ In response to the Examiner's rejections, amendments were made to the '332 Patent claims specifically to distinguish the claimed invention from the Ryan/Holmes process, including the negative limitations suggested by the

¹² (*Id.* at 169 (08/29/2012) ("Regarding claim 6, Examiner has expressed that 'consists essentially of' language does not exclude the additional processes of Goddin ... and further it was discussed of possible ways of excluding additional process steps including negative claim limitations.") (emphasis added), 233 (03/25/2013) ("Examiner ... recommended removing said broadening line to show that cryogenic conditions, membranes, and solvents are not utilized anywhere in the process.") (emphasis added).)

¹³ (*Id.* at 263-300 (05/08/2013).)

¹⁴ (EX2003, 7:24-33 ("CO₂ is further removed from the hydrocarbon enriched process stream by cryogenic fractionation and/or by CO₂ solution absorption.")).

¹⁵ *See infra*, Section VI(B); Ex. 2004, Table of Similarities (demonstrating similarities between Goddin '411 Patent Figure 11 and Three-Column Ryan/Holmes Process).

Examiner to specify that the ‘332 Patent process does not use cryogenic conditions, membranes, or CO₂ recovery solvents.¹⁶

As confirmed by the Examiner in the reasons for allowance set forth in the Notice of Allowability, these amendments distinguished the ‘332 Patent process from the Ryan/Holmes cryogenic distillation process,¹⁷ and led to the issuance of the challenged claims, after the Examiner meaningfully addressed the Ryan/Holmes prior art.¹⁸

¹⁶ (EX1003 at 257-58 (04/11/2013) (Applicant amending application claims to recite the negative limitations of no cryogenic conditions, membranes, or CO₂ recovery solvents, and asserting patentability because: “The other cited reference, Goddin, clearly uses all three of a membrane, cryogenic conditions, and carbon dioxide recovery solvents.”).)

¹⁷ (*Id.* at 270 (05/08/2013) (Examiner in Reasons for Allowance stating: “Further, none of the prior art of record [including Goddin] provide for utilizing an overall process for heavy hydrocarbon separation, NGL separation, and CO₂ separation without the utilization of cryogenic conditions, membranes, or [CO₂ recovery] solvents and still provide the same method and order of separation as claimed by the applicant. Therefore, in view of all the evidence, it is seen that the claimed invention is patentable as it is novel and non-obvious over the prior art.”) (emphasis added).)

¹⁸ (*See, e.g., id.* at 269 (05/08/2013) (Examiner in the Reasons for Allowance noting that: “The closest prior at on record include U.S. patent number 6,128,919 Daus et al. (hereinafter Daus) and U.S. patent number 4,529,411 Goddin Jr. et al. (hereinafter Goddin).”) (emphasis added).)

IV. LEVEL OF ORDINARY SKILL IN THE ART

Petitioners assert that a “person of ordinary skill in the art (POSITA) would have had: (i) a B.S. degree in Chemical Engineering, Petroleum Engineering, or an equivalent field and (ii) two or three years of academic or industry experience in chemical processing systems, oil and gas production and/or refining; or comparable experience,” and that “[a]dditional work experience can substitute for educational or research experience, and vice versa. (Petition at 8 (citing EX1002 at ¶¶26-29).)

Patent Owner agrees with Petitioners’ assertions regarding the level of ordinary skill in the art.

V. CLAIM CONSTRUCTION UNDER 37 C.F.R. §42.104(B)(3)

While Petitioners assert that “explicit construction” of terms in this matter is “unnecessary because it is not dispositive,” relying on an assertion that “the art teaches the claims under any reasonable construction,”¹⁹ it is clear that the Petition necessarily relies upon critically flawed proposed interpretations of at least two particular claim terms in support of the obviousness grounds, which are the “cryogenic conditions” and “CO2 recovery solvents” terms in challenged independent Claim 1, upon which each of the challenged dependent Claims 2-4, 6, and 7 depend.

¹⁹ Petition at 8.

A. Cryogenic Conditions

Challenged Claim 1 of the Prim '332 Patent includes the negative limitations suggested by the Examiner during prosecution to distinguish the claimed invention from the prior art Goddin cryogenic distillation process, including the requirement that the “hydrocarbon feed stream, the carbon dioxide recycle stream, and the sour NGL rich stream” in the Prim process “are not subjected to cryogenic conditions.” (*See supra*, Section III(B).)

The Goddin patent, just like the Ryan/Holmes patents and journal articles, repeatedly refer to their process as “cryogenic distillation” and “cryogenic fractionation,” or “cryogenic distillative fractionation.” (*See, e.g.*, EX2003, EX1010, EX2006, EX2008.)

The term cryogenic does not have a universal definition, and is often different depending on the context and the industry. (EX2001 at ¶47.) At the outset of the related federal court proceeding, the Patent Owner Plaintiff proposed a general definition of the term in response to Petitioners/Defendants’ Motion to Dismiss asserting that cryogenic conditions included temperatures as warm as 5.7°F. (EX1011 at 12.)

Patent Owner/Plaintiff’s response asserted that cryogenic conditions were colder than 5.7°F, using an EPA website reference describing cryogenic conditions as -130°F (-90°C) or less. (EX1011 at 12, n2.) This reference is related to the storage

of gases which have been liquified such as air, argon, carbon monoxide, ethylene, fluorine, helium, hydrogen, methane, nitrogen, and oxygen. (EX2001 at ¶47.) Patent Owner/Plaintiff cited a second reference, from the American Institute of Chemical Engineers, which defines cryogenic liquid as a refrigerated liquid gas having a boiling point below -130°F (-90°C) at atmospheric pressure. (NFPA 30). (EX1011 at 12, n2.)

Petitioners provide a definition of cryogenic from the National Institute of Standards and Technology of -150C (-238°F), again related to the liquification of permanent gases. (EX1017 at 1.)

Each of the definitions offered at the outset of the related federal court litigation, which had not, and still has not reached even the beginning of the claim construction process, and Petitioners' Exhibit 1017 definition, generally relate to the liquification of gases, rather than providing a definition applicable to the oil and gas industry, and in particular the gas processing industry, which is the field of the Prim '332 Patent process. (EX2001 at ¶48.)

In the oil and gas industry, a well-known and most widely used publication is the Gas Processors Association (GPA) and the Gas Processors Suppliers Association (GPSA) "Engineering Data Book." (EX2001 at ¶53.) The Twelfth Edition (2004), at Section 1, includes Definitions of Words and Terms Used in the Gas Processing Industry, which includes the following:

cryogenic plant

A gas processing plant which is capable of producing natural gas liquid products, including ethane, at very low operating temperatures, usually below minus 50°F.

(EX2005 at 1-4.)

The GPA, in addition to publishing the Engineering Data Book, also sponsors an annual technical convention and publishes technical papers such as Exhibit 1010 “Pilot Tests Prove Ryan/Holmes Cryogenic Acid Gas/Hydrocarbon Separations.” The “Hydrate Formation in Chevron Mabee Unit for NGL Recovery and CO₂ Purification for EOR,” which was submitted to the Gas Processors Association conference 2017, also lists the 1998 edition of the GPSA Engineering Data Book as a reference. (EX2012.) The GPA (and GPSA) Engineering Data Book is also referenced in the Exhibit 1022 at 1:30, and was acknowledged in the reference (21) of Exhibit 1005 as being presented at the 61st Annual Gas Processors Association Convention. Exhibit 1007 reference 3 is also a GPA publication from 1983.

Because the Prim ‘332 Patent process at issue in this case is related to the oil and gas industry, and in particular the field of gas processing, Patent Owner proposes that the term be construed as set forth in the GPS “Engineering Data Book” definition of “below minus 50°F.” (EX2001 at ¶55.)

B. Carbon Dioxide Recovery Solvents

Challenged Claim 1 of the Prim '332 Patent includes additional negative limitations suggested by the Examiner during prosecution to distinguish the claimed invention from the prior art Goddin cryogenic distillation process, including the requirement that the “hydrocarbon feed stream, the carbon dioxide recycle stream, and the sour NGL rich stream” in the Prim process “are not subjected to ... carbon dioxide recovery solvents.” (*See supra*, Section III(B).)

Patent Owner proposes that this “carbon dioxide recovery solvents” term being construed according to its plain and ordinary meaning: “solvents used for recovery of carbon dioxide.”

Petitioners propose that this “carbon dioxide recovery solvents” be construed to be limited to “carbon dioxide solvents,” which Petitioners refer to as “solvents having CO₂ affinity” (Petition at 35). But these words in the claim were chosen specifically with the intention of not limiting the solvents to carbon dioxide solvents. Had Prim intended the exclusion to include only solvents with an affinity to CO₂, the patent would have used the term “carbon dioxide solvents.” (EX2001 at ¶58.)

With this in mind, the additives in the Ryan/Holmes process, and the Soldati process, are used extensively to allow the separation of CO₂ from the hydrocarbons. This separation is accomplished by relying on the solubility of the hydrocarbons into the additive. Additives, also referred to as agents, liquid hydrocarbon streams,

recycled hydrocarbon stream, absorbent oil, stream 10 and stream 32 (in Soldati), recirculating hydrocarbon, lean oil, among others, amounts to the use of carbon dioxide recovery solvents. The use of these carbon dioxide recovery solvents is mentioned by one of the terms above in Exhibits 1005, 1006, 1007, and 1010, but never in Exhibit 1002. (*Id.* at ¶59.)

VI. OVERVIEW OF THE PRIOR ART

A. The Ryan/Holmes Process

Ryan/Holmes is a cryogenic distillation process developed in the late 1970's and early 80's to improve the process of separating methane and ethane from carbon dioxide recycle streams in enhanced oil recovery ("EOR") operations. The Ryan/Holmes process uses hydrocarbon solvents ("additives"), and an extensive amount of process equipment (up to four distillation columns), to solve two particular problems in the separation of methane and ethane from carbon dioxide recycle streams. The Ryan/Holmes additives avoid carbon dioxide freezing (solidification) in the separation of methane from carbon dioxide, and allows for the separation of ethane from carbon dioxide, by eliminating the formation of what is known as the ethane-carbon dioxide "azeotrope" which otherwise would preclude a separation of ethane from carbon dioxide. (EX2001 at ¶60.)

While the Ryan/Holmes process uses additives and extensive process equipment to improve the process of separating methane and ethane from carbon dioxide recycle streams, the innovative process described and claimed in the ‘332 Patent improves the process of recovering NGLs from carbon dioxide recycle streams by “disregarding the recovery” of methane and ethane from the carbon dioxide recycle stream, to recover NGLs “with relatively little process equipment or energy.”²⁰ (EX2001 at ¶61.)

The purpose, process, and result of implementation of the Ryan/Holmes process is to separate methane and ethane from carbon dioxide recycle streams, using additives and extensive processing equipment, to produce methane and ethane for sales. The Prim ‘332 invention goes in the opposite direction by NOT using additives or extensive processing equipment to separate methane and ethane from carbon dioxide recycle streams. This innovative process leaves all (or almost all) of the methane and ethane in the carbon dioxide recycle streams, to produce NGLs, having little to no methane and ethane, while using significantly less process equipment and energy, and thereby recovers NGLs with significantly less costs. (*Id.* at ¶62.)

²⁰ (EX1001, 4:55-60.)

Ryan and Holmes authored several journal articles describing their cryogenic distillation process that were published in the early 1980's, and were issued several U.S. patents for their process. Petitioners included two of the Ryan/Holmes journal articles in the Petition, Exhibits 1007 and 1010. Patent Owner adds in this Preliminary Response an additional Ryan/Holmes journal article as Exhibit 2008. Patent Owner also includes two of the Ryan/Holmes patents, as Exhibits 2006 and 2007. (*Id.* at ¶63.)

Petitioners rely upon one of the Ryan/Holmes journal articles as the primary basis for each of the six obviousness Grounds asserted in the Petition. Petitioners incorporate Ryan's 1984 Chemical Engineering Progress article (EX1007 ("Ryan")) into the Aycaguer (EX1005) reference, by asserting that Aycaguer's citing of the Ryan article (at footnote 22) "evidences a POSITA's knowledge at the relevant time" (Petition at 35). Aycaguer, and by incorporation Ryan, is the primary reference for each of the six obviousness Grounds asserted in the Petition. Grounds 4 and 6 explicitly add Ryan to the combination of references for those Grounds. (EX2001 at ¶64.)

Petitioners made a similar attempt to incorporate another Ryan/Holmes journal article into their obviousness grounds, but mistakenly cited to the wrong article. Petitioners mistakenly assert that Aycaguer cites to a Ryan/Holmes 1982 Gas Processors Association article (EX1010), and quote from that article in support

of their obviousness grounds. (Petition at 35-36.) The additional Ryan/Holmes article actually cited in Aycaguer (at footnote 21) is a different 1982 article authored by Ryan and Holmes, published in the Hydrocarbon Processing journal, which Patent Owner attaches as Exhibit 2008. (EX2001 at ¶65.)

In both of these 1982 journal articles authored by Ryan and Holmes, they refer to their distillation processes as being “cryogenic.” (EX1010, entitled “Pilot Tests Prove Ryan/Holmes Cryogenic Acid Gas/Hydrocarbon Separations” (emphasis added); EX2008, subtitled “Ryan/Holmes cryogenic processes overcome roadblocks to distillation of C₁-CO₂, C₂-CO₂ and CO₂-H₂S systems” (emphasis added)).

At pages 35-36 of the Petition, Petitioners rely upon two particular quotes from the Ryan/Holmes journal articles that reference non-cryogenic temperatures for particular proposed configurations of the Ryan/Holmes process, referencing operating temperatures as warm as “-30 to -40°F” (EX1010 at 81), and “-35°F” (*id.* at 83). Upon a closer review of these Ryan/Holmes journal article descriptions of the process, the non-cryogenic (warmer than -50°F) conditions referenced are particular proposed configurations of the Ryan/Holmes process in which these warmer conditions were accomplished by increasing the flow of the CO₂ recovery solvents (“NGL-based additives”). *See* EX1010 at 83 (“By increasing the volume of recycle additive to the column, the overhead temperature can be raised to -35°F.”). (EX2001 at ¶67.)

While these Ryan/Holmes 1982 journal articles described their proposed configurations to operate at non-cryogenic conditions by increasing the flow of CO₂ recovery solvents (“NGL-based additives”), by 1984 Ryan and Holmes were teaching away from this configuration by promoting their new four-column process, and criticizing their old increased additives three-column process. (EX2001 at ¶68.)

Four-column scheme

The major objectives which lead to the development of the four-column arrangement were to lower the energy consumption and capital cost of the overall processing scheme. After some study it became apparent that reducing the flow of additive and producing the CO₂ product as a liquid-column bottoms stream would help accomplish these objectives. If a liquid CO₂ product bottoms stream were to be produced, it would have to be from a column into which no additive was fed. Figure 3 shows the resulting four-column flow schematic.

(EX1007 at 84 (emphasis added).)

In other words, although the Ryan/Holmes process back in 1982 may have included a proposed non-cryogenic configuration for the Ryan/Holmes cryogenic distillation process, within a few short years in 1984 Ryan and Holmes were teaching away from that particular proposed configuration. (EX2001 at ¶69.)

B. Goddin (EX2003)

The Goddin patent describes two alternative processes for CO₂ removal, including a first stage using membranes for removal of CO₂, and a second stage

using either: 1) cryogenic distillation; or 2) CO₂ solution absorption.²¹ (EX2001 at ¶71.)

In Goddin’s first alternative, the second stage is the Ryan/Holmes cryogenic distillation process.²² In response to the Examiner’s Goddin-based rejections, amendments were made to the ‘332 Patent claims specifically to distinguish the claimed invention from the Ryan/Holmes process, including the negative limitations suggested by the Examiner to specify that the ‘332 Patent process does not use cryogenic conditions, membranes, or CO₂ recovery solvents.

As confirmed by the Examiner in the reasons for allowance set forth in the Notice of Allowability, these amendments distinguished the ‘332 Patent process from the Ryan/Holmes cryogenic distillation process, and led to the issuance of the challenged claims, after the Examiner meaningfully addressed the Ryan/Holmes prior art.

The following Table demonstrates the similarities between the process described in Figure 11 of the Goddin ‘411 Patent (EX2003), which was meaningfully addressed during prosecution of the Prim’332 Patent, and the three-

²¹ (EX2003, 7:24-33 (“CO₂ is further removed from the hydrocarbon enriched process stream by cryogenic fractionation and/or by CO₂ solution absorption.”)).

²² *See* Ex. 2004, Table of Similarities (demonstrating similarities between Goddin ‘411 Patent Figure 11 and Three-Column Ryan/Holmes Process).

column Ryan/Holmes process asserted as the primary basis for each of the obviousness Grounds in the Petition.

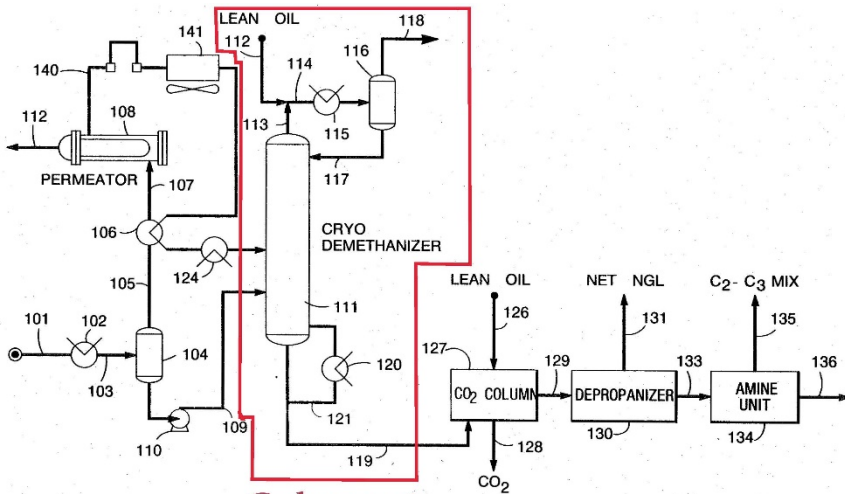
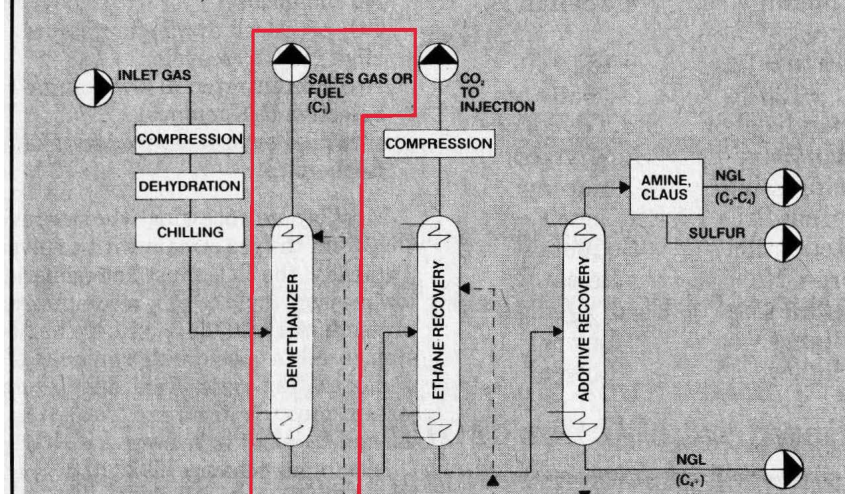
As demonstrated below for each of the three distillation columns in this process, and the final step of sweetening the NGL output stream, the input, process, and output for each of the three distillation columns, and the final sweetening step, are the same. In other words, the cryogenic distillation process in the Goddin '411 Patent, which was meaningfully addressed during prosecution of the Prim '332 Patent, is the same art asserted as the primary basis for each of the six obviousness Grounds in the Petition. (EX2001 at ¶73.)

The following presentation for brevity excludes the footnotes referencing the source of each item. The corresponding attached Exhibit 2004 Table of Similarities includes the footnotes referencing the source of each item.

Goddin '411 Patent Figure 11

Three-Column Ryan/Holmes Process

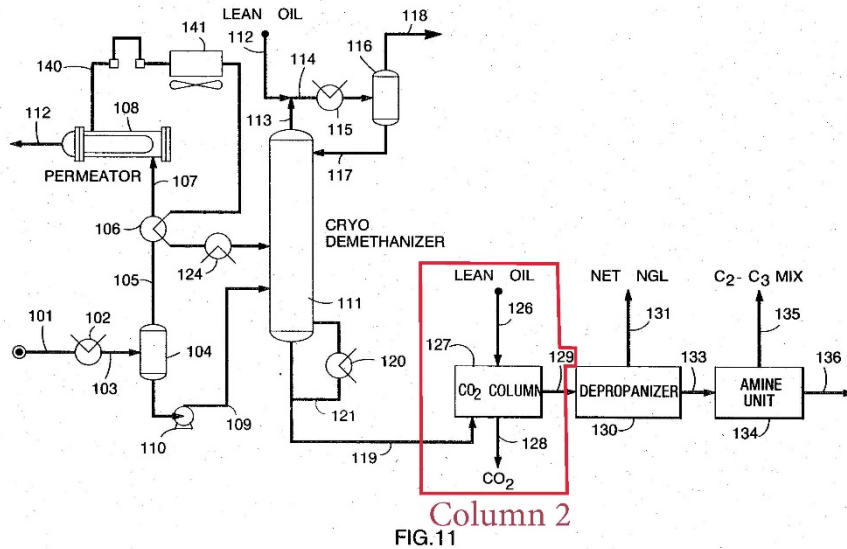
Column 1

CRYO DEMETHANIZER	DEMETHANIZER
 Column 1 FIG. 11	Figure 2. Three-column Ryan/Holmes process.  Column 1
INPUT: Primarily C_{1,2,3,4+} and CO₂, some H₂S and N₂, and “Lean Oil” (C_{4,5} hydrocarbon solvent).	INPUT: Primarily C_{1,2,3,4+} and CO₂, some H₂S and N₂, and “NGL-based additive” (C₄₊ hydrocarbon solvent).
PROCESS: Separation of Methane C₁ from CO₂ for sales of Methane C₁, using “Lean Oil” (C_{4,5} hydrocarbon solvent) to avoid CO₂ freeze-up.	PROCESS: Separation of Methane C₁ from CO₂ for sales of Methane C₁, using “NGL-based additive” (C₄₊ hydrocarbon solvent) to avoid CO₂ freeze-up.
OUTPUT – Overhead: Primarily Methane C₁ Residue [sales] gas stream. Bottom: “bulk of” CO₂ and C₂₊	OUTPUT - Overhead: Primarily Methane C₁ Sales Gas or Fuel Bottom: CO₂ and C₂₊

Goddin '411 Patent Figure 11

Three-Column Ryan/Holmes Process

Column 2

CO₂ COLUMN

Column 2
FIG.11

INPUT: CO₂ and C₂₊, and “Lean Oil” (C_{4,5} hydrocarbon solvent).

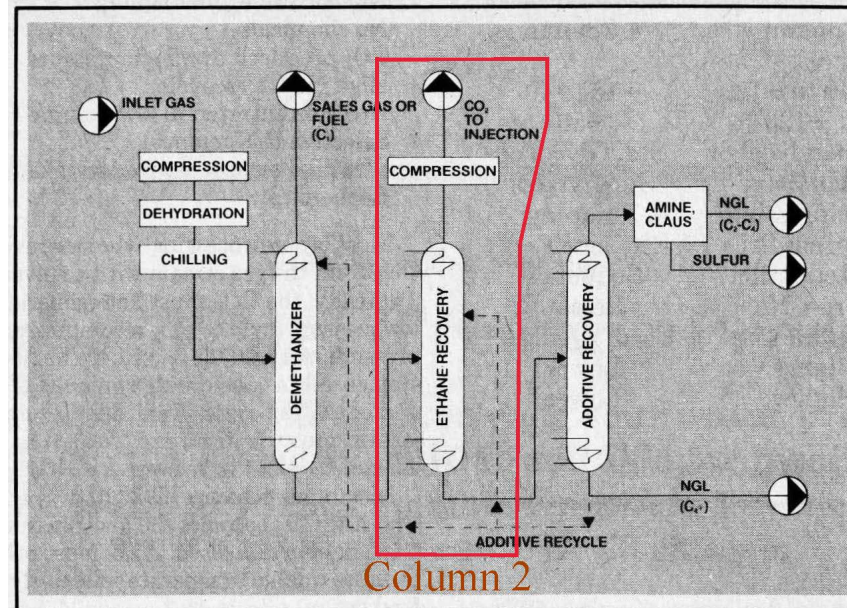
PROCESS: Separation of Ethane C_2 from CO_2 , using “Lean Oil” ($C_{4,5}$ hydrocarbon solvent) to facilitate separation of Ethane C_2 from CO_2 .

OUTPUT- Overhead: Sweet high purity CO₂ product stream.

Bottom: Ethane C₂ and other hydrocarbons.

ETHANE RECOVERY

Figure 2. Three-column Ryan/Holmes process.



Column 2

INPUT: CO₂ and C₂₊, and “NGL-based additive” (C₄₊ hydrocarbon solvent).

PROCESS: Separation of Ethane C_2 from CO_2 , using “NGL-based additive” (C_{4+} hydrocarbon solvent) to facilitate separation of Ethane C_2 from CO_2 .

OUTPUT - Overhead: CO₂ product stream.

Bottom: Ethane C₂ and other hydrocarbons.

Three-Column Ryan/Holmes Process

Column 3

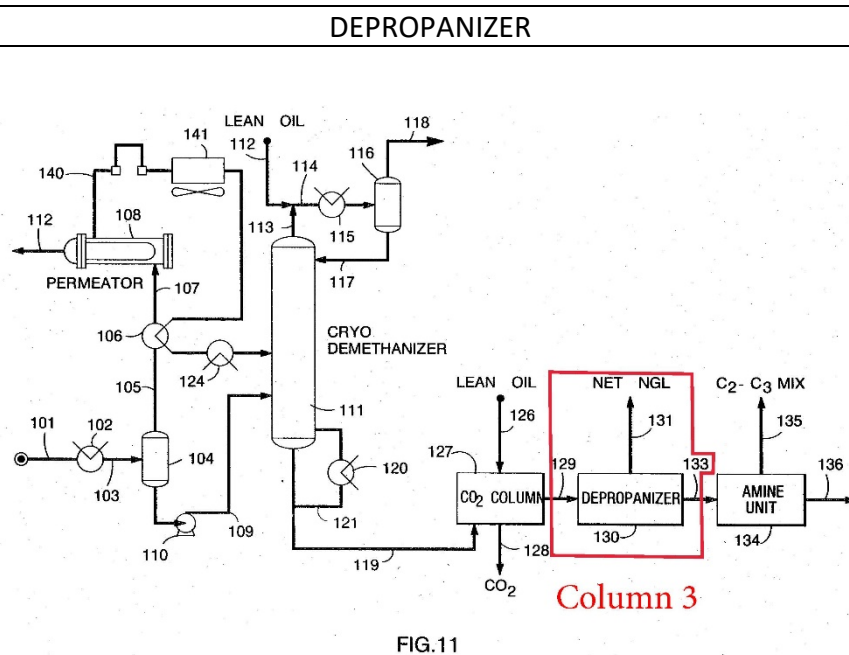
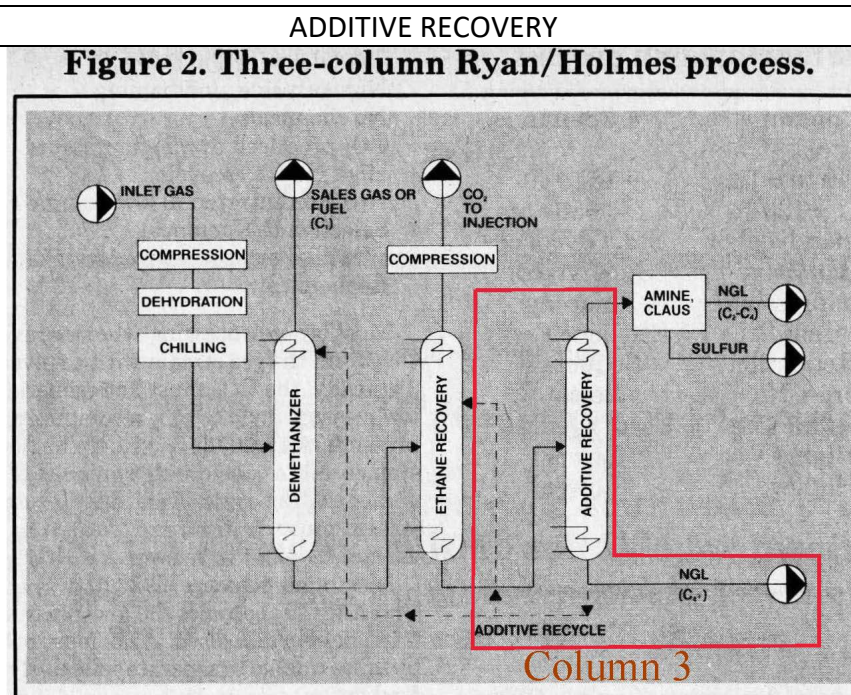


FIG.11



INPUT: Ethane C_2 and other hydrocarbons.

PROCESS: Separation of light (Ethane C_2 and Propane C_3) and heavier hydrocarbons (Butane C_4 and heavier hydrocarbons C_{5+}).

OUTPUT - Overhead: Ethane C₂ and Propane C₃ (“E-P mix”), and some acid gases CO₂ and H₂S.
Bottom: Butane and heavier hydrocarbons (C₄+ aka “Net NGL”).

INPUT: Ethane C₂ and other hydrocarbons.

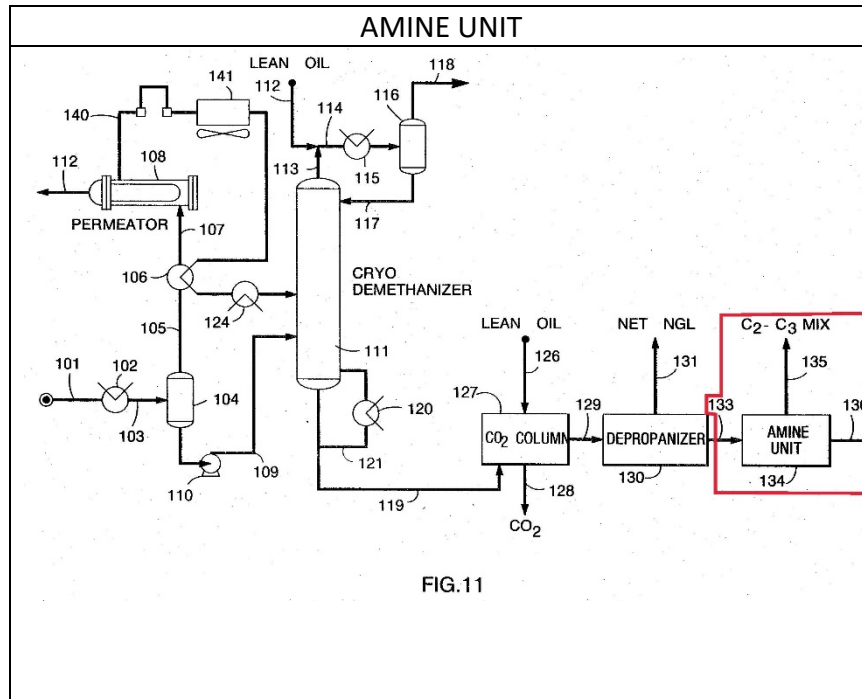
PROCESS: Separation of light (Ethane C₂ and Propane C₃) and heavier hydrocarbons (Butane C₄ and heavier hydrocarbons C₅₊).

OUTPUT - Overhead: Ethane C₂ and Propane C₃, and some acid gases CO₂ and H₂S.
Bottom: Butane and heavier hydrocarbons (C₄₊ aka “NGL” and “Additive Recycle”)

Goddin '411 Patent Figure 11

Three-Column Ryan/Holmes Process

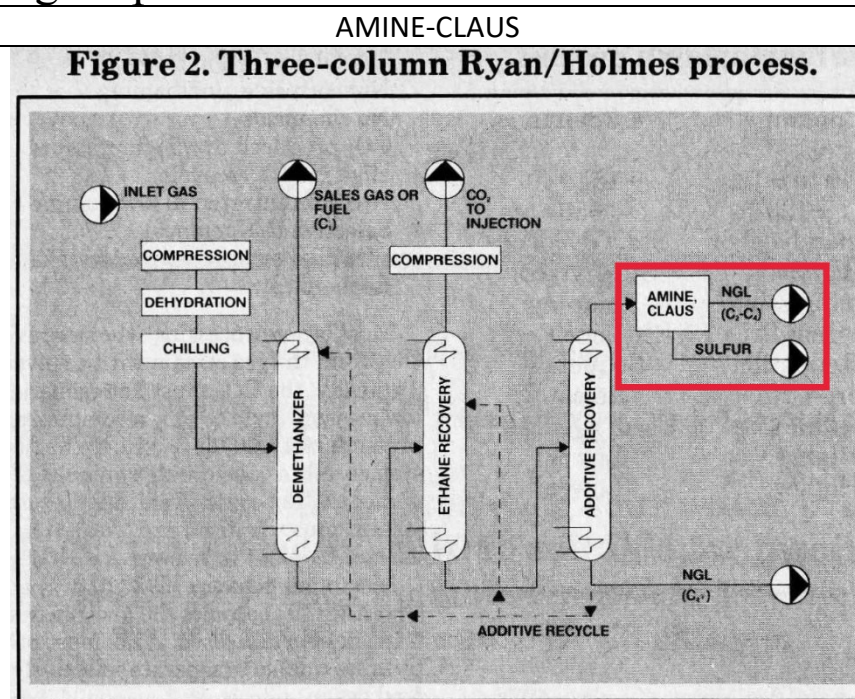
Sweetening Step



INPUT: Ethane C_2 and Propane C_3 , and some acid gases CO_2 and H_2S (sour "E-P mix").

PROCESS: Amine Scrubbing (sweetening of the Ethane C_2 and Propane C_3 ("E-P mix")).

OUTPUT: - Overhead: Sweet Ethane C_2 and Propane C_3 (sweet "E-P mix").
Bottom: Acid gases CO_2 and H_2S .



INPUT: Ethane C_2 and Propane C_3 , and some acid gases CO_2 and H_2S .

PROCESS: Conventional amine treatment to produce sweet NGL product.

OUTPUT: Overhead: Sweet Ethane C_2 and Propane C_3 ("sweet NGL product")
Bottom: Sulfur

C. Aycaguer (EX1005)

Reducing Carbon Dioxide Emissions with Enhanced Oil Recovery Projects: A Life Cycle Assessment Approach (“Aycaguer”) is an article published in the Energy & Fuel journal, managed by the American Chemical Society. (EX1005.)

Aycaguer is an article written from an Environmental, Health and Safety perspective about CO₂ emissions in EOR. A POSITA may not have been motivated to read the article since the title does not evoke thoughts of Gas Processing. (EX2001 at ¶75.)

Aycaguer does not render the challenged Prim ‘332 Patent claims obvious, although Aycaguer does correctly state that “the gas processing stage is the most complex stage of the system.” (EX1005 at 305.) Rockstraw, in section 56 of Ex 1002 states that Aycaguer alone renders Claim 1 of the ‘332 Patent obvious. Aycaguer alone does not show any detail of how the Ryan/Holmes process works, nor does it explain any of the internal processes. Figure 1, relied upon by Rockstraw as proof of obviousness does not even do the Ryan/Holmes process justice as it leaves off the methane stream. Aycaguer may describe what happens in Ryan/Holmes, but it does not describe how Ryan/Holmes works. One thing that Aycaguer does is introduce the presence of “additives” into the discussion. Looking into the references cited in Aycaguer would introduce Exhibit 1007 (“Ryan”), which will be discussed later. (EX1005 at 305, footnotes 21 (1982) and 22 (1984) are

journal articles authored by Ryan and Holmes, describing the Ryan/Holmes process.) (EX2001 at ¶76.)

Interestingly, Rockstraw only refers to one of the two cited articles in Aycaguer (EX1002, ¶ 111 (referring to EX1007 (“Ryan”)))²³. The other article, “Process improves acid gas separation,” written by Holmes et al was published in the May 1982 edition of Hydrocarbon Processing.²⁴ It describes the three-column version of the Ryan/Holmes process, which is also described in Exhibit 1007. The article includes some interesting descriptions of the Ryan/Holmes processes in general such as “Carbon Dioxide separated cleanly from troublesome systems when distillation additives are strategically used.” (EX2008 at 131.) The article also

²³ Rockstraw refers to EX1007 Ryan as “one of two references cited by Aycaguer to describe the Ryan/Holmes process and evidences a POSITA’s knowledge at the relevant time.” EX1002, ¶ 111. Rockstraw then mistakenly refers to EX1010 (“Holmes”) as “the other Ryan/Homes publication cited to by Aycaguer,” and quotes from this Holmes publication in support of Rockstraw’s opinions. The other Ryan/Holmes publication cited to by Aycaguer is not Holmes EX1010, but instead is a different 1982 publication by Holmes, which is attached as EX2008. (EX2001 at ¶77 n.5.)

²⁴ Holmes AS, Ryan JM, Price BC, Styring RE. Process Improves Acid Gas Separation. Hydrocarbon Processing 1982; 61:131–136 (EX2008). Process improves acid gas separation is an article published in a well-known journal - Hydrocarbon Processing. Hydrocarbon Processing has been published since 1922. Through its monthly magazine, website and e-newsletters, Hydrocarbon Processing covers technological advances, processes and optimization developments from throughout the global Hydrocarbon Processing Industry. (EX2001 at ¶77 n.6.)

describes how the Ryan/Holmes process accomplishes three otherwise impossible distillations using additives including:

- methane from CO₂ - Prim makes no attempt to recover methane from any stream;
- CO₂ from ethane and heavier hydrocarbons - Prim does not recover ethane, and makes no attempt to separate ethane from CO₂. Prim avoids this separation, because the use of additives is required to break the CO₂ - C₂ azeotrope (EX2008 at 134, 8:1-4); and
- CO₂ from H₂S - Although Prim does a partial separation between CO₂ and H₂S, more than 90% of the H₂S remains in the Purified CO₂ Recycle Stream. Ryan/Holmes performs an almost complete separation between H₂S and CO₂, down to <100 ppm (Exhibit 2008 at 134, 8:23-24).

(EX2001 at ¶77.)

D. Soldati (EX1006)

U.S. Patent No. 4,976,849 (“Soldati”) was filed on September 20, 1988, issued on December 11, 1990. (EX1006.)

Soldati describes a fractionation process for high acid gas streams. The patent at 1:14-19 states that “the purpose of the process according to the present invention is to separate a fraction formed of ethane, propane and heavier hydrocarbons, a fraction formed essentially of acid gases, and a fraction formed essentially of methane,” contrary to the Rockstraw description in section 68 where it is stated that “Soldati discloses methods of processing oil and natural gas streams to remove CO₂ and H₂S.” (EX2001 at ¶79.)

Soldati incorporates four distillations to complete the separation described above, and makes use of carbon dioxide recovery solvents referred to as the “liquid hydrocarbon stream” shown in Figures 1, 3, and 4 as streams 10 and 32. (EX2001 at ¶80.)

The Soldati patent makes reference to a “known art” described as “the teachings of A.S. Holmes and J.M. Ryan.” (EX1006, 1:21-25.) Soldati describes his innovation as an improvement over the Ryan/Holmes process by incorporating “a considerable reduction in energy consumption mainly by recycling smaller liquid hydrocarbon stream throughputs while at the same time increasing the percentage of ethane recovery.” (EX1006, 1:54-58.)

Although this Exhibit 1006 is the Soldati patent, the Rockstraw Declaration focuses most of the discussion referencing the prior art Ryan/Holmes process. All of the component throughput data used in the Declaration refer to Table III, which is the data for Example 2, Ryan/Holmes Fig 4. (EX1006, 8:49-10-23, 11:1-13-7.)

In the Rockstraw Declaration, the Ryan/Holmes known art description is usually referenced, however there are instances where the references are to the Soldati process. For example, in section 70 Rockstraw references the lower stream of column 8 using the Ryan Holmes Table III and the Soldati process description at 4:30-32, quoting “propane and higher hydrocarbons.” He could have referenced the Ryan/Holmes process description at 1:31-32 “ethane and higher hydrocarbons” but

he didn't. The presence of ethane in this stream is a significant deviation from the Prim patented process. (EX2001 at ¶83.)

In section 71, Rockstraw describes column 21 as “where the hydrogen sulfide and carbon dioxide are removed.” Although it is true that these components are included in stream 27, this stream is made up of 94.54% hydrocarbons. It would be more accurate to describe stream 27 as a sour NGL rich stream, which is further processed as described in Aycaguer (Ex 1005) using “a nonselective chemical absorption amine process.” (EX1005 at 305.) (EX2001 at ¶84.)

Rockstraw mischaracterizes column 21 as if its purpose is to remove the hydrogen sulfide and carbon dioxide, while in reality the purpose and function of column 21 is to separate the C₄ butane and heavier hydrocarbons from the lighter hydrocarbons (C₂ ethane and C₃ propane), which is always the function of the fourth column in the Ryan/Holmes process.²⁵ The C₄₊ heavier hydrocarbons are produced as a bottom product for recycling as the “liquid hydrocarbon stream” (aka

²⁵ See, for example, EX1007 at 54 (Ryan describing the “additive recovery” fourth column in the Four-Column Ryan/Holmes process) (“The role of the additive recovery column is to remove lighter NGL’s to prevent them from being recycled. Butanes-plus is produced from the bottom of the column providing the net heavier NGL make and recovered additive to be recycled to the first two columns. H₂S, if present in the plant feed, will be produced in the overhead of the additive recovery column. The sour NGL’s of the overhead are processed by conventional amine treatment to produce sweet NGL product.”).

“additives”), while the C₂/C₃ lighter hydrocarbons are produced as an overhead product. (EX2001 at ¶85.)

The C₂/C₃ overhead stream is a sour NGL stream, meaning it contains some hydrogen sulfide and carbon dioxide acid gasses, which are further processed to produce sweet NGL product, by removing the hydrogen sulfide and carbon dioxide acid gasses. This sleight of hand mischaracterization by Rockstraw is purposeful, done in order to support Rockstraw’s later opinion for Grounds 3 and 5, regarding challenged Claim 4, which specifies that the sweet NGL rich stream comprises “no more than 1 molar percent ethane.” (EX2001 at ¶86.)

Rockstraw purposefully incorrectly reverses the overhead and bottom products of column 21, intentionally mischaracterizing the stream 28 bottom product as the sweet NGL rich stream. (EX1002, ¶177.) The stream 28 bottom product is used for recycling as the “liquid hydrocarbon stream” (aka “additives”), while the overhead product is the sour NGL stream produced for sale, containing about 50% ethane. See Soldati Table III components, showing the sour NGL stream 27 as about 50/50 ethane/propane. (EX2001 at ¶87.)

TABLE III

COMPONENT THROUGHPUT KMOLS/H	STREAM		
	94	57	27
NITROGEN	—	16.44	—
HYDROGEN SULPHIDE	—	—	0.03
CARBON DIOXIDE	—	1.20	3.65
METHANE	—	57.46	—
ETHANE	—	—	32.57
PROPANE	1.20	0.03	30.51
N-BUTANE	108.25	0.65	0.67
N-PENTANE	32.52	0.05	—
HEXANE	8.03	—	—
THROUGHUT KMOLS/H	150.00	75.83	67.43
PHASE	L	V	L
TEMPERATURE °C.	−20.0	−35.0	5.5
PRESSURE ATA	41.5	40.5	18.5

EX1006, Table III (annotated to highlight the ethane/propane components in the overhead stream 27 of the fourth column). Ryan and Holmes refer to this stream 27, the overhead stream of the fourth column of their four-column Ryan/Holmes process, as the “sour NGL” stream, which is further processed “to produce sweet NGL product.”²⁶ (EX2001 at ¶87.)

Rockstraw presents a similar mischaracterization to support Rockstraw’s opinion for Grounds 3 and 5, regarding challenged Claim 7, which specifies that the sour NGL rich stream comprises “no more than 5 molar percent ethane.” Rockstraw

²⁶ EX1007 at 54 (Ryan describing the “additive recovery” fourth column in the Four-Column Ryan/Holmes process) (“H₂S, if present in the plant feed, will be produced in the overhead of the additive recovery column. The sour NGL’s of the overhead are processed by conventional amine treatment to produce sweet NGL product.”).

purposefully incorrectly presents the stream 12 bottom product of column 8 (the first column of the four-column Ryan/Holmes process) as the sour NGL rich stream. (EX1002, ¶189.) Rockstraw attempts to disguise the fact that the stream 12 bottom product of column 8 is subsequently fed into the “additive recovery” column 21, which produces the sour NGL rich stream as the stream 27 overhead product, containing about 50% ethane and 50% propane. (EX1006, Fig. 4, Table III.) And as Ryan and Holmes themselves specifically refer to the overhead product of the fourth column as the “sour NGL” stream, which is further processed “to produce sweet NGL product.”²⁷ (EX2001 at ¶88.)

Table IV of Soldati shows the typical recoveries of the Soldati process compared to the Ryan/Holmes process.

²⁷ EX1007 at 54 (Ryan describing the “additive recovery” fourth column in the four-column Ryan/Holmes process) (“H₂S, if present in the plant feed, will be produced in the overhead of the additive recovery column. The sour NGL’s of the overhead are processed by conventional amine treatment to produce sweet NGL product.”).

TABLE IV

	Example 2 (comparative)	Example 1
Ethane recovery %	78.5	94.1
Propane and higher hydrocarbon recovery (Mol %)	94.2	94.5
Carbon dioxide recovery %	99.6	99.9
Recirculating hydrocarbons Ton/h (stream 32)	93.8	17.2
Absorbed power kW	6150	5350
Steam required for reboilers 10 ⁶ kCal/h	18.8	5.3
	(P _{sat} = 6 ATA)	(P _{sat} = 4 ATA)

Prim Claim 5 at 18:39-42 specifies the recovery of C₃₊ should be in the range of “20 molar percent to 40 molar percent” whereas both examples presented in Soldati show recoveries of over 94%. (EX2001 at ¶90.)

A review of stream 6 and stream 44 of Table III shows that the inlet stream (the carbon dioxide recycle stream) contains 57.59 kMol/hr of methane, and the purified carbon dioxide stream contains 0.0 kMol/hr of methane. This means that the purified carbon dioxide recycle stream contains 0.0% of the methane contained in the carbon dioxide recycle stream. (EX2001 at ¶91.)

The carbon dioxide recycle stream also contains 41.50 kMol/hr of ethane and the purified carbon dioxide stream contains 8.86 kMol/hr of ethane. This means that the purified carbon dioxide recycle stream contains 21.35% of the ethane contained in the carbon dioxide recycle stream. (EX2001 at ¶92.)

Claim 5 of Prim at 18:42-46 states that purifies carbon dioxide stream comprises “at least 94 molar percent of the methane and at least 93 molar percent of the ethane from the carbon dioxide recycle stream.” Since none of the methane and only 21.35% of the ethane are contained in the carbon dioxide stream, the both the Soldati process and the Ryan/Holmes process described in the Soldati patent differ significantly from Prim. (EX2001 at ¶93.)

The Soldati process and the Ryan/Holmes process described in the Soldati patent both require 4 distillation columns, both use carbon dioxide recovery solvents, both produce a separate methane stream, both produce an NGL stream which contains essentially all of the ethane from the carbon dioxide recycle stream, and produce a purified carbon dioxide stream which is over 99% carbon dioxide. In contrast, the Prim ‘332 Patent process makes no attempt to separate methane from the purified carbon dioxide stream, and recovers less than 7% of the ethane from the carbon dioxide recycle stream (Prim Claim 5). (EX2001 at ¶94.)

E. Ryan (EX1007)

CO₂ Recovery by the Ryan/Holmes Process (“Ryan”) is an article published in the Chemical Engineering Progress journal, managed by the American Institute of Chemical Engineers.

Exhibit 1007 describes a process including “distillation separations using NGL-based additive.” (EX1007 at 1:12.) The first column “separates methane as an

overhead product from CO₂, C₂, H₂S and C₃ and heavier hydrocarbons.” (*Id.* at 1:18-20.) Prim does not separate methane from any stream. This first distillation step includes the addition of an additive “to avoid freezing in the column.” (*Id.* at 1:21.) The Prim ‘332 Patent process does not include the addition of an additive to “permit the separations to occur” (*Id.* at 1:15), nor are additives used to “avoid freezing in the column” (*Id.* at 1:21).

The next column produces a CO₂ overhead product and a C₂, H₂S, C₃ and heavier hydrocarbons as a bottom product. (*Id.* at 1:37-39.) “The use of additive in this column breaks the azeotrope which forms between CO₂ and C₂” (*Id.* at 1:39-40). The Prim ‘332 Patent process does not require the use of additives, because there is no desire to break the CO₂ C₂ azeotrope.

The third column in this process is an additive recovery column. The article describes “the sour NGL’s of the overhead are processed by conventional amine treatment to produce sweet NGL product.” (*Id.* at 54, 4:16-18.) The article goes on to say that “Butanes-plus is produced from the bottom of the column providing the net heavier NGL make and recovered additive.” (*Id.* at 4:12-14.)

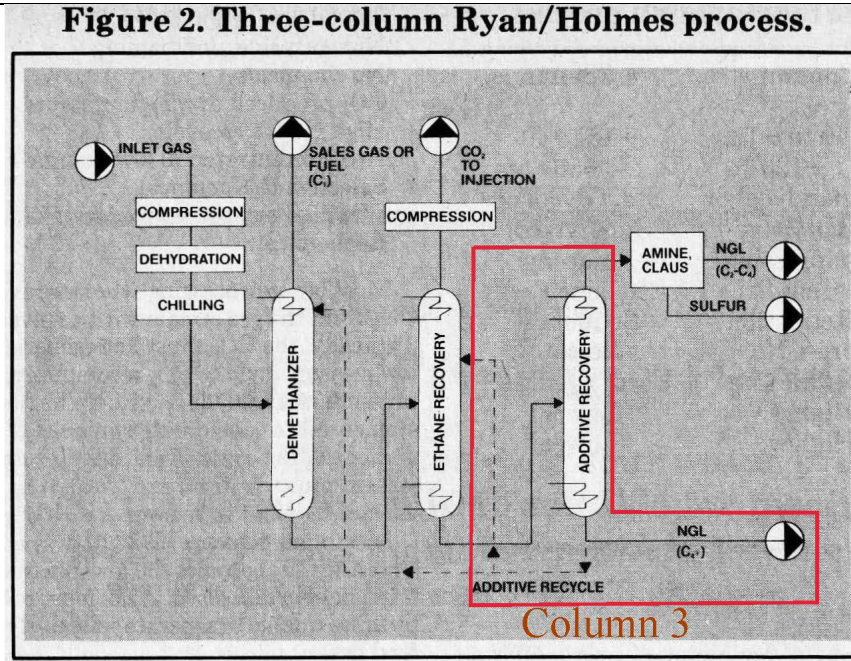
One subtle but significant point is that in the Rockstraw description of the additive recovery column in Soldati (column 21), Rockstraw in section 71 describes it as a sweetening step, whereas Rockstraw in section 75 asserts that the additive recovery column is where “the stream is separated into a sweet NGL stream with the

C₄₊ hydrocarbons and a sour NGL stream with C₂-C₃ hydrocarbons,” and then goes on to say that “[t]he sour NGL stream is then sweetened.”

The Ryan/Holmes three-column description in Exhibit 1007 at 4:3-4 says “the bottom product of the demethanizer is CO₂, C₂ and heavier hydrocarbons.”

From Exhibit 1007, Figure 2. Three-column Ryan/Holmes process shows the addition of additive to the Column 2. It goes on to state at 4:7-9 that “CO₂ is produced as an overhead fraction. C₂, H₂S, C₃, C₄₊ and additive are produced from the bottom.”

DEPROPANIZER	ADDITIVE RECOVERY



In the '411 Goddin Patent at 18:13-15, it states that “In the depropanizer butane and heavier hydrocarbons are separated as bottom stream.” At 18:15-19 it states “[t]he top of depropanizer 130 is preferably subjected to conventional amine scrubbing in amine unit 134 and the acid gases CO₂ and H₂S sent to sulfur recovery (not shown) by line 136. The sweet C₂-C₃ stream 135 from the amine unit 134 can be sold.”

In describing the Three-column Ryan/Holmes process, Ryan states that “Butane-plus is produced from the bottom of the column,” and that “H₂S, if present in the plant feed, will be produced in the overhead of the additive recovery column. The sour NGL’s of the overhead are processed by conventional amine treatment to produce sweet NGL product.” (EX1007 at 4:12-18.)

F. Arand (EX1004)

Petitioners appear to rely upon Arand only to propose definitions for the claim terms Natural Gas Liquids (“NGL”) and heavy hydrocarbons.

VII. THE RYAN/HOLMES PROCESS “TEACHES AWAY” FROM THE PRIM ‘332 PATENT PROCESS

Ryan/Holmes is a cryogenic distillation process developed in the late 1970’s and early 80’s to improve the process of separating methane and ethane from carbon dioxide recycle streams in enhanced oil recovery (“EOR”) operations. The Ryan/Holmes process uses hydrocarbon solvents (“additives”), and an extensive

amount of process equipment (up to four distillation columns), to solve two particular problems in the separation of methane and ethane from carbon dioxide recycle streams. The Ryan/Holmes additives avoid carbon dioxide freezing (solidification) in the separation of methane from carbon dioxide, and allows for the separation of ethane from carbon dioxide, by eliminating the formation of what is known as the ethane-carbon dioxide “azeotrope” which otherwise would preclude a separation of ethane from carbon dioxide. (EX2001 at ¶111.)

While the Ryan/Holmes process uses additives and extensive process equipment to improve the process of separating methane and ethane from carbon dioxide recycle streams, the innovative process described and claimed in the ‘332 Patent improves the process of recovering NGLs from carbon dioxide recycle streams by “disregarding the recovery” of methane and ethane from the carbon dioxide recycle stream, to recover NGLs “with relatively little process equipment or energy.”²⁸ (EX2001 at ¶112.)

The purpose, process, and result of implementation of the Ryan/Holmes process is to separate methane and ethane from carbon dioxide recycle streams, using additives and extensive processing equipment, to produce methane and ethane for sales. The Prim ‘332 invention goes in the opposite direction by NOT using

²⁸ Ex. 1001, 4:55-60.

additives or extensive processing equipment to separate methane and ethane from carbon dioxide recycle streams. This innovative process leaves all (or almost all) of the methane and ethane in the carbon dioxide recycle streams, to produce NGLs, having little to no methane and ethane, while using significantly less process equipment and energy, and thereby recovers NGLs with significantly less costs. (EX2001 at ¶113.)

Considering that the Prim ‘332 process conserves costs by “disregarding the recovery” of methane and ethane from the carbon dioxide recycle stream, it would make no sense for a person of ordinary skill in the art to use the Ryan/Holmes methane/ethane recovery process as a starting point to modify it or combine with other teachings to develop the Prim ‘332 Patent process. The Ryan/Holmes process focus on recovery of methane and ethane would lead a person of ordinary skill in the art in a direction divergent from the path that was taken by Prim to develop the ‘332 Patent process. The Ryan/Holmes process and the Prim ‘332 Patent process go in opposite directions for recovering salable components of carbon dioxide recycle streams. (EX2001 at ¶114.)

The Ryan/Holmes process thereby “teaches away” from the Prim ‘332 Patent process. A person of ordinary skill in the art would not be motivated to modify or combine the Ryan/Holmes process with other teachings to develop the Prim ‘332 Patent process. The Ryan/Holmes process therefore cannot be the basis for an

obviousness finding as asserted by Petitioners in each of their six obviousness grounds. (EX2001 at ¶115.)

VIII. THE BOARD SHOULD DISCRETIONARILY DENY INSTITUTION UNDER 35 U.S.C. 325(D)

The Board can deny the Petition without even determining whether Petitioners met their burden to demonstrate a reasonable likelihood of establishing any challenged claim obvious. The Board can instead exercise its discretion to deny the Petition under 35 U.S.C. § 325(d). Petitioners chose to file a Petition based on prior art that was previously presented to the Office. Every obviousness Ground in the Petition relies on the Ryan/Holmes cryogenic distillation process, which was previously presented to the Office during examination. Despite that, the Petition does not even attempt to establish error. Petitioners failed to meet their burden to have a trial instituted based on art that was previously presented to the Office.

A. Petitioners Failed to Meet Their Burden

The Director has discretion to deny a petition when, “the same or substantially the same prior art or arguments previously were presented to the Office.” 35 U.S.C. § 325(d).

In evaluating whether to exercise its discretion to deny a petition under § 325(d), the Board follows the guidelines set forth in the *Advanced Bionics*

precedential decision. *Advanced Bionics* explains that: under § 325(d), the Board uses the following two-part framework:

(1) whether the same or substantially the same art previously was presented to the Office or whether the same or substantially the same arguments previously were presented to the Office; and

(2) if either condition of first part of the framework is satisfied, whether the petitioner has demonstrated that the Office erred in a manner material to the patentability of challenged claims.

Advanced Bionics, LLC v. MED-EL Elektromedizinische Geräte GmbH, IPR2019-01469, Paper 6 at 8 (PTAB Feb. 13, 2020) (precedential).

In evaluating the factual issues underlying the first and second *Advanced Bionics* prongs, the Board considers the “*Becton, Dickinson* factors”²⁹ which provide “useful insight into how to apply the framework under 35 U.S.C. § 325 (d).” *Id.* at 9. *Advanced Bionics* characterizes *Becton Dickinson* as identifying the following non-exclusive factors:

- (a) the similarities and material differences between the asserted art and the prior art involved during examination;
- (b) the cumulative nature of the asserted art and the prior art evaluated during examination;
- (c) the extent to which the asserted art was evaluated during examination, including whether the prior art was the basis for rejection;
- (d) the extent of the overlap between the arguments made during examination and the manner in which petitioner relies on the prior art;

²⁹ See *Becton, Dickinson & Co. v. B. Braun Melsungen AG*, IPR2017-01586, Paper 8 (PTAB Dec. 15, 2017) (precedential as to § III.C.5, first paragraph) (“*Becton, Dickinson*”).

- (e) whether petitioner has pointed out sufficiently how the examiner erred in its evaluation of the asserted prior art; and
- (f) the extent to which additional evidence and facts presented in the petition warrant reconsideration of the prior art or arguments.

See Becton, Dickson, Paper 8 at 17–18 (§ III.C.5, first paragraph).

Advanced Bionics, IPR2019-01469, Paper 6 at 9 (footnote 10).

In Part 1 of the *Advanced Bionics* two-part framework the Board evaluates *Becton, Dickinson* factors (a), (b) and (d). *Id.* at 10. (citing *Becton Dickinson*). If it is determined that the same or substantially the same art or arguments previously were presented to the Office, the Board then turns to Part Two of *Advanced Bionics* framework. In Part 2 the Board evaluates *Becton Dickinson* factors (c), (e) and (f).

In this case, all of these factors weigh in favor of the Board exercising its discretion to deny the Petition under 35 U.S.C. § 325(d).

**B. Part 1 (*Becton Dickinson* Factors (a), (b), (d)):
Examiner Considered Substantially the Same Art and/or
Arguments during Prosecution**

There were three Office Actions issued by the Examiner during prosecution of the ‘332 Patent, three Responses to those Office Actions, two Examiner Interviews, and a Notice of Allowance including a Notice of Allowability setting forth the Examiner’s reasons for allowance.

Beginning with the second Office Action, the Examiner cited U.S. Patent No. 4,529,411 (“Goddin”) (EX2003) as the basis for rejecting application claims, including those that ultimately issued as the challenged claims in this matter.

Responses to the second and third Office Actions argued against the Goddin-based rejections, and the two Examiner Interview summaries reflect the Examiner's suggestions to amend claims to overcome the rejections by adding negative limitations to distinguish the '332 Patent claims from Goddin. Amendments were made to distinguish the '332 Patent claims from Goddin, and the Examiner confirmed those distinctions and patentability in the reasons for allowance.

The Goddin patent describes two alternative processes for CO₂ removal, including a first stage using membranes for removal of CO₂, and a second stage using either: 1) cryogenic distillation; or 2) CO₂ solution absorption.³⁰

In Goddin's first alternative, the second stage is the Ryan/Holmes cryogenic distillation process.³¹ In response to the Examiner's rejections, amendments were made to the '332 Patent claims specifically to distinguish the claimed invention from the Ryan/Holmes process, including the negative limitations suggested by the Examiner to specify that the '332 Patent process does not use cryogenic conditions, membranes, or CO₂ recovery solvents.

³⁰ (EX2003, 7:24-33 ("CO₂ is further removed from the hydrocarbon enriched process stream by cryogenic fractionation and/or by CO₂ solution absorption.")).

³¹ *See supra*, Section VI(B); Ex. 2004, Table of Similarities (demonstrating similarities between Goddin '411 Patent Figure 11 and Three-Column Ryan/Holmes Process).

Becton, Dickinson factors (a), (b), and (d) are all met here. The same or substantially the same art and arguments previously were presented to the Office, so the Board should now turn to the second prong of the *Advanced Bionics* framework.

**C. Part 2 (*Becton, Dickinson* Factors (c), (e), (f)):
Petitioners Have Not Established That the Office Materially Erred**

As confirmed by the Examiner in the reasons for allowance set forth in the Notice of Allowability, the amendments made in response to the Examiner's Goddin-based rejections distinguished the '332 Patent process from the Ryan/Holmes cryogenic distillation process, and led to the issuance of the challenged claims, after the Examiner meaningfully addressed the Ryan/Holmes prior art.

The Petition ignores the fact that Ryan/Holmes art asserted in the Petition is the same as, or cumulative to, the Ryan/Holmes art that the Examiner previously considered during prosecution of the '332 Patent, and makes no attempt to establish, or even argue, that the Examiner erred in evaluating the Ryan/Holmes art asserted in the Petition and previously considered during prosecution.

Becton, Dickinson factors (c), (e), and (f) all weigh in favor to discretionary denial. The Board therefore should exercise its discretion under Section 325(d) to deny institution because the same art asserted in the Petition, the Ryan/Holmes cryogenic distillation process, was meaningfully addressed by the Examiner during

prosecution. And the Petitioners made no attempt to establish, or even argue, that the Examiner erred in its evaluation of the Ryan/Holmes art.

D. The Board Should Not Allow Petitioners Any Requested Additional Briefing, Because Petitioners Could Have and Should Have Anticipated These Discretionary Denial Issues

Furthermore, the Board should not allow Petitioners any requested additional briefing, because Petitioners could have and should have anticipated this issue, but instead chose not to address it in the Petition, devoting just one paragraph and three sentences to make nothing more than a conclusory assertion that discretionary denial is “unwarranted.”³²

IX. THE BOARD SHOULD NOT CANCEL THE CHALLENGED CLAIMS OF THE ’332 PATENT

A. Ground 1: Claim 1 is Not Obvious Over Aycaguer

1. No Motivation to Modify or Combine Aycaguer with Other Teachings

Aycaguer, as presented by Petitioners, describes a three-column Ryan/Holmes process. As described above in Section VII, the Ryan/Holmes process “teaches away” from the Prim ’332 Patent process. The purpose of the Ryan/Holmes process is to separate methane and ethane from carbon dioxide recycle streams, using additives and extensive processing equipment, to produce methane and ethane for

³² Petition at 90.

sales. The Prim ‘332 Patent process goes in the opposite direction by “disregarding the recovery” of methane and ethane from the carbon dioxide recycle stream, to recover NGLs “with relatively little process equipment or energy,”³³ by NOT using additives or extensive processing equipment to separate methane and ethane from carbon dioxide recycle streams.

The Ryan/Holmes process and the Prim ‘332 Patent process go in opposite directions for recovering salable components of carbon dioxide recycle streams. The Ryan/Holmes process thereby “teaches away” from the Prim ‘332 Patent process. A person of ordinary skill in the art would not be motivated to modify or combine the Ryan/Holmes process with other teachings to develop the Prim ‘332 Patent process. The Ryan/Holmes process therefore cannot be the basis for an obviousness finding as asserted by Petitioners.

Petitioners make no attempt to meet their burden to show a motivation to modify or combine Aycaguer with other teachings to develop the Prim ‘332 Patent process. While Petitioners at least attempt to present a case for motivation to combine for Grounds 2-6, Petitioners completely neglect to address this required showing for Ground 1.

³³ (EX1001, 4:55-60.)

When discussing obviousness over a single reference (here, Aycaguer), a motivation to modify is legally necessary. *SIBIA Neurosciences, Inc. v. Cadus Pharmaceutical Corp.*, 225 F.3d 1349, 1356 (Fed. Cir. 2000) (“In appropriate circumstances, a single prior art reference can render a claim obvious. However, there must be a showing of a suggestion or motivation to modify the teachings of that reference to the claimed invention in order to support the obviousness conclusion.”). Petitioners fail to attempt, let alone make, this showing. Petitioners’ Ground 1 therefore should be rejected for failure to meet their burden to show a motivation to modify or combine Aycaguer with other teachings to develop the Prim ‘332 Patent process, and because the Aycaguer Ryan/Holmes process “teaches away” from the Prim ‘332 Patent process.

2. Claim 1

a. “wherein the hydrocarbon feed stream, the carbon dioxide recycle stream, and the sour NGL rich stream are not subjected to cryogenic conditions, membranes, and carbon dioxide recovery solvents between being received and being separated into the heavy hydrocarbon rich stream, the purified carbon dioxide recycle stream, the sweet NGL rich stream, and the acid gas stream.” [1.6]

Aycaguer, as presented by Petitioners to describe a three-column Ryan/Holmes process, subjects the carbon dioxide recycle stream to cryogenic conditions and carbon dioxide recovery solvents in the process steps in which limitation [1.6] specifically excludes cryogenic conditions and carbon dioxide

recovery solvents. (*See, e.g., supra*, §§V(A, B), VI(C).) Therefore, even if there could somehow be found a motivation to modify Aycaguer or combine it with other teachings, Aycaguer does not render Claim 1 unpatentable as obvious.

B. Ground 2: Claim 1 is Not Obvious Over Aycaguer and Arand

1. No Motivation to Combine Aycaguer and Arand

Petitioners' Ground 2 suffers from the same defects as Ground 1, including no motivation to modify or combine, because the Petitioners' asserted Ryan/Holmes process "teaches away" from the Prim '332 Patent process. The addition of Arand in a combination with Aycaguer provides nothing to overcome these defects. Petitioners' Ground 2 combination of Aycaguer and Arand is still nothing more than a Ryan/Holmes process asserted to render obvious the Prim '332 Patent process.

Petitioners in their Ground 2 at least make an attempt to meet their burden to show a motivation to combine, but still fail. Petitioners assert a general motivation to combine Aycaguer and Arand, presenting Aycaguer once again as a three-column Ryan/Holmes process.

Petitioners assert that a POSITA would be motivated to combine Aycaguer and Arand because "because both references relate to methods of natural gas liquid separation." (Petition at 36.) A general motivation to combine two references because they are in the same field is not sufficient. Petitioners must show a motivation to combine to make the Prim '332 Patent process. *See, e.g., William*

Wesley Carnes, Sr., Inc. v. Seaboard Int’l Inc., IPR2019-00133, Paper 10 (PTAB May 8, 2019) at 18 (“[S]tatement of similarity [that ‘both references are in the oil and gas exploration and drilling fields’], however, does not constitute an articulated reasoning with rational underpinning as to why a POSITA would combine elements of one reference with another, and why a POSITA would modify the teachings of the references to arrive at the claimed invention.”).

Just like Aycaguer’s three-column Ryan/Holmes focus on the recovery of methane and ethane teaches away from the Prim ‘332 Patent process, which disregards the recovery of methane and ethane, Arand’s focus of recovery of methane and ethane teaches away from Prim. Arand describes its invention as “a method for processing a produced fluid stream ... from a ... reservoir to produce a residue [sales] gas stream comprising predominantly methane, [and] also has the flexibility and capability of including ethane ... in the residue [sales] gas stream if desired.” (EX1004, 4:1-9; *see also id.* at 12:27-31 (producing a stream “comprising predominantly methane or methane and ethane”).)

Ground 2 therefore should be rejected for failure to meet their burden to show a motivation to combine Aycaguer and Arand to arrive at the Prim ‘332 Patent process, and because Aycaguer and Arand both “teach away” from the Prim ‘332 Patent process.

2. Claim 1

a. Claim element [1.6].

As explained above for Ground 1, Aycaguer does not teach limitation [1.6].

The addition of Arand does nothing to overcome Aycaguer's failure to teach limitation [1.6].

Therefore, even if there could somehow be found a motivation to combine Aycaguer and Arand, the combination does not render Claim 1 unpatentable as obvious.

C. Ground 3: Claims 1-4 and 6-7 are Not Obvious Over Aycaguer and Soldati

1. No Motivation to Combine Aycaguer and Soldati

Petitioners' Ground 3 suffers from the same defects as Grounds 1 and 2, including no motivation to modify or combine, because the Petitioners' asserted Ryan/Holmes process "teaches away" from the Prim '332 Patent process. The addition of Soldati, a four-column Ryan/Holmes process, in a combination with Aycaguer's three-column Ryan/Holmes process, provides nothing to overcome these defects. Petitioners' Ground 3 combination of Aycaguer and Soldati is still nothing more than Ryan/Holmes processes asserted to render obvious the Prim '332 Patent process.

Petitioners once again merely assert that a POSITA would be motivated to combine Aycaguer and Soldati because "because both references relate to methods

of processing natural gas liquid streams.” (Petition at 42.) As stated noted, a general motivation to combine two references because they are in the same field is not sufficient (citing *Carnes* at 18).

Petitioners further assert that a POSITA would be motivated to combine Aycaguer and Soldati because they both describe the use of “a Ryan/Holmes process to process a natural gas stream into natural gas liquids and carbon dioxide.” (Petition at 44.) But once again, a general motivation to combine two references because they are in the same field is not sufficient. Petitioners must show a motivation to combine to make the Prim ‘332 Patent process. While Aycaguer and Soldati both describe the use of a Ryan/Holmes process, and therefore could be combined to develop improvements of the Ryan/Holmes process, neither provide any motivation to use a Ryan/Holmes process to arrive at the Prim ‘332 Patent process. Instead, they both teach away from the Prim ‘332 Patent process.

Ground 3 therefore should be rejected for Petitioners’ failure to meet their burden to show a motivation to combine Aycaguer and Soldati to arrive at the Prim ‘332 Patent process, and because both Aycaguer and Soldati “teach away” from the Prim ‘332 Patent process.

2. Claim 1

a. Claim element [1.6]

As explained above regarding Ground 1, Aycaguer does not teach limitation [1.6]. Soldati, as a four-column Ryan Holmes process, adds nothing to overcome Aycaguer's failure to teach limitation [1.6].

b. “wherein the hydrocarbon feed stream, the carbon dioxide recycle stream, and the sour NGL rich stream are not subjected to cryogenic conditions, membranes, and carbon dioxide recovery solvents between being received and being separated into the heavy hydrocarbon rich stream, the purified carbon dioxide recycle stream, the sweet NGL rich stream, and the acid gas stream.” [1.6]

As explained above regarding Ground 1, Aycaguer, as presented by Petitioners to describe a three-column Ryan/Holmes process, subjects the carbon dioxide recycle stream to cryogenic conditions and carbon dioxide recovery solvents in the process steps in which limitation [1.6] specifically excludes cryogenic conditions and carbon dioxide recovery solvents.

Soldati suffers from the same defects. As a four-column Ryan/Holmes process, Soldati also subjects the carbon dioxide recycle stream to the same carbon dioxide recovery solvents as Aycaguer, in the process steps in which limitation [1.6] specifically excludes carbon dioxide recovery solvents.

Therefore, even if there could somehow be found a motivation to combine Aycaguer and Soldati, the combination does not render Claim 1 unpatentable as obvious.

3. Claims 2 and 3

Claims 2 and 3 each depend from Claim 1. For the same reasons set forth above that a combination of Aycaguer and Soldati does not render Claim 1 unpatentable as obvious, this combination does render dependent Claims 2 and 3 unpatentable as obvious.

4. Claim 4: “The method of claim 3, wherein the sweet NGL rich stream comprises no more than 1 molar percent methane, no more than 1 molar percent ethane, and no more than 1 molar percent acid gases.”

Claim 4 depends from Claim 3, which depends from Claim 1. For the same reasons set forth above that a combination of Aycaguer and Soldati does not render Claim 1 unpatentable as obvious, this combination does not render dependent Claim 4 unpatentable as obvious.

In addition, Claim 4 specifically requires that “the sweet NGL rich stream comprises ... no more than 1 molar percent ethane.”

Considering that both Aycaguer and Soldati are Ryan/Holmes processes that focus on the recovery of ethane, it should be no surprise that the sweet NGL rich streams in both Aycaguer and Soldati comprise more than 1 molar percent ethane. (*See, e.g., supra*, §§VI(C, D).) Therefore, even if there could somehow be found a

motivation to combine Aycaguer and Soldati, the combination does not render Claim 4 unpatentable as obvious.

5. Claim 6

Claim 6 depends from Claim 1. For the same reasons set forth above that a combination of Aycaguer and Soldati does not render Claim 1 unpatentable as obvious, this combination cannot render dependent Claim 6 unpatentable as obvious.

6. Claim 7: “The method of claim 6, wherein the sour NGL rich steam comprises no more than 5 molar percent carbon dioxide, no more than 1 molar percent methane, and no more than 5 molar percent ethane, and wherein the sweet NGL rich stream is substantially free of carbon dioxide.”

Claim 7 depends from Claim 6, which depends from Claim 1. For the same reasons set forth above that a combination of Aycaguer and Soldati does not render Claim 1 unpatentable as obvious, this combination does not render dependent Claim 7 unpatentable as obvious.

In addition, Claim 7 specifically requires that “the sour NGL rich stream comprises ... no more than 5 molar percent ethane.”

Considering that both Aycaguer and Soldati are Ryan/Holmes processes that focus on the recovery of ethane, it should be no surprise that the sour NGL rich streams in both Aycaguer and Soldati comprise more than 5 molar percent ethane. (*See, e.g., supra*, §§VI(C, D).) Therefore, even if there could somehow be found a

motivation to combine Aycaguer and Soldati, the combination does not render Claim 7 unpatentable as obvious.

D. Ground 4: Claim 2 is Not Obvious Over Aycaguer, Soldati, and Ryan

1. No Motivation to Combine Aycaguer, Soldati, and Ryan

Petitioners' Ground 4 suffers from the same defects as Grounds 1, 2, and 3, including no motivation to modify or combine, because the Petitioners' asserted Ryan/Holmes process "teaches away" from the Prim '332 Patent process. The addition of Ryan with Aycaguer, both presented by Petitioners as a three-column Ryan/Holmes process, in a combination with Soldati's four-column Ryan/Holmes process, provides nothing to overcome these defects. Petitioners' Ground 4 combination of Aycaguer, Soldati, and Ryan is still nothing more than Ryan/Holmes processes asserted to render obvious the Prim '332 Patent process.

Ground 4 therefore should be rejected for Petitioners' failure to meet their burden to show a motivation to combine Aycaguer, Soldati, and Ryan to arrive at the Prim '332 Patent process, because each of these references "teach away" from the Prim '332 Patent process.

2. Claim 2

Claim 2 depends from Claim 1. The addition of Ryan, as an additional cumulative disclosure of the three-column Ryan/Holmes process, adds nothing to overcome the failure of the combination of Aycaguer and Soldati to teach limitation

[1.6]. Ryan, as an additional cumulative disclosure of the three-column Ryan/Holmes process, subjects the carbon dioxide recycle stream to the same cryogenic conditions and carbon dioxide recovery solvents in the process steps in which limitation [1.6] specifically excludes cryogenic conditions and carbon dioxide recovery solvents.

For these same reasons that a combination of Aycaguer, Soldati, and Ryan does not render Claim 1 unpatentable as obvious, this combination does not render dependent Claim 2 unpatentable as obvious.

Therefore, even if there somehow could be found a motivation to combine Aycaguer, Soldati, and Ryan, this combination does not render dependent Claim 2 unpatentable as obvious.

E. Grounds 5 and 6: Claims 1-4 and 6-7 Are Not Obvious Over Aycaguer, Soldati, and Arand (Ground 5) and Claim 2 Is Not Obvious Over Aycaguer, Soldati, Ryan, and Arand (Ground 6)

1. No Motivation to Combine the References

Petitioners' Ground 5 suffers from the same defects as Grounds 1-4, including no motivation to modify or combine, because the Petitioners' asserted Ryan/Holmes process "teaches away" from the Prim '332 Patent process. The addition of Arand to the previously presented Grounds, which as described above also teaches away from Prim, provides nothing to overcome these defects. Petitioners' Grounds 5 and

6 combinations are still nothing more than Ryan/Holmes processes asserted to render obvious the Prim '332 Patent process.

Ground 4 therefore should be rejected for Petitioners' failure to meet their burden to show a motivation to combine these references to arrive at the Prim '332 Patent process, because each of these references "teach away" from the Prim '332 Patent process.

2. Grounds 5 and 6 are Duplicative of Grounds 3 and 4, Merely Adding Arand

The addition of Arand to the combinations asserted in Grounds 3 and 4 does nothing to overcome the defects of Grounds 3 and 4. Therefore, for the same reasons set forth above for Grounds 3 and 4, even if there somehow could be found a motivation to combine these references, the combinations asserted in Grounds 5 and 6 do not render unpatentable as obvious Claims 1-4 and 6-7.

X. CONCLUSION

For the reasons and authorities set forth above, Patent Owner respectfully requests that the Board deny the Petition for *Inter Partes* Review because Petitioners failed to meet their burden to show motivation to combine the asserted references to arrive at the challenged claims for the Prim '332 Patent process, because all of the references "teach away" from Prim.

In the alternative, Petitioners respectfully request that the Board exercise its discretion under Section 325(d) to deny institution because the same art asserted in

the Petition, the Ryan/Holmes cryogenic distillation process, was meaningfully addressed by the Examiner during prosecution.

Alternatively, Petitioners respectfully request that the Board deny the Petition because Petitioners have failed to meet their burden to demonstrate a reasonable likelihood of prevailing on any of their asserted obviousness challenges to Claims 1-4, 6 & 7 of the Prim '332 Patent.

Respectfully submitted this 13th day of May, 2024.

/Charles J. Rogers/
Charles J. Rogers
Reg. No. 38,286
Conley Rose, P.C.
777 North Eldridge Parkway, Suite 600
Houston, Texas 77079-4425
Phone: (713) 238-8049
Fax: (713) 238-8008
E-mail: CRogers@conleyrose.com

Lead Counsel for Patent Owner
Pilot Intellectual Property, LLC

CERTIFICATE OF WORD COUNT COMPLIANCE

Pursuant to 37 C.F.R. § 42.24(d), I hereby certify that this Preliminary Response to Petition complies with the type-volume limitation of 37 C.F.R. § 42.24(b)(1) because it contains 12,974 words (fewer than the limit of 14,000 words), as determined by the word-processing program used to prepare the paper, excluding the parts of the paper exempted by 37 C.F.R. § 42.24(a)(1) (table of contents, table of authorities, mandatory notices under § 42.8, certificate of service, certificate of word count compliance, appendix of exhibits, and claim listing).

/Charles J. Rogers/

Charles J. Rogers

Reg. No. 38,286

Conley Rose, P.C.

777 North Eldridge Parkway, Suite 600

Houston, Texas 77079-4425

Phone: (713) 238-8049

Fax: (713) 238-8008

E-mail: crogers@conleyrose.com

Lead Counsel for Patent Owner

Pilot Intellectual Property, LLC

CERTIFICATE OF SERVICE

Pursuant to 37 C.F.R. §§ 42.6(e), I hereby certify that on May 13, 2024 the foregoing *Patent Owner Pilot Intellectual Property, LLC'S Preliminary Response* is being served electronically by agreement of the parties, by e-mail to the following counsel of record.

Brian W. Oaks
McDermott Will & Emery LLP
300 Colorado Street, Suite 2200
Austin, TX 78701
Tel. (512) 726-2574

Lead Counsel for Petitioner
Scout Energy Management, LLC

BOaks@mwe.com
ScoutMWETeam@mwe.com

Alexander T. Piala
McDermott Will & Emery LLP
300 Colorado Street, Suite 2200
Austin, TX 78701
Tel. (512) 298-4558

Back-Up Counsel for Petitioner
Scout Energy Management, LLC

APiala@mwe.com

Naveen Modi
Daniel Zeilberger
Michael A. Wolfe
Paul Hastings LLP
2050 M St., N.W.,
Washington DC, 20036
Tel. (202) 551-1700

Back-Up Counsel for Petitioner
Chevron U.S.A. Inc.

Pilot-Chevron@paulhastings.com

/Charles J. Rogers/

Charles J. Rogers

Reg. No. 38,286

Conley Rose, P.C.

777 North Eldridge Parkway, Suite 600

Houston, Texas 77079-4425

Phone: (713) 238-8049

Fax: (713) 238-8008

E-mail: crogers@conleyrose.com

Lead Counsel for Patent Owner

Pilot Intellectual Property, LLC