IN THE UNITED STATES PATENT AND TRADEMARK OFFICE BEFORE

THE PATENT TRIAL AND APPEAL BOARD

In the *Inter Partes* Review of: Trial Number: IPR2020-01660

U.S. Patent No. 9,982,179

Filed: June 1, 2012

Issued: May 29, 2018

Inventor(s): Kenneth M. Ponder and Steffan Thomas, Jr.

Assignee: R421A LLC d/b/a Choice Refrigerants

Title: REFRIGERANT WITH LUBRICATING OIL FOR REPLACEMENT OF R22 REFRIGERANT

Mail Stop *Inter Partes* Review Commissioner for Patents

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PETITION FOR INTER PARTES REVIEW OF U.S. PATENT NO. 9,982,179 UNDER 35 U.S.C. § 311 AND 37 C.F.R. § 42.100

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EXHIBIT LIST

Exhibit No.	Description
1001	U.S. Patent No 9,982,179 (the '179 Patent)
1002	U.S. Patent No. 8,197,706 ("the '706 Patent") Parent of the '179 Patent
1003	File History of the '179 Patent
1004	File History of the '706 Patent (parent of the '179 Patent)
1005	File History of U.S. Appln No. 10/937,736, Grandparent of the '179 Patent ("the '736 Application")
1006	U.S. Patent No. 6,207,071 ("Takigawa")
1007	U.S. Patent No. 6,606,868 ("Powell")
1008	U.S. Patent No. 6,863,840 ("Goble")
1009	U.S. Patent No. 5,688,432 ("Pearson")
1010	Board Decision in U.S. Appln No. 10/937,736 ("Decision")
1011	U.S. Pub. No. 2003/0062508 ("Singh")
1012	U.S. Patent No. 6,271,184 ("Seebauer")
1013	Declaration of Dr. Eckhard Groll ("Groll")
1014	AHRI Standard 700
1015	Provisional Application 60/501,049
1016	U.S. Pub. No. 2005/0082510
1017	U.S. Patent No. 10,703,949
1018	Federal Register, 71, 88, p. 56844, Sept. 28, 2006
1019	U.S. Patent No. 6,655,160 ("Roberts")
1020	Lemmon et al. Appendix B, Equations of States for Mixtures of R-32, R-125, R-134a, R-143a, and R-152a, Report No. DOE/OR22674/605-50010-01-Pt1_B ARTI-21CR/605-50010-01-Pt1_B; TRN: US200308%%85, Published 08-30-2002, available at https://www.osti.gov/biblio/808636 "Lemmon"

PETITION FOR *INTER PARTES* REVIEW

Dynatemp International, Inc. and Fluorofusion Specialty Chemicals, Inc. "Petitioner"), respectfully petition for *Inter Partes* review ("IPR") of claims 1-37 of U.S. Patent No. 9,982,179 ("the '179 Patent"), currently owned by R421A LLC d/b/a Choice Refrigerants ("Choice" or "Patent Owner") pursuant to 35 U.S.C. § 311 and 37 C.F.R. § 42.100.

This Petition is supported by the Declaration of Dr. Eckhard Groll ("Groll") (Ex. 1013) and other exhibits listed above.

I. GROUNDS FOR STANDING UNDER 37 C.F.R. § 42.104(a)

Petitioner hereby certifies that the '179 Patent is available for IPR and the Petitioner is not barred or estopped from requesting IPR of claims 1-37 on the grounds identified herein. Petitioner is not the owner of the '179 Patent. Petitioner has not previously initiated a civil action challenging the validity of any claims of the '179 Patent. The estoppel provisions of 35 U.S.C. § 315(e)(1) do not prohibit this IPR.

II. MANDATORY NOTICES – 37 C.F.R. § 42.8(a)(1)

A. 37 C.F.R. § 42.8(b)(1): Real Party-In-Interest

Dynatemp International, Inc., a Pennsylvania corporation, and Fluorofusion Specialty Chemicals, Inc., a Delaware corporation, are the real parties-in-interest.

B. 37 C.F.R. § 42.8(b)(2): Related Matters

According to the United States Patent and Trademark ("USPTO") records, the '179 Patent has been asserted in or has otherwise been associated with the following cases or proceedings that may affect, or be affected by, a decision in this proceeding:

- R421A LLC d/b/a Choice Refrigerants, Plaintiff, v. Dynatemp International, Inc., Fluorofusion Specialty Chemicals, Inc., BMP USA, Inc., IGas USA, Inc., T.T. International Co., Ltd, Harold B. Kivlan, IV, William Gresham, and David Couchot; complaint filed but not served in the Eastern District of North Carolina on April 8, 2020; civil action no. 5:20-cv-00147-FL.
- R421A LLC d//b/a Choice Refrigerants, Plaintiff, v. Dynatemp International, Inc., Fluorofusion Specialty Chemicals, Inc., Harold B. Kivlan, IV, William Gresham, and David Couchot; complaint filed in the Eastern District of North Carolina on July 7, 2020 for infringement of the continuation '179 Patent, the '706 Patent and the continuation '949 Patent; civil action no. 5:20-cv-00147-FL.
- U.S. Patent No. 10,703,949 is a continuation of the '179 Patent.

C. 37 C.F.R. § 42.8(b)(3) and (4): Lead and Back-Up Counsel and Service Information

Pursuant to 37 C.F.R. § 42.8(b)(3) and 37 C.F.R. § 42.10(a), Petitioner

provides the following designation of counsel.

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Pursuant to 37 C.F.R. §42.10(b), a Power of Attorney accompanies this Petition. Service information for lead and back-up counsel is provided in the designation of lead and back-up counsel, above. Service of any documents via hand-delivery may be made at the postal mailing addresses designated above.

D. PAYMENT OF FEES – 37 C.F.R. § 42.103

The undersigned authorizes the Office to charge any required fees in connection with this Petition, including those due under 37 C.F.R. § 42.15(a) to Deposit Account No. 60-0847.

III. IDENTIFICATION OF CHALLENGED CLAIMS (37 C.F.R. § 42.104(b)

Petitioner asserts invalidity of claims 1-37 on these grounds:

Ground	Claims	Basis (35 U.S.C. §)	Primary Reference	Further references
1	1-37	102(Claims 21-37) 103 (Claims 1-37)	Goble	Singh, Takigawa
2	1-37	103	Singh	Goble, Takigawa
3	1-37	103	Powell	Goble, Singh, Takigawa
4	1-37	103	Pearson	Goble, Singh, Takigawa
5	1-37	103	Federal Register	Goble, Singh, Takigawa
6	1-37	103	Roberts	Goble, Singh,

Ground	Claims	Basis (35 U.S.C. §)	Primary Reference	Further references
				Takigawa
7	1-37	103	Lemmon	Goble, Singh, Takigawa

IV. SUMMARY OF THE '179 PATENT

A. Brief Description of the Technology at Issue

The '179 Patent (Ex. 1001) is entitled "Refrigerant With Lubricating Oil For Replacement Of R22 Refrigerant." It has 37 claims of which claims 1, 8, 15, 26 and 31 are independent.

The technology of the '179 Patent pertains to formulations that encompass R421A refrigerant, which is a replacement for R22 ($CHClF_2$). R421A is the following mixture:

- 58 wt% (54.5 M%) R125, pentaflouroethane (CF_3CHF_2); and
- 42% wt% (45.5 M%) R134a, 1,1,1-tetrafluoroethane (CF_3CH_2F)

R421A is frequently mixed with a lubricant in order to inhibit pump breakdown. Groll ¶¶28-29.

The independent claims are directed to the following subject matter:

- Independent claim 1 is an apparatus claim where R22 is replaced with an R421A formulation (57-59% R125 and 41-43% R134a, which corresponds to AHRI Standard 700: Ex. 1014 at 15) mixed with a lubricating oil selected

from mineral oil and synthetic alkyl aromatic lubricants. Ex. 1001 10:2-29.

- Independent claim 8 is a method claim for filling an apparatus where R22 is replaced with R421A formulation mixed with a lubricating oil selected from mineral oil and synthetic alkyl aromatic lubricants. Id. 10:49-11:16.
- Independent claim 15 is for a refrigerant composition that encompasses R421A formulation mixed with a lubricating oil selected from mineral oil and synthetic alkyl aromatic lubricants. Id. 11:36-58.
- Independent Claim 21 is an apparatus claim for use with R421A. Id. 12:9-27.
- Independent claim 26 is a method for filling an apparatus where R22 is replaced with R421A. Id.12:40-65.
- Independent claim 31 is the broadest claim and recites a refrigerant composition that encompasses R421A. Id. 13:10-14:3. Groll ¶31.

The claims of the '179 Patent are similar to those of the parent '706 Patent, except that the '706 Patent recites a napthenic lubricant either directly or by virtue of dependence. Ex. 1002 9:55-12:40.

The'179 Patent identifies the problems the purported invention was designed to overcome, *i.e.*, replacement of environmentally damaging R22 with refrigerant compositions that are less damaging to the ozone layer. Ex. 1001 1:15-3:62.

At column 3, the '179 Patent discusses prior art references that were not filed in an IDS for the '179 application. Id. 3:20-62. The '179 Patent teaches the disadvantages of not using a lubricant. Id. 3:43-46. Nonetheless, the '179 Patent presents claims that contain no lubricant, for example, independent claims 26 and 31. Groll ¶34.

B. Summary of the Prosecution History of the '179 Patent (Ex. 1003) and its ancestors: the '706 Patent (Ex. 1004), the '736 Application (Ex. 1005) and Provisional Application 60/501,049

a. The '179 Patent

In the prosecution of the '179 Patent, a non-final rejection mailed March 25, 2013, rejected all the claims as obvious under 35 U.S.C. § 103 over Takigawa (Ex. 1003 at 264-271). Importantly, the Takigawa reference had been applied in both the parent and grandparent applications, and rejections over Takigawa were contested on appeal in the grandparent application. Notably, the Board upheld the Examiner's position that Takigawa rendered the invention obvious. See Decision Ex. 1010 at 8.

Takigawa issued on March 27, 2001, making it prior art under 35 U.S.C § 102(b).

The Examiner continued rejecting over Takigawa on March 28, 2017 (Ex. 1003 at 147-153) and October 12, 2017 (id. at 114-118). The Applicant's response

included a "Second Declaration by Kenneth M. Ponder" (id. at 96-104) that included graphs showing the performance of R421A, and purporting that these graphs show unexpected results over the prior art.

On February 23, 2018, the Examiner issued an Office Action containing a double patenting rejection but did not reject the claims over the art. Id. at 41-47. On March 8, 2018, the Applicant filed an amendment that addressed formal issues along with a terminal disclaimer. This amendment presented new, broader, claims which claimed R421 without a lubricant, corresponding to claims 26-37 of the issued patent. Id. at 17-32

On April 5, 2018 the Examiner entered a Notice of Allowance that did not set forth reasons for allowance or discuss the newly presented claims. Id. at 11-16.

b. The '706 Patent (The Parent Patent)

On December 6, 2010, Applicants filed application no. 12/961,045 as a continuation application. It matured into the parent '706 Patent (Ex. 1002) on June 12, 2012. Its file history is Ex. 1004. All the independent claims (1, 3 9, 11, 17 and 19) claim a mixture of pentafluoroethane (R125) and tetrafluoroethane defined by bubble point and dew point with additional lubricating components that can be napthenic distillate, napthenic distillate petroleum, or polyol. Id. at 9:55-12:40.

The Examiner rejected the claims of the '706 Patent application on June 6, 2011, as obvious over Takigawa. Ex. 1004 at 72-78. Following an amendment

and declaration, the Examiner allowed the claims on February 15, 2012**, based on the lubricant**, stating in the reasons for allowance (id. at 26):

> *"3...The closest prior art is Takigawa US 6,207,071.* ***The reference discloses the utility of compositions pentafluoroethane and tetrafluoroethane in amounts which make obvious those presently recited.*** *However, the reference further discloses that napthenic based lubricants and polyol esters were not satisfactory lubricants. As the present claims require those lubricants, they are not obvious over the prior art of record (emphasis added)."*

In the Notice of Allowability, the Examiner also entered an Examiner's Amendment which rewrote claims in Jepson format. Id. at 18-26.

c. The '736 Application

The '706 Patent application was a continuation of Appln. No. 10/937,736 (Ex. 1005), which was abandoned after losing an appeal to the Board of Patent Appeals and Interferences ("BPAI"). The '736 Application was filed on September 8, 2004 and was abandoned on August 8, 2011. Id. at 1-7. The Examiner entered Office Actions on February 24, 2006 (id. at 575-580), June 5, 2006 (id. at 556-561), August 20, 2007 (id. at 342-347), December 17, 2007 (id. at 319-324), and June 27, 2008 (id. at 295-299). The '736 application entered appeal with the claims rejected as being obvious over Takigawa. Id. at 235.

On April 29, 2010, the BPAI entered a Decision affirming the rejection over

Takigawa. In the Decision, the BPAI made the following factual findings (Ex. 1010 at 3-4):

1. Takigawa discloses a refrigerant oil and a fluid composition for a refrigerator containing 1,1,1,2-tetrafluoroethane (HFC-134a) and/or pentafluoroethane (HFC-125) (col. 1, 11. 13-19).

2. Takigawa discloses that the HFC refrigerant contains HFC-134a and/or HFC-125 (col. 2, 11. 15-17; 23-24; 40-41).

3. Takigawa discloses that the HFC-134a and/or HFC-125 blend may include additional HFC refrigerants such as alkane fluorides having 1 to 3 carbon atoms (col. 8, 11. 20-28).

4. Takigawa claims that the HFC refrigerant used in the fluid composition contains "*at least one of HFC-134a and/or HFC-125*" (claim 1).

5. Takigawa discloses that HFC-134a is present in the refrigerant composition in an amount of 40 weight percent or greater and that HFC-125 is present in a most preferable amount of 40 weight percent or greater (col. 8, 11. 20-28).

For the purposes of this IPR Petition, Takigawa should be considered in light of the BPAI Decision in regard to formulations of R125 and R134a that render the R421A formulation obvious. The rationale of the BPAI Decision also applies to the disclosures of new art, which encompass the R421A formulation.

However, Takigawa has additional disclosure (such as additives) that is combinable with the other art without taking the BPAI decision into account.

At pages 5 and 6 of the Decision (Ex. 1010), the BPAI concluded:

> *"As the simplest binary mixture, the Examiner correctly determines... that HFC-134a would have been present in an amount of 40 to 60% by weight and HFC-125 correspondingly would be present in a range of 60 to 40% by weight (Ans. 3, 5). Therefore, Takigawa' s disclosure would have suggested that at least two of the end points of Appellants' claimed ranges (i.e., 40% HFC-134a and 60% HFC-125) and thus further narrowed Takigawa's range.* ***Accordingly, we agree with the Examiner that given the guidance provided by Takigawa, determining acceptable refrigerant gas concentration ranges would have been a matter of routine experimentation*** *(emphasis added)."*

Therefore, this Board's predecessor has already determined that R421A by itself is obvious.

d. The Provisional Application (Ex. 1015)

The '736 Application claims priority of provisional application no. 60/501,049, filed September 8, 2003. The provisional application as filed had no teaching or suggestion of the claimed proportions of R125 and R134a claimed in the '179 Patent.

At p. 6 the provisional specification teaches: "*about 40 to about 45 weight percent pentafluoroethane to about 55 to about 60 percent 1,1,1,2-*

tetrafluoroethane...about 42 weight percent pentafluoroethane to about 58 weight percent 1,1,1,2- tetrafluoroethane." Ex 1015 at 9. This is repeated at p. 9 (id. at 12), p. 10 (id. at 13), p. 11 (id. at 14) and in claim 1(id. at 18), claims 6 and 9 (id. at 19), claims 10, 11 and 13 (id. at 19). Claim 14 claims 45% pentafluoroethane and 55 % tetrafluoroethane, and claim 15 claims 40% pentafluoroethane and 60 % tetrafluoroethane. (id. at 20). Claims 16, and 18-20 set forth similar percentages of pentafluoroethane and tetrafluoroethane (id. at 21), as well as claims 21 and 23-25. (id. at 22).

The reverse proportions were also present in the '736 Application (Ex 1005 at 643, 644, 648, 649, 650, Claims 1, 3-6, 8-11, 13-16, 18-21 and 25 9 (id. 654-659) and in its publication US 2005/0082510, Ex 1016 (¶¶ 0024, 0050, 0052, 0056, 0062, Claims 1, 3-5, 8-10, 21, 23-25) published on April 21, 2005.

On August 13, 2007, the specification was amended to reflect the R421A formulation in the discussion of the drawing figures. Ex. 1005 at 356. However, the specification was not consistently amended to reflect the R421A formulation, and multiple references to the reverse formulation were retained.

For Example, see the '706 Patent (Ex. 1002 4:26-27, 7:39, 8:13-15); the '179 Patent (Ex. 1001 4:31-33, 7:13-14, 7:46-47, 8:24-26); and the '949 Patent (Ex. 1017 4:46-48, 7:31-32, 7:65-66, 8:40-42).

The amended specification of the '736 application prompted a written

description rejection for new matter on August 20, 2007. Ex 1005 at 344-345. The Amendment of October 30, 2007 traversed the new matter rejection and presented a Declaration by Andrew Gbur Ex. 1005 at 327-330. The Declaration (id. 333-335) asserted that Fig. 1 obviously shows Pressure (liquid) vs. temperature profiles of 40/60, 45/55 and 42/58 of tetrafluoroethane and pentafluoroethane, respectively.

However, these arguments are not persuasive to a person having ordinary skill in the art (PHOSITA). Groll ¶60.

Accordingly, August 13, 2007 is the true priority date of the '179 Patent.

C. Claim Construction 37 C.F.R. § 42.104(b)(3)

Per 37 C.F.R. § 42.100(b) as amended (2019), in an IPR, claim terms are given their "ordinary and customary meaning... as understood by a PHOSITA and the prosecution history pertaining to the patent." *Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005) (*en banc*). See 37 C.F.R. § 42.100(b). Here a PHOSITA would apply the ordinary and customary meaning to most of the claim elements in the challenged claims, such that minimal specific claim construction is necessary.

a. "phase change"

A phase change is used to describe transitions between states of matter, *i.e.*, between solid, liquids and gases. In the '179 Patent, there is no definition for the term "phase change." However, a PHOSITA would recognize that this means the

transition from the liquid to the gaseous state (and *vice versa*) of the refrigerant. Groll ¶79.

The requirement for a phase change of the refrigerant is well known in the art and is part of the necessary vapor-compression cycle. Groll ¶80. For Example, Lemmon Ex. 1020 at 13 details the equation of state for vapor-liquid equilibrium. Moreover, Goble Ex. 1008 6:63-67 describes boiling point ranges; at 10:56 describes an evaporator, at 10:59 a condenser. All these teach a phase change. Groll ¶81.

Accordingly, a "phase change," as is set forth in claims 1, 8 and 26 of the '179 Patent is an inherent property of fluorocarbon mixture and thus has no patentable weight. Groll ¶83. See, *e.g.*, *In re Robertson*, 169 F.3d 743, 745, 49 USPQ2d 1949, 1950-51 (Fed. Cir. 1999 ("*To establish inherency, the extrinsic evidence 'must make clear that the missing descriptive matter is necessarily present in the thing described in the reference, and that it would be so recognized by persons of ordinary skill*.").

b. "dew point"

The dew point is the point at which the first drop of a gaseous mixture begins to condense, expressed as temperature at constant pressure. Groll ¶84.

c. "bubble point"

The bubble point is the point at which the first drop of a liquid mixture

begins to vaporize. If the pressure is held constant, the dew point is expressed as temperature. The '079 Patent recites the bubble point and dew point at 1 standard atmosphere of pressure. Id. ¶85.

d. Relationship between dew point and bubble point

As is well known in the art, the relationship between the dew point and the bubble point of a mixture is governed by Raoult's Law, which states that the partial pressure of each component of an ideal mixture of liquids is equal to the vapor pressure of the pure component multiplied by its mole fraction in the mixture. Id. ¶¶86-87.

Thus, the -32ºF dew point and the -41.5ºF bubble point recited in the claims of the '179 patent are inherent properties of the R421A formulation. The recited dew point and bubble point accordingly do not add any patentable weight to the claims. Id. ¶88.

Each claim limitation must be expressly, implicitly, or inherently supported in the originally filed disclosure. MPEP § 2163(II)(3)(b). When an explicit limitation in a claim "*is not present in the written description whose benefit is sought it must be shown that a person of ordinary skill would have understood, at the time the patent application was filed, that the description requires that limitation*." *Hyatt v. Boone*, 146 F.3d 1348, 1353, 47 USPQ2d 1128, 1131 (Fed. Cir. 1998). Groll ¶89.

The independent claims of the '179 Patent recite the proportions of R125 and R134a using the restrictive "consisting" language. See claims 1, 8, 15, 21, 26 and 31. This language excludes the addition of additional refrigerants to the formulation. It is well known in the chemical arts that a specific formulation will have specific properties. As a result, the claimed bubble point, dew point and glide are inherent properties of the claimed refrigerant formulations and do not further restrict the claim. Groll ¶90.

e. "glide"

The term "glide" is not defined in the specification of the '179 Patent, but "glide" is mentioned at column 8, line 22 of the '179 Patent, and the phrase "9.5 ^{o}F glide" is in dependent claims 6, 13, 19, 24 and 29.

As is known in the art, glide is the difference between the bubble point and the dew point of a zeotropic refrigerant mixture. A zoetrope is a refrigerant mixture or blend that boils across a range of temperatures at any given pressure. Groll ¶92.

Accordingly, since a dew point of -32 ^{o}F and a bubble point of -41.5 ^{o}F is recited in the independent claims, reciting the difference of 9.5 ^{o}F in dependent claims does not add any patentable weight. Id. ¶93.

"*Products of identical chemical composition cannot have mutually exclusive properties*." See *In re Papesch*, 315 F.2d 381, 391, 137 USPQ 43, 51 (CCPA

1963) (a chemical compound and its properties are inseparable). See also *In re Spada*, 911 F.2d 705, 709, 15 USPQ2d 1655, 1658 (Fed. Cir. 1990). Groll ¶94.

V. IDENTIFICATION OF CHALLENGE – 37 C.F.R. § 42.104(b)

A. 37 C.F.R. § 42.104(b)(1): Claims for Which IPR Is Requested

Petitioner requests IPR of claims 1-37 of the ’179 Patent.

B. 37 C.F.R. § 42.104(b)(2): The Specific Art and Statutory Ground(s) on Which the Challenge Is Based

IPR of claims 1-37 is requested in view of the following references:

- Ex. 1006 – U.S. Patent No. 6,207,071 (“Takigawa”);
- Ex. 1007 – U.S. Patent No. 6,606,868 (“Powell”);
- Ex. 1008 – U.S. Patent No. 6,863,840 (“Goble”);
- Ex. 1009 – U.S. Patent No. 5,688,432 (“Pearson”);
- Ex. 1010 – Board Decision in U.S. Appln. No. 10,937,736 (”Decision”);
- Ex. 1011 – U.S. Pub. No. 2003/0062508 (“Singh”); and
- Ex. 1012 – U.S. Patent No. 6,271,184 (“Seebauer”).
- Ex. 1018 – Federal Register
- Ex. 1019 – U.S. Patent N. 6,655,160 (“Roberts”)
- Ex. 1020 – Report No. DOE/OR22674/605-50010-01-Pt1_B (“Lemmon”)

The statutory grounds include 35 U.S.C. § 102 for anticipation (for Goble claims 21-37) and 35 U.S.C. § 103 for all the references.

VI. EVIDENCE SHOWS A REASONABLE LIKELIHOOD THAT ONE OR MORE CLAIMS OF THE '179 PATENT IS UNPATENTABLE UNDER 37 C.F.R. § 42.104(b)(4) AND 37 C.F.R. § 42.104(b)(5).

A. Person Having Ordinary Skill in the Art (PHOSITA)

For the '179 Patent, at the time the purported invention was made, a person of ordinary skill in the art would have had a bachelor's degree (and preferably a Ph.D.) in chemistry, chemical engineering or a related field or, as a substitute, at least three years of work or research experience in refrigerant formulation. Groll ¶77.

B. Overview of the Art References

a. Goble

Goble (Ex. 1008 at 2:61-3:7) teaches that chlorofluorocarbons (CFCs) refrigerants cause harm to the Earth's stratospheric ozone layer. Goble solves this problem by starting with a formulation that approximates the formulation for R421A: "*Applicant set the ratio of R125/R134a to establish a pressure temperature curve approximating R-22, which is roughly 56 weight percent R-125 and 44 weight percent R-134a*." Id. at 7:6-9.

Goble is clearly in the same field of endeavor as the '179 Patent.

b. Singh

Singh teaches providing hydrofluorocarbon compositions to replace chlorine-containing refrigerants. Ex. 1011 ¶ 0003. Singh teaches concentration ranges overlapping the R421 formulation, the most preferred being about 48 to about 80 parts by weight of R125 and about 18 to about 60 parts by weight of R134A. Id. ¶ 0020. Singh is clearly in the same filed of endeavor as the '179 Patent

Singh also teaches lubricants and additives. Id. ¶¶ 0021-0029.

c. Powell

Powell (Ex. 1007) teaches at 1:26-34 that chlorine containing R22 must be phased out. Powell solves this problem by utilizing a mixture of R125 and R134a. Powell teaches 50-80% R125 and 50-20% R134a, ranges that encompass the 58/42 % range of R421A. Ex. 1007 at 2:50-53, Claim 1.

Powell is clearly in the same filed of endeavor as the '179 Patent.

d. Pearson

Pearson teaches replacing R22 with a mixture of R125 and R134a with the addition of a hydrocarbon. Ex. 1009 at Abstract. Pearson teaches 0.5% to 60% R125 and 30 to 90% R134a. Id. 2:19-29.

Pearson is clearly in the same filed of endeavor as the '179 Patent.

e. Federal Register (Ex. 1018)

Federal register at P. 2, first column teaches: "*R-421A is a blend of 48% by weight hydrofluorocarbon (HFC)-125 (pentafluoroethane VASID #354-33-6), and 425 by weight HFC-134a (1,1,1,2-tetrafluoroethane, CAS ID # 811-97-2).*"

Federal Register thus encompasses all the R421 formulations claimed in the '179 Patent.

Federal Register at column 1 also discloses R421A being used in refrigerators, air conditioners, etc.

f. Roberts (Ex. 1019)

Roberts pertains to refrigerant compositions. Roberts Ex. 1019 2:48-52 discloses a refrigerant composition containing 35-60 wt% R134A and 35-60 wt% R125, which encompasses the 58/42 wt% proportions of R125/R134A of R421A. Roberts in Table 1 has a formulation that is 58.9% R125 and 40.1% R134A. Id. 4:11. This latter formulation is very close to the 58/42% proportion of R421A.

Fig. 1 of Roberts shows performance of R134A (balance R125) with a solvent that shows a steep drop in performance as the concentration of R134A goes above 42%. Fig 2 of Roberts shows performance of R134A (balance R125) with a solvent that has an inflection point hovering over 42%.

g. Lemmon (Ex. 1020)

In Table 4, Ex 1020 at P. 27, Lemmon summarizes studies published on

mixtures of R125 and R 134a, where ranges of R125 (balance R134a) were studied including mole fractions of R125 of 0.349-0.719, 0.0865-0.923, 0.250-0.751, 0.179-0.776, 0.259-0.649, 0.0001-0.813, 0.254-0.749, 0.0865-0.923, 0.222-0.718, and 0.348-0.693.

All the above mole fractions of R125 (balance R134a) encompass the 0.545 R125 and 0.455 R134a mole fractions of R421A.

Lemmon teaches bubble point and dew point can be calculated. Id. at 2.

Therefore, the solution to the problem, which the '179 Patent is purported to solve, was known in the art before the earliest filing associated with the '179 Patent. Id. ¶49.

C. Overview of the Unpatentability of the '179 Patent Claims

a. Expert Testimony

Among the other evidence, the unpatentability of the '179 Patent is supported by the Declaration of Dr. Eckhard Groll (Ex. 1013). Dr. Groll is a Professor of Mechanical Engineering at Purdue University and specializes in refrigeration systems, and in 2019 was appointed head of the School of Mechanical Engineering. He received a doctorate in Mechanical Engineering from the University of Hannover, Germany in 1994. He has published extensively, including in the *International Journal of Refrigeration*, the *Journal of Applied Thermal Engineering*, the *Journal of Energy and Buildings*, *ASHRAE Transactions*

and the *Journal of Spacecraft and Rockets*. Dr. Groll has received numerous awards, including awards from ASHRAE. Id. ¶¶ 1-7.

b. The R421A Formulation

The technology of the '179 Patent revolves around a formulation of pentafluoroethane (R125) and 1,1,1,2 tetrafluoroethane (R134a) that encompasses the 58 wt% R125 and 42 wt% R134a (54.5:45.5 M%) formulation of R124A. Each independent claim of the '179 Patent recites a formulation that can be compared to the prior art, as will be discussed in detail for each ground.

That is, as will be shown, the prior art teaches ranges that overlap or touch those of the '179 Patent.

In the case where the claimed ranges "overlap or lie inside ranges disclosed by the prior art" a *prima facie* case of obviousness exists. *In re Wertheim*, 541 F.2d 257, 191 USPQ 90 (CCPA 1976); *In re Woodruff*, 919 F.2d 1575, 16 USPQ2d 1934 (Fed. Cir. 1990) (The prior art taught carbon monoxide concentrations of "*about 1-5%*" while the claim was limited to "more than 5%." The court held that "*about 1-5%*" allowed for concentrations slightly above 5% thus the ranges overlapped.); *In re Geisler*, 116 F.3d 1465, 1469-71, 43 USPQ2d 1362, 1365-66 (Fed. Cir. 1997) (Claim reciting thickness of a protective layer as falling within a range of "*50 to 100 Angstroms*" considered *prima facie* obvious in view of prior art reference teaching that "for suitable protection, the thickness of

the protective layer should be not less than about 10 nm [i.e., 100 Angstroms]." The court stated that "*by stating that 'suitable protection' is provided if the protective layer is 'about' 100 Angstroms thick, [the prior art reference] directly teaches the use of a thickness within [applicant's] claimed range*."). "*[A] prior art reference that discloses a range encompassing a somewhat narrower claimed range is sufficient to establish a prima facie case of obviousness.*" *In re Peterson*, 315 F.3d 1325, 1330, 65 USPQ2d 1379, 1382-83 (Fed. Cir. 2003). See also *In re Harris*, 409 F.3d 1339, 74 USPQ2d 1951 (Fed. Cir. 2005).

Generally, differences in concentration or temperature will not support the patentability of subject matter encompassed by the prior art unless there is evidence indicating such concentration or temperature is critical. *In re Aller*, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955)(stating: "*[W]here the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation*.")

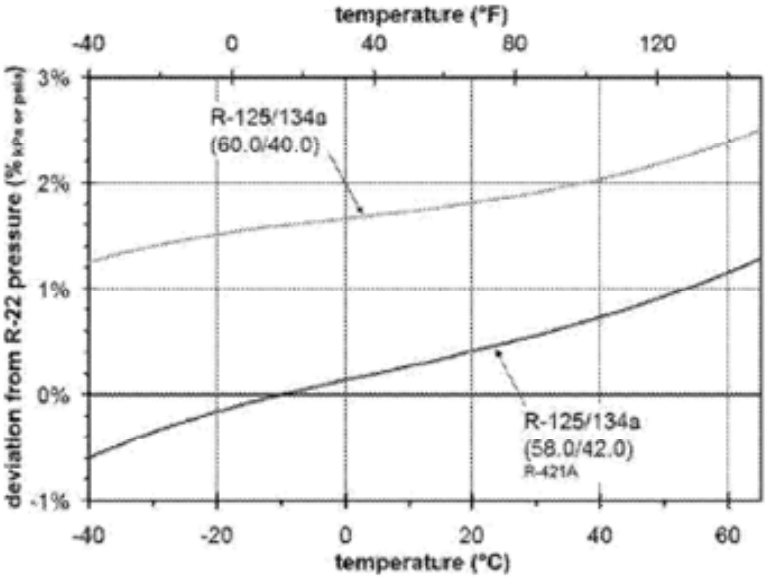
Also, the conclusions reached by the BPAI in finding Takigawa rendering the R421 formulation obvious is equally applicable to Powell (as well as to Goble and to Pearson). Groll ¶105.

Accordingly, anticipation and a *prima facie* case of obviousness exists for the proportions of R125 and R134a claimed in the '179 Patent. Id. 105.

c. No Unexpected Results

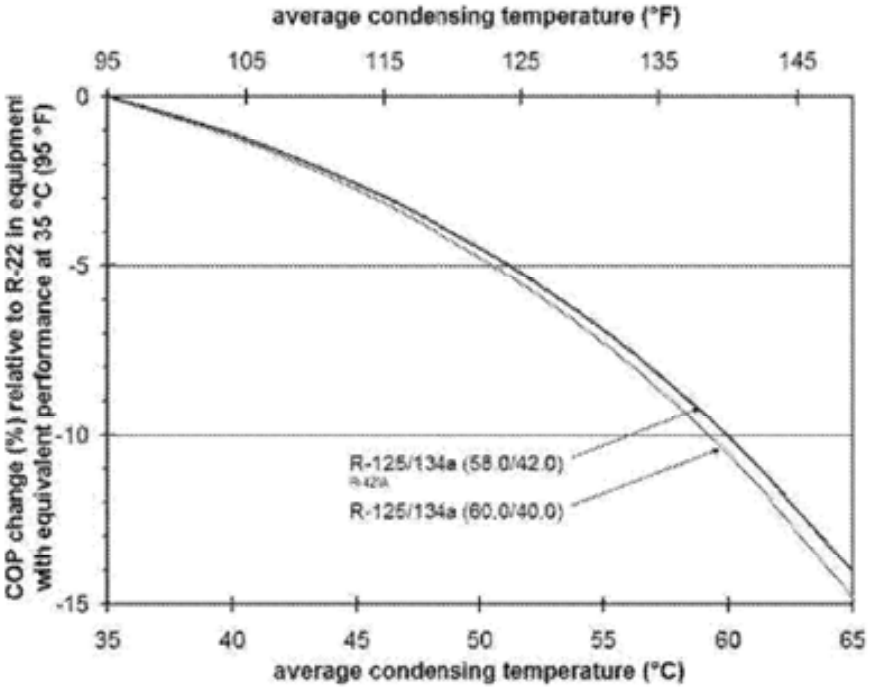
As noted above, during the prosecution of the '179 Patent, the applicants presented a "Second Declaration of Kenneth M. Ponder" (dated Sept. 28, 2017) alleging purported unexpected results in order to rebut the Examiner's finding of unpatentability over the Takigawa Patent. Ex. 1003 at 96-104.

This Second Declaration presented two graphs. One graph showed theoretical calculations of deviations from R22 comparing the 60/40 and 58/42 mixtures (Ex. 1003 at 97):



The Declaration asserted that the 58/42 mixture better approximates the pressure-temperature characteristics of R22. At page 3, the Declaration asserted that the 58/42 mixture unexpected better approximates the pressure-temperature characteristics of R22. However, there was no data showing that this fit had a significant effect on actual performance. Groll ¶114.

At ¶8 (Ex. 1003 at 99), the Declaration presented a coefficient of performance ("COP") for 60/40 and 58/42 mixtures:



There is barely any difference over much of the temperature range. Groll ¶116. Even at 65°C, the difference is likely less than 1%. Accordingly, the results presented in the declaration fail to demonstrate an unexpected result. Id. ¶116.

During the prosecution of ancestor application 10/937,736, the applicants presented a report by James M. Calm as evidence, which compared R410A, R421A, R422B and R422D to R22. Ex. 1005 at 55-68. This report presented figures that showed no appreciable difference between the performance of R421A against similar R22-substitute refrigerants. Groll ¶117. An example is shown in Figure 2 below (Ex. 1005 at 66):

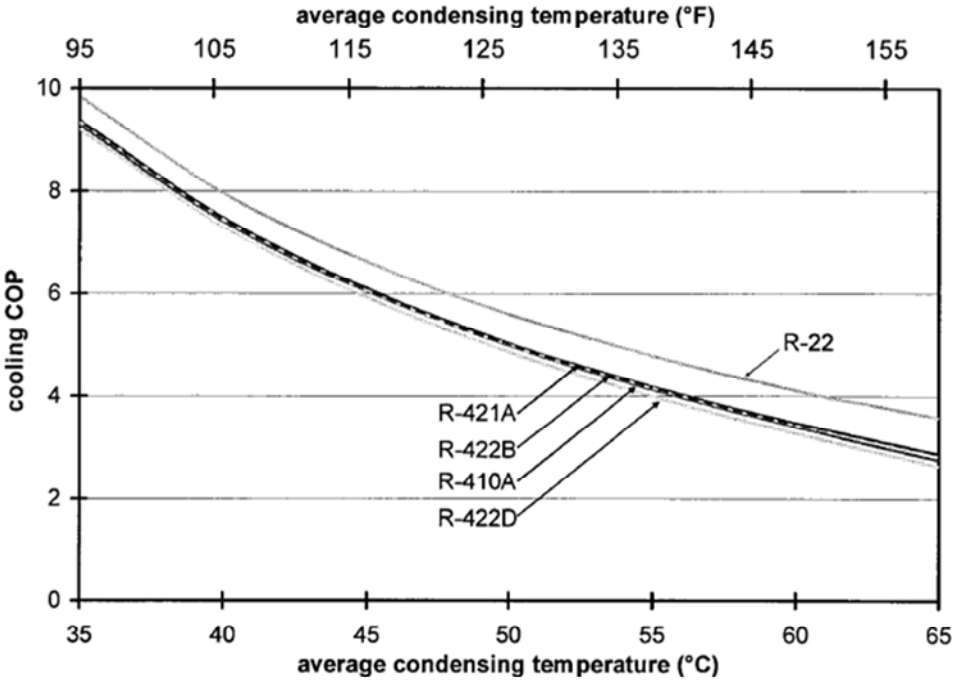


Figure 2: Cooling Coefficient of Performance (COP) Comparison

As can be seen, the performance of R421A is virtually identical to substitute refrigerant formulations R422B and R410A, and very close to R422D. There is no indication that the R421A COP is unexpectedly closer to the R22 COP. Groll ¶118.

Under applicable law, the material question is whether these theoretical results are greater than expected. "*A greater than expected result is an evidentiary factor pertinent to the legal conclusion of obviousness ... of the claims at issue*." *In re Corkill*, 711 F.2d 1496, 226 USPQ 1005 (Fed. Cir. 1985). Applicant must further show that the results were greater than those which would have been expected from the prior art to an unobvious extent, and that the results are of a **significant, practical advantage**. *Ex parte The NutraSweet Co.*, 19 USPQ2d 1586

(Bd. Pat. App. & Inter. 1991) (emphasis added). Groll ¶119.

In this case, the Applicants of the '179 Patent argued that differences are indicated between 58/42 and 60/40 formulations. However, the Applicants made no observations as to whether these differences would have a significant effect on the performance of the refrigerant. Id. ¶120.

Moreover, the closest formulation in the newly found prior art is the 56% R125 and 44% R134 at set forth by Goble. Ex. 1008 at 7:6-9. Also, there were no experimental results presented by the Applicant of the'179 Patent for this formulation. Groll ¶121.

Further, a (first) Declaration by Kenneth M. Ponder (Sept. 8, 2018) had been submitted in the grandparent application (10/937,736) Ex. 1005 at 289-291, (discussing the development of R421A and discussing the Takigawa reference), along with a (Second) Declaration by Gbur. Id. at 315-317 (presenting no data but merely discussing the teachings of Takigawa). However, the BPAI found:

> *"**Appellants' evidence of unexpected results is not persuasive because it fails to compare the claimed invention to the closest prior art** (i.e., Takigawa) as noted by the Examiner (Ans. 7). Instead, the Ponder and Gbur Declarations compare the claimed invention to the refrigerant R421B (85% pentafluoroethane and 15% tetrafluoroethane), a refrigerant composition not disclosed by Takigawa. Though the declarations may establish that different combinations of refrigerant gases produce refrigerant compositions*

with different properties, the comparison of R421A to R421B fails to account for Takigawa' s disclosure of a binary refrigerant composition having 40% or greater tetrafluoroethane content (i.e., HFC-134a) and preferably 40% or greater pentafluoroethane content (i.e., HFC-125).” Ex. 1011 at p. 7 (emphasis added).

Accordingly, the applicant of the ‘179 Patent failed to rebut a finding of *prima facie* obviousness. Groll ¶123.

d. Apparatus Claims

Whether directed to apparatus or to method, claims 1, 8, 21 and 26 of the ‘179 Patent recite an “apparatus” associated with the refrigerant. Dependent claims 2, 10, 36 and 37 further define the apparatus as being selected from refrigeration equipment, air-conditioning equipment and HVAC equipment.

The use of refrigerants with this type of equipment is notoriously well known in the art. See Takigawa (Ex. 1006) at 2:22 (refrigerator), 11:21 (air-conditioner); Powell (Ex. 1007) at 1:6-7 (“a refrigerant particularly but not exclusively for air conditioning systems.”), 10:42-47 (rooftop heat pump, which is an HVAC system); Goble (Ex. 1008) at 8:59 (air-conditioner), 10:48-49 (2.5 ton R-22 home central air conditioning split system, which is an HVAC system.); Singh (Ex. 1011) at ¶¶0036-0037 (refrigeration system). Groll ¶125.

The “apparatus” limitation is thus notoriously well known in the art. Id. ¶126.

e. Bubble Point and Dew Point

As noted above in Section (IV)(C) on Claim Construction and in the Declaration of Dr. Groll (Ex. 1013 ¶¶84-87), the claimed bubble point and dew point in the independent claims of the '179 Patent are properties that are inherent to the claimed R125/R134a formulation. Moreover, noting that ranges (57-59% R125, 41-43% R134A) are claimed, the resulting properties will vary accordingly. The claimed bubble point and dew point thus add no additional patentable weight to the claims. Id. ¶88.

VII. EXPLANATION OF GROUNDS FOR UNPATENTABILITY

The criteria for unpatentability are set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966). The factors were validated decision by the Supreme Court in *KSR International Co. v. Teleflex Inc. (KSR)*, 550 U.S. 398, 82 USPQ2d 1385 (2007).

In short, it was well known that the industry needed a replacement for R22, and R1125 and R134A were well known in the art. Also, the need for lubricants were well known. Accordingly, producing the claims of the '179 Patent would have been routine a PHOSITA. Groll ¶268-271.

As detailed below, claims 1-37 of the '179 Patent are unpatentable as being anticipated under 35 U.S.C. § 102 or obvious under 35 U.S.C. § 103.

A. GROUND 1 – GOBLE AS PRIMARY REFERENCE

Goble's U.S. application filing date of June 25, 2003 is prior to the September 8, 2003 filing date of the provisional application of earliest ancestor of the '179 Patent. As such, Goble is prior art under at least 35 U.S.C. § 102(e) (pre-AIA).

Goble (Ex. 1008), entitled "Nonflammable, Nonozone Depleting, Refrigerant Mixtures Suitable For Use In Mineral Oil," teaches a replacement for R22 (Abstract) that can be 30-70% R125 and 15-60% R134a at 16:28-30, which encompasses the claimed range of the '179 Patent. Goble 2:61-3:7 teaches that chlorine containing refrigerants harm Earth's the ozone layer and are being phased out. Goble solves this problem by starting with a formulation that approximates the formulation for R421: "*Applicant set the ratio of R125/R134a to establish a pressure temperature curve approximating R-22, which is* ***roughly 56 weight percent R-125 and 44 weight percent R-134a.*** *"* (emphasis added) Id. 7:6-9.

Goble thus teaches a formulation that discloses the 57-59% R125 and 41-43% R134a claimed in the independent claims of the '179 Patent. Groll ¶103. This clearly reads on the ratio set forth in the independent claims of the '179 Patent. Id. ¶130.

A *prima facie* case of obviousness exists where the claimed ranges and prior art ranges do not overlap but are close enough that one skilled in the art would

have expected them to have the same properties. *Titanium Metals Corp. of America v. Banner*, 778 F.2d 775, 227 USPQ 773 (Fed. Cir. 1985) (Court held as proper a rejection of a claim directed to an alloy "*having 0.8% nickel, 0.3% molybdenum, up to 0.1% iron, balance titanium*" as obvious over a reference disclosing alloys of 0.75% nickel, 0.25% molybdenum, balance titanium and 0.94% nickel, 0.31% molybdenum, balance titanium.).

Moreover, Goble provides a motivation to combine R125/R134a to establish a pressure temperature curve approximating R22. In so doing, Goble (Ex. 1008) at 7:6-9 determines that the ratio of R125/R134a is *"**roughly** 56 weight percent R-125 and 44 weight percent R-134A."* Groll ¶132.

Further, the use of the word "roughly" in the Goble disclosure makes a clear overlap with the R421A formulation. See *In re Woodruff*, 919 F.2d 1575, 16 USPQ2d 1934 (Fed. Cir. 1990) (The prior art taught carbon monoxide concentrations of "*about 1-5%" while the claim was limited to "more than 5%.*" The court held that "*about 1-5%*" allowed for concentrations slightly above 5% thus the ranges overlapped.)

Thus, Goble fulfills the requirement for anticipating the '179 Patent's R421A formulation under 35 U.S.C. § 102 and clearly renders R421 obvious under 35 U.S.C. § 103. Groll ¶134.

Additionally, starting from the 56% R125 and 44% R134a taught by Goble,

it is clearly within the ambit of routine experimentation to obtain the proportions set forth in the independent claims of the '179 Patent. Id. ¶135. "*[W]here the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation*." *In re Aller*, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955).

The independent claims of the '179 Patent recite a dew point at about -32° F or a bubble point at about -41.5^{o} F. Related to this, the independent claims of the '179 patent recite the formulation of pentafluoroethane and tetrafluoroethane using the closed "consisting" language, which excludes other refrigerants being added to the formulations. As is well known in the chemical arts, a specific formulation will have specific properties. Groll ¶136. Accordingly, the recited dew point and bubble point are inherent to the closed refrigerant composition claimed in the '179 Patent. "*[T]he discovery of a previously unappreciated property of a prior art composition, or of a scientific explanation for the prior art's functioning, does not render the old composition patentably new to the discoverer*." *Atlas Powder Co. v. IRECO Inc.*, 190 F.3d 1342, 1347, 51 USPQ2d 1943, 1947 (Fed. Cir. 1999).

The independent claims of the '179 Patent recite a "*phase change*," which is well known in the art as being a necessary property of a refrigerant. Groll ¶83. Moreover, Goble 6:63-67 describes boiling point ranges; at 10:56 describes an evaporator, and at 10:59 a condenser. All these teach a phase change.

At 2:15-22, Goble teaches lubricating oils that includes mineral oils polyolefin ester (POE) oils, and at 2:35 teaches alkyl benzene oils.

Goble at, e.g., 7:45-48 teaches storing refrigerant in a cylinder. Goble at 8:59-64 teaches a Frigidaire air conditioner fitted with Shraeder valves, which corresponds to a manifold. Goble thus teaches the equipment of independent claims 8 and 26 of the '179 Patent. Moreover, cylinders and manifolds are notoriously well known in the art. Groll ¶140.

Dr. Groll explains how Goble applies to independent claim 1 at ¶141. In brief:

No.	Limitation	Relevant Art - Goble Ex. 1008
1.1	1. In an apparatus designed for use with chlorodifluoromethane refrigerant,	10:48-51 explains use in an air conditioning system operating with R22 (a chlorodifluoromethane refrigerant).
1.2	the improvement comprising substituting the chlorodifluoromethane with a refrigerant composition designed to achieve a phase change,	6:63-67 describes boiling point ranges; at 10:56 describes an evaporator, at 10:59 a condenser. All these teach a phase change of a substitute refrigerant.
1.3	the refrigerant composition comprising a combination of refrigerant gases, said refrigerant gases consisting of a blend of tetrafluoroethane and pentafluoroethane,	7:6-9. The "consisting" language excludes the addition of additional refrigerants, i.e., HFCs. The substitute refrigerant gases consist of a blend of tetrafluoroethane and pentafluoroethane.

No.	Limitation	Relevant Art - Goble Ex. 1008
1.4	the ratio of the tetrafluoroethane to the pentafluoroethane being selected such that the blend exhibits a dew point at about -32° F or a bubble point at about -41.5 ° F. at about one standard atmosphere of pressure,	Inherent; Groll ¶88. Since the "consisting" language excludes additional HFCs, the bubble point and dew point are specific to the claimed proportion of R125 and R134a. These numerical limitations would be inherent in the blend that Goble suggests.
1.5	wherein in the substitute refrigerant said pentafluoroethane is present in an amount of 59% to 57% by weight and said tetrafluoroethane is present in an amount of 41% to 43% by weight of the combined weight of the pentafluoroethane and tetrafluoroethane on the basis of the combined weights of said pentafluoroethane and said tetrafluoroethane totaling 100%,	Goble discloses these ranges: • 6:24-25 (1-85% R125, 1-80% R134a), • 7:6-9 (~56% R125, ~44 % R134a); • 16:28-30 (30-70% R125, 15-60% R134a);
1.6	and wherein the refrigerant composition further comprises non-refrigerant gas components, said non-refrigerant gas components including a lubricating oil,	Goble 2:15-36 teaches that the substitute refrigerant composition also includes non-refrigerant gas components, (mineral oil, alkylbenzene). Alkylbenzene is a synthetic aromatic lubricant.
1.7	wherein the lubricating oil is present up to about 20% by weight of the refrigerant gases and is soluble in chlorodifluoromethane, tetrafluoroethane and pentafluoroethanes	Goble does not teach the 20% limitation explicitly, but this range is well known in the prior art; Takigawa Ex. 1006 Claim 1(for 20%); Singh Ex.1011 at ¶ 0018 for solubility
1.8	wherein the lubricating oil is selected from the group consisting of mineral oil, synthetic alkyl aromatic lubricants, and mixtures	Goble 2:15-37 (mineral oil, alkylbenzene);

No.	Limitation	Relevant Art - Goble Ex. 1008
	thereof,	
1.9	and the tetrafluoroethane is 1,1,1,2-tetrafluoroethane.	Goble at 1:40 teaches this specific tetrafluoroethane.

The claim charts below refer back to the limitations enumerated for claim 1 above.

Dr. Groll explains how Goble applies to independent claim 8 at ¶143. In brief:

No.	Limitation	Relevant Art - Goble Ex. 1008
8.1	8. A method for refilling an apparatus designed for use with a chlorodifluoromethane refrigerant, the method comprising:	Goble 10:48-52 (charging an air conditioner operating with R22);
8.2	(1) selecting a substitute refrigerant composition designed to achieve a phase change and comprising a combination of refrigerant gases,	See 1.2
8.3	the refrigerant gases consisting of a blend of tetrafluoroethane and pentafluoroethane,	See 1.3
8.4	the ratio of the tetrafluoroethane to the pentafluoroethane being selected such that the blend exhibits a dew point at about -32° F or a bubble point at about -41.5 ^{o} F at about one standard atmosphere of pressure,	Inherent; See 1.4
8.5	wherein in the substitute refrigerant said pentafluoroethane is present in an amount of 59% to 57% by weight and said tetrafluoroethane is present in an amount of 41% to 43% by weight of the combined weight of the pentafluoroethane and	See 1.5

No.	Limitation	Relevant Art - Goble Ex. 1008
	tetrafluoroethane on the basis of the combined weights of said pentafluoroethane and said tetrafluoroethane totaling 100%,	
8.6	(2) supplying the substitute refrigerant composition under pressure, in a cylinder can fitted with an outlet compatible with a chlorodifluoromethane recharging manifold of the apparatus; and	7:45-53,10:48-59;
8.7	(3) adding to said apparatus via the manifold the substitute refrigerant composition for chlorodifluoromethane, wherein the refrigerant composition further comprises non-refrigerant gas components,	10:48-51
8.8	said non-refrigerant gas components including a lubricating oil, wherein the lubricating oil is present up to about 20% by weight of the refrigerant gases and is soluble in chlorodifluoromethane, tetrafluoroethane and pentafluoroethane,	See 1.6/1.7
8.9	wherein the lubricating oil is selected from the group consisting of mineral oil, synthetic alkyl aromatic lubricants, and mixtures thereof,	See 1.8
8.10	and wherein the tetrafluoroethane is 1,1,1,2-tetrafluoroethane.	See 1.9

Dr. Groll explains how Goble applies to independent claim 15 at ¶144. In brief:

No.	Limitation	Relevant Art - Goble Ex. 1008
15.1	15. A refrigerant composition comprising a combination of refrigerant gases, the refrigerant gases consisting of a blend of tetrafluoroethane and pentafluoroethane,	See 1.3
15.2	the ratio of the tetrafluoroethane to the pentafluoroethane being selected such that the blend exhibits a dew point at about -32° F. or a bubble point at about -41.5^{o} F. at about one standard atmosphere of pressure,	See 1.4
15.3	wherein in the substitute refrigerant said pentafluoroethane is present in an amount of 59% to 57% by weight and said tetrafluoroethane is present in an amount of 41% to 43% by weight of the combined weight of the pentafluoroethane and tetrafluoroethane on the basis of the combined weights of said pentafluoroethane and said tetrafluoroethane totaling 100%,	See 1.5
15.4	wherein the refrigerant composition further comprises non-refrigerant gas components, said non-refrigerant gas components including a lubricating oil, wherein the lubricating oil is present up to about 20% by weight of the refrigerant gases and is soluble in chlorodifluoromethane, tetrafluoroethane and pentafluoroethane, wherein the lubricating oil is selected from the group consisting of mineral oil, synthetic alkyl aromatic lubricants, and mixtures thereof	See 1.6/1/7
15.5	and wherein the tetrafluoroethane is 1,1,1,2-tetrafluoroethane.	See 1.9

Dr. Groll explains how Goble applies to independent claim 21 at ¶145. In brief:

No.	Limitation	Relevant Art - Goble Ex. 1008
21.1	15. A refrigerant composition comprising a combination of refrigerant gases, the refrigerant gases consisting of a blend of tetrafluoroethane and pentafluoroethane,	See 1.3
21.2	the ratio of the tetrafluoroethane to the pentafluoroethane being selected such that the blend exhibits a dew point at about -32° F. or a bubble point at about -41.5° F. at about one standard atmosphere of pressure,	Inherent; See 1.4
21.3	wherein in the substitute refrigerant said pentafluoroethane is present in an amount of 59% to 57% by weight and said tetrafluoroethane is present in an amount of 41% to 43% by weight of the combined weight of the pentafluoroethane and tetrafluoroethane on the basis of the combined weights of said pentafluoroethane and said tetrafluoroethane totaling 100%,	See 1.5
21.4	wherein the refrigerant composition further comprises non-refrigerant gas components, said non-refrigerant gas components including a lubricating oil, wherein the lubricating oil is present up to about 20% by weight of the	See 1.7

No.	Limitation	Relevant Art - Goble Ex. 1008
	refrigerant gases and is soluble in chlorodifluoromethane, tetrafluoroethane and pentafluoroethane, wherein the lubricating oil is selected from the group consisting of mineral oil, synthetic alkyl aromatic lubricants, and mixtures thereof	
21.5	and wherein the tetrafluoroethane is 1,1,1,2-tetrafluoroethane.	See 1.9

Goble applies to independent claim 26, as Dr. Groll explains at ¶146. In brief:

No.	Limitation	Relevant Art - Goble Ex. 1008
26.1	15. A refrigerant composition comprising a combination of refrigerant gases, the refrigerant gases consisting of a blend of tetrafluoroethane and pentafluoroethane,	See 1.3
26.2	the ratio of the tetrafluoroethane to the pentafluoroethane being selected such that the blend exhibits a dew point at about -32° F. or a bubble point at about -41.5° F. at about one standard atmosphere of pressure,	Inherent; See 1.4
26.3	wherein in the substitute refrigerant said pentafluoroethane is present in an amount of 59% to 57% by weight and said tetrafluoroethane is present in an amount of 41% to 43% by weight of the combined weight of the pentafluoroethane and	See 1.5

No.	Limitation	Relevant Art - Goble Ex. 1008
	tetrafluoroethane on the basis of the combined weights of said pentafluoroethane and said tetrafluoroethane totaling 100%,	
26.4	wherein the refrigerant composition further comprises non-refrigerant gas components, said non-refrigerant gas components including a lubricating oil, wherein the lubricating oil is present up to about 20% by weight of the refrigerant gases and is soluble in chlorodifluoromethane, tetrafluoroethane and pentafluoroethane, wherein the lubricating oil is selected from the group consisting of mineral oil, synthetic alkyl aromatic lubricants, and mixtures thereof	See 1.6/1.7
26.5	and wherein the tetrafluoroethane is 1,1,1,2-tetrafluoroethane.	See 1.9

Dr. Groll explains how Goble applies to independent claim 31 at ¶147. In brief:

No.	Limitation	Relevant Art- Goble Ex. 1008
31. 1	31. A refrigerant composition comprising a combination of refrigerant gases, the refrigerant gases consisting of a blend of tetrafluoroethane and pentafluoroethane	See 1.3
31.2	the ratio of the tetrafluoroethane to the pentafluoroethane being selected such that the blend	Inherent; See 1.4

No.	Limitation	Relevant Art- Goble Ex. 1008
	exhibits a dew point at about -32º F. or a bubble point at about -41.5º F. at about one standard atmosphere of pressure,	
31.3	wherein in the substitute refrigerant said pentafluoroethane is present in an amount of 59% to 57% by weight and said tetrafluoroethane is present in an amount of 41% to 43% by weight of the combined weight of the pentafluoroethane and tetrafluoroethane on the basis of the combined weights of said pentafluoroethane and said tetrafluoroethane totaling 100%,	See 1.5
31.4	and wherein the tetrafluoroethane is 1,1,1,2-tetrafluoroethane.	See 1.9

a. The Dependent Claims

Many of the dependent claims fail to further limit the independent claim on which it depends. Claims 2, 9, 16, 23, 28 and 33 contain the limitation "*the blend exhibits a dew point at about -32º F. or a bubble point at about -41.5º F. at about one standard atmosphere of pressure*." However, this limitation is already present in each independent claim as an inherent property of the formulation. These claims thus fail to further limit the claim from which they depend and add no patentable weight. See MPEP § 706.03(k) and 37 C.F.R. § 1.75 ("*One or more claims may be presented in dependent form, referring back to* ***and further limiting*** *another claim or claims in the same application*.") (emphasis added). Groll ¶148. See 35 USC

112, 4th para. (pre-AIA).

Similarly, dependent claims 7, 14, 20, 22 and 32 recite "*a dew point of -32 º F*" while their respective independent claims recite "*a dew point of* ***about*** *-32 º F* (emphasis added)." Removal of the term "about" does little to further limit the independent claim where the claimed proportions are encompassed by the prior art. Groll ¶149.

In determining the range encompassed by the term "*about*," one must consider the context of the term as it is used in the specification and claims of the application. *Ortho-McNeil Pharm., Inc. v. Caraco Pharm. Labs., Ltd.*, 476 F.3d 1321, 1326, 81 USPQ2d 1427, 1432 (Fed. Cir. 2007). *In W.L. Gore & Associates, Inc. v. Garlock, Inc*., 721 F.2d 1540, 220 USPQ 303 (Fed. Cir. 1983), the court held that a limitation defining the stretch rate of a plastic as "*exceeding about 10% per second*" is definite because infringement could clearly be assessed through the use of a stopwatch. However, in another case, the court held that claims reciting "at least about" were invalid for indefiniteness where there was close prior art and there was nothing in the specification, prosecution history, or the prior art to provide any indication as to what range of specific activity is covered by the term "*about*." *Amgen, Inc. v. Chugai Pharmaceutical Co.,* 927 F.2d 1200, 18 USPQ2d 1015 (Fed. Cir. 1991).

In the specification and the prosecution history of the '179 Patent, no

definition of the word "*about*" could be found. That is, although the word is used, no ± range is given. Thus, it is questionable that removal of "about" further limits the independent claim. Groll ¶151. In any case, the ranges taught by Goble still encompass the ranges of the '179 Patent, and due to the "consisting" language of the independent claims, the resulting properties are fixed. Id. ¶151.

Another issue arises from claiming a glide of 9.5 ^{o}F in dependent claims 6, 13, 19, 24, 29 and 34. However, the glide is the difference in temperature between the dew point and bubble point, which are recited in the respective base claims. As a result, the glide is already implicitly claimed in the corresponding independent claim. Id. ¶152.

Dependent claims 4, 11and 17 set forth additives, reciting: "*wherein the lubricating oil includes an additive selected from the group consisting of an acrylic polymer, a corrosion inhibitor, a surfactant, a foaming agent, and mixtures thereof.*" Adding additives to lubricating oil was already well known to a PHOSITA in this well-developed art. For example, Takigawa Ex. 1006 at 8:1-14: teaches:

> *"It is also possible, if required, to use singly or jointly suitable conventional additives in the refrigerating machine oil for the purpose of improving the oil in properties. The suitable conventional additives include anti-oxidants...wear resistant additives...extreme pressure ... ...anti-foaming agents ... metal inactivators ...pour point depressants;*

and detergent-dispersants. These additives may be used singly or in combination." Groll ¶153.

Takigawa Ex. 1006 at 5:31-45 teaches phosphorous compounds for wear resistance. Optionally, Seebauer Ex.1012 at 1:33-37, 56-59 teaches acrylic polymer added to lubricant to modulate viscosity. Singh Ex. 1011 ¶0025 teaches polymethcrylates, at ¶0022 corrosion inhibitors and at ¶ 0021 surfactants and anti-foaming agents. Seebauer issued on August 7, 2001 and is a divisional of USSN 09/218, 905, filed on December 12, 1998. Seebauer is thus prior art under 35 U.S.C. § 102(b).

Singh includes an exhaustive review of additives at Ex. 1011 ¶¶ 0021-0029. These include corrosion inhibitors, surfactants (lubricity additives" and antifoaming agents at ¶0021, and acrylic polymer antifoaming agents in ¶ 0028.

Roberts Ex. 1019 3:9-26 discusses oils and additives, including polyols, mineral oil, napthenic oil, antiwear additives, oxidation and thermal stability improves, corrosion inhibitors, anti-foaming agents and viscosity adjusters.
A PHOSITA would thus add the additive teachings of Takigawa, Singh, and Seebauer to the rejection of the independent claims to reject dependent claims 4, 11and 17. Groll ¶156.

Claims 3, 10, 36 and 37 of the '179 Patent recite "wherein the apparatus is selected from the group consisting of refrigeration equipment, air-conditioning

equipment, and HVAC equipment." These were already well known in the art. For example:

- Goble Ex. 1008 8:59-60 teaches window A/C units at 3:18, a Frigidaire window air conditioning unit, at 10:48-49, a 2.5 ton HVAC unit, and at 1:8 to "refrigerants generally," which covers refrigeration equipment.
- Takigawa Ex. 1006 at 2:22 (refrigerator),11:21 (air conditioner);
- Powell Ex.1007 at 1:6-7 (air conditioning systems),10:42-47 (5 ton rooftop heat pump);
- Singh Ex.1011 ¶¶ 0037,0038 (refrigerant heating systems);
- Federal Register Ex. 1020 at 2 (chillers, industrial air conditioning, retail refrigeration, cold storage warehouses, refrigerated transport, household refrigerators, etc.

Accordingly, all the dependent claims either fail to further limit the independent claim or would have been *prima facie* unpatentable to a PHOSITA at least further in view of Takigawa and Singh. Groll ¶163.

In conclusion, in light of the discussion of the relationship between a chemical formulation and its properties set forth in Section IV(C)(d) above, the R421A formulations claimed in claims 26-37, along with the refrigeration equipment, cylinder and manifold are all taught or inferred by the single reference

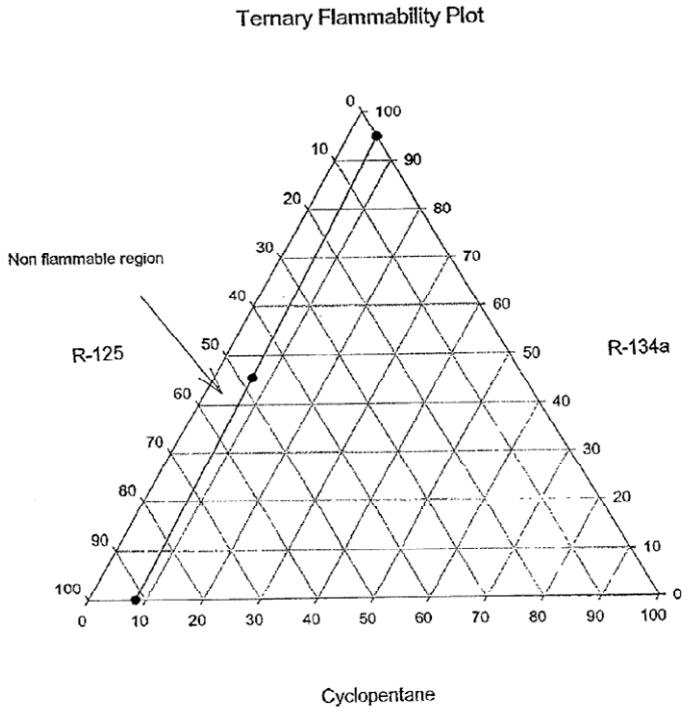
of Goble. Claims 26-37 are thus either anticipated by or obvious over Goble and are thus invalid. The addition of the teaching of Takigawa and Singh, would render all claims 1-37 invalid.

Accordingly, all the dependent claims either fail to further limit the independent claim or would be *prima facie* unpatentable to a PHOSITA at least further in view of Takigawa and Singh. Id. ¶163.

B. GROUND 2 – SINGH AS PRIMARY REFERENCE

Singh is prior art under at least 35 U.S.C. § 102(a) (pre-AIA) because it was published on April 3, 2003, which was prior to even the September 8, 2003 filing date of the provisional application of the '179 Patent. It is also prior art under 35 U.S.C. § 102(e) (pre-AIA) because it was filed in the U.S. on September 21, 2001.

Singh teaches concentration ranges that overlap the R421A formulation, the most preferred being about 48 to about 80 parts by weight of R125 and about 18 to about 60 parts by weight of R134A. Ex. 1011 at ¶0020. Motivation to readily achieve R421is found in Figure 1 of Singh:



A horizontal isocline drawn through the tip of the arrow will yield the 58/42% R125/R134a percentage of R421A. This arrow and the midrange data point (closest to the arrow) will motivate a PHOSITA seeking to optimize and R125/R134a formulation, to start experimenting at where the arrow is pointing or, alternately, the midrange data point. Groll. ¶166.

Either way, the arrow points to the 58/42% formulation and the midrange data point lies very close to this formulation. Starting from the midrange data point, it would be routine experimentation to arrive at the R421A formulation. Id. ¶167.

"*The use of patents as references is not limited to what the patentees describe as their own inventions or to the problems with which they are concerned.*

They are part of the literature of the art, relevant for all they contain." *In re Heck*, 699 F.2d 1331, 1332-33, 216 USPQ 1038, 1039 (Fed. Cir. 1983) (quoting *In re Lemelson*, 397 F.2d 1006, 1008, 158 USPQ 275, 277 (CCPA 1968)). A reference may be relied upon for all that it would have reasonably suggested to one having ordinary skill the art, including nonpreferred embodiments. *Merck & Co. v.Biocraft Laboratories*, 874 F.2d 804, 10 USPQ2d 1843 (Fed. Cir.), cert. denied, 493 U.S. 975 (1989).

In this case, Singh has an arrow pointing at the R421A formulation and a midrange data point very close to this formulation. Groll ¶169.

Moreover, in the case where the claimed ranges "*overlap or lie inside ranges disclosed by the prior art*" a *prima facie* case of obviousness exists. See, e.g., *In re Wertheim*, 541 F.2d 257, 191 USPQ 90 (CCPA 1976). See also the discussion in Section VI(C)(b) above.

As noted above, Singh teaches the additives claimed in the '179 Patent at Ex. 1011 ¶¶0021-0029 and claim 4. Id. ¶0012 discloses mineral oil and alkyl benzene oil.

Singh ¶0027 teaches a broadly defined "refrigeration system," Singh ¶0021-0029. Singh ¶0038 teaches refrigeration and heat pump applications as well as condensing and evaporating (phase change), Singh ¶0044 teaches a 2 ton air conditioner system.

Dr. Groll explains how Singh applies to the independent claim 1 at ¶172. In brief:

No.	Limitation	Relevant Art - Singh Ex. 1011
1.1	1. In an apparatus designed for use with chlorodifluoromethane refrigerant,	Singh ¶13 teaches replacing CFCs (chlorofluorocarbons) in a refrigerant system
1.2	the improvement comprising substituting the chlorodifluoromethane with a refrigerant composition designed to achieve a phase change,	Singh ¶3 teaches replacing CFCs and evaporation.
1.3	the refrigerant composition comprising a combination of refrigerant gases, said refrigerant gases consisting of a blend of tetrafluoroethane and pentafluoroethane,	Singh ¶10 teaches R125 and R134a.
1.4	the ratio of the tetrafluoroethane to the pentafluoroethane being selected such that the blend exhibits a dew point at about -32° F or a bubble point at about -41.5^{o} F. at about one standard atmosphere of pressure,	Inherent; Groll ¶88. Since the "consisting" language excludes additional HFCs, the bubble point and dew point are specific to the claimed proportion of R125 and R134a. These numerical limitations would be inherent in the blend that Singh suggests.
1.5	wherein in the substitute refrigerant said pentafluoroethane is present in an amount of 59% to 57% by weight and said tetrafluoroethane is present in an amount of 41% to 43% by weight of the combined weight of the pentafluoroethane and tetrafluoroethane on the basis of the	Singh ¶20 teaches 47-80% R125, 15-60%R134a. 0.1% cyclopentane would be an impurity.

No.	Limitation	Relevant Art - Singh Ex. 1011
	combined weights of said pentafluoroethane and said tetrafluoroethane totaling 100%,	
1.6	and wherein the refrigerant composition further comprises non-refrigerant gas components, said non-refrigerant gas components including a lubricating oil,	Singh ¶36 teaches lubricant, i.e., mineral oil.
1.7	wherein the lubricating oil is present up to about 20% by weight of the refrigerant gases and is soluble in chlorodifluoromethane, tetrafluoroethane and pentafluoroethanes	Takigawa Ex. 1006 Claim 1(for 20%); Singh ¶18 for solubility.
1.8	wherein the lubricating oil is selected from the group consisting of mineral oil, synthetic alkyl aromatic lubricants, and mixtures thereof,	Singh ¶32 mineral oil, and alkylbenzene oil, which is a synthetic alkyl aromatic lubricant.
1.9	and the tetrafluoroethane is 1,1,1,2-tetrafluoroethane.	Singh ¶10.

Dr. Groll explains how Singh applies to the independent claim 8 at ¶173. In brief:

No	Limitation	Relevant Art - Singh Ex. 1011
8.1	8. A method for refilling an apparatus designed for use with a chlorodifluoromethane refrigerant, the method comprising:	Singh ¶34 teaches a method for recharging a system containing chlorine-containing refrigerants.
8.2	(1) selecting a substitute refrigerant composition designed to achieve a phase change and comprising a combination of refrigerant gases,	See 1.2
8.3	the refrigerant gases consisting of a blend of tetrafluoroethane and	See 1.3

No	Limitation	Relevant Art - Singh Ex. 1011
	pentafluoroethane,	
8.4	the ratio of the tetrafluoroethane to the pentafluoroethane being selected such that the blend exhibits a dew point at about -32° F or a bubble point at about -41.5^{o} F at about one standard atmosphere of pressure,	Inherent; See 1.4
8.5	wherein in the substitute refrigerant said pentafluoroethane is present in an amount of 59% to 57% by weight and said tetrafluoroethane is present in an amount of 41% to 43% by weight of the combined weight of the pentafluoroethane and tetrafluoroethane on the basis of the combined weights of said pentafluoroethane and said tetrafluoroethane totaling 100%,	See 1.5
8.6	(2) supplying the substitute refrigerant composition under pressure, in a cylinder can fitted with an outlet compatible with a chlorodifluoromethane recharging manifold of the apparatus; and	Goble 7:45-53,10:48-59;
8.7	(3) adding to said apparatus via the manifold the substitute refrigerant composition for chlorodifluoromethane, wherein the refrigerant composition further comprises non-refrigerant gas components,	Goble 10:48-51
8.8	said non-refrigerant gas components including a lubricating oil, wherein the lubricating oil is present up to about 20% by weight of the refrigerant gases and is soluble in chlorodifluoromethane, tetrafluoroethane and pentafluoroethane,	See 1.6/1.7

No	Limitation	Relevant Art - Singh Ex. 1011
8.9	wherein the lubricating oil is selected from the group consisting of mineral oil, synthetic alkyl aromatic lubricants, and mixtures thereof,	See 1.8
8.10	and wherein the tetrafluoroethane is 1,1,1,2-tetrafluoroethane.	See 1.9

Dr. Groll explains how Singh applies to the independent claim 15 at ¶174. In brief:

No.	Limitation	Relevant Art - Singh Ex. 1011
15.1	15. A refrigerant composition comprising a combination of refrigerant gases, the refrigerant gases consisting of a blend of tetrafluoroethane and pentafluoroethane,	See 1.3
15.2	the ratio of the tetrafluoroethane to the pentafluoroethane being selected such that the blend exhibits a dew point at about -32° F. or a bubble point at about -41.5^{o} F. at about one standard atmosphere of pressure,	See 1.4
15.3	wherein in the substitute refrigerant said pentafluoroethane is present in an amount of 59% to 57% by weight and said tetrafluoroethane is present in an amount of 41% to 43% by weight of the combined weight of the pentafluoroethane and tetrafluoroethane on the basis of the combined weights of said pentafluoroethane and said tetrafluoroethane totaling 100%,	See 1.5
15.4	wherein the refrigerant composition	See 1.6/1/7

No.	Limitation	Relevant Art - Singh Ex. 1011
	further comprises non-refrigerant gas components, said non-refrigerant gas components including a lubricating oil, wherein the lubricating oil is present up to about 20% by weight of the refrigerant gases and is soluble in chlorodifluoromethane, tetrafluoroethane and pentafluoroethane, wherein the lubricating oil is selected from the group consisting of mineral oil, synthetic alkyl aromatic lubricants, and mixtures thereof	
15.5	and wherein the tetrafluoroethane is 1,1,1,2-tetrafluoroethane.	See 1.9

Dr. Groll explains how Singh applies to independent claim 21 at ¶175. In brief:

No.	Limitation	Relevant Art - Singh Ex. 1011
21.1	15. A refrigerant composition comprising a combination of refrigerant gases, the refrigerant gases consisting of a blend of tetrafluoroethane and pentafluoroethane,	See 1.3
21.2	the ratio of the tetrafluoroethane to the pentafluoroethane being selected such that the blend exhibits a dew point at about -32° F. or a bubble point at about -41.5^{o} F. at about one standard atmosphere of pressure,	Inherent; See 1.4
21.3	wherein in the substitute refrigerant said pentafluoroethane is present in an amount of 59% to 57% by weight and said tetrafluoroethane is present	See 1.5

No.	Limitation	Relevant Art - Singh Ex. 1011
	in an amount of 41% to 43% by weight of the combined weight of the pentafluoroethane and tetrafluoroethane on the basis of the combined weights of said pentafluoroethane and said tetrafluoroethane totaling 100%,	
21.4	wherein the refrigerant composition further comprises non-refrigerant gas components, said non-refrigerant gas components including a lubricating oil, wherein the lubricating oil is present up to about 20% by weight of the refrigerant gases and is soluble in chlorodifluoromethane, tetrafluoroethane and pentafluoroethane, wherein the lubricating oil is selected from the group consisting of mineral oil, synthetic alkyl aromatic lubricants, and mixtures thereof	See 1.7
21.5	and wherein the tetrafluoroethane is 1,1,1,2-tetrafluoroethane.	See 1.9

Dr. Groll explains how Singh applies to independent claim 26 at ¶176. In brief:

No.	Limitation	Relevant Art - Singh Ex. 1011
26.1	15. A refrigerant composition comprising a combination of refrigerant gases, the refrigerant gases consisting of a blend of tetrafluoroethane and pentafluoroethane,	See 1.3
26.2	the ratio of the tetrafluoroethane to the pentafluoroethane being	Inherent; See 1.4

No.	Limitation	Relevant Art - Singh Ex. 1011
	selected such that the blend exhibits a dew point at about -32° F. or a bubble point at about -41.5° F. at about one standard atmosphere of pressure,	
26.3	wherein in the substitute refrigerant said pentafluoroethane is present in an amount of 59% to 57% by weight and said tetrafluoroethane is present in an amount of 41% to 43% by weight of the combined weight of the pentafluoroethane and tetrafluoroethane on the basis of the combined weights of said pentafluoroethane and said tetrafluoroethane totaling 100%,	See 1.5
26.4	wherein the refrigerant composition further comprises non-refrigerant gas components, said non-refrigerant gas components including a lubricating oil, wherein the lubricating oil is present up to about 20% by weight of the refrigerant gases and is soluble in chlorodifluoromethane, tetrafluoroethane and pentafluoroethane, wherein the lubricating oil is selected from the group consisting of mineral oil, synthetic alkyl aromatic lubricants, and mixtures thereof	See 1.6/1.7
26.5	and wherein the tetrafluoroethane is 1,1,1,2-tetrafluoroethane.	See 1.9

Dr. Groll explains how Singh applies to independent claim 31 at ¶177. In brief:

No.	Limitation	Relevant Art- Singh Ex. 1011
31. 1	31. A refrigerant composition comprising a combination of refrigerant gases, the refrigerant gases consisting of a blend of tetrafluoroethane and pentafluoroethane	See 1.3
31.2	the ratio of the tetrafluoroethane to the pentafluoroethane being selected such that the blend exhibits a dew point at about -32° F. or a bubble point at about -41.5° F. at about one standard atmosphere of pressure,	Inherent; See 1.4
31.3	wherein in the substitute refrigerant said pentafluoroethane is present in an amount of 59% to 57% by weight and said tetrafluoroethane is present in an amount of 41% to 43% by weight of the combined weight of the pentafluoroethane and tetrafluoroethane on the basis of the combined weights of said pentafluoroethane and said tetrafluoroethane totaling 100%,	See 1.5
31.4	and wherein the tetrafluoroethane is 1,1,1,2-tetrafluoroethane.	See 1.9

A PHOSITA would thus achieve claims 21-37 of the '179 Patent from a knowledge of the single reference of Singh. Groll ¶177. Claims 1-37 would be rendered invalid from a knowledge of Singh, Goble and Takigawa.

a. The dependent claims

As discussed in Section a VII(A)(a), the dependent claims are either

repetitive, a trivial removal of the term "about" or recitations of additives (exhaustively detailed in Singh) or equipment that are well known in the art.

The dependent claims thus do not address the failures of the independent claims to be valid.

A PHOSITA would thus achieve all the claims of the '179 Patent from a knowledge of Singh, Goble and Takigawa. Groll ¶181.

C. GROUND 3 – POWELL AS PRIMARY REFRENCE

Powell is prior art under 35 U.S.C. §102(a) (pre-AIA) because it issued on August 19, 2003 which antedates the September 8, 2003 filing date of the provisional application of the '179 Patent. Powell's U.S. application filing date of October 2, 2000 also makes Powell prior art under 35 U.S.C. § 102(e) (pre-AIA).

Powell Ex. 1007 at 1:26-34 discusses that R22 and other chlorine-containing refrigerants are to be phased out due to ozone depletion. Powell notes that the replacement refrigerant must have no chlorine. Id. 1:35-40

Powell teaches 50-80% R125 and 50-20% R134a, ranges that encompass the 58/42 % range of R421A. Id. 2:50-53. Claim 1 Id. 15:49-59 sets forth this range:

1. A refrigerant composition comprising 1,1,1,2-tetrafluoroethane (R 134a), pentafluoroethane (R 125) and an additive selected from a saturated hydrocarbon or mixture thereof boiling in the range −5 to +70° C., wherein the weights of R 125 to R 134a are in the ranges:

R 125	50–80%
R 134a	50–20%.

Powell at 10: 42-50 discloses a commercial 5 ton heat pump and throughout the examples uses "*standard refrigeration cycle analysis techniques*," at e.g., id. 4:53-54.

A PHOSITA would thus produce the formulation of the '179 Patent from a knowledge of Powell through routine experimentation. Groll ¶186.

Powell fails to explicitly disclose a cylinder and manifold (although using cylinders and manifolds for refrigerants is well known in the art). This lack is addressed by Goble Ex. 1008 7:45-48. See also Roberts Ex. 1019 at 3:44.

Powell fails to disclose lubricants and additives. As noted above, including these with the refrigerant mixture was very well known. Singh teaches the additives claimed in the '179 Patent at Ex. 1011 ¶¶0021-0029. Singh ¶0012 discloses mineral oil and alkyl benzene oil. Moreover, Singh ¶0027 teaches a broadly defined "refrigeration system," Singh ¶0021-0029. Singh ¶0038 teaches refrigeration and heat pump applications as well as condensing and evaporating (phase change), Singh Id. ¶0044 teaches a 2 ton air conditioner system.

While Powell and Singh fail to disclose that the lubricant is present up to about 20% by weight, this feature is addressed by Takigawa at Ex. 1006 8:59-63.

Dr. Groll explains how Powell applies to the independent claim 1 at ¶190. In brief:

No.	Limitation	Relevant Art - Powell Ex. 1007
1.1	1. In an apparatus designed for use with chlorodifluoromethane refrigerant,	Title, 1:8.
1.2	the improvement comprising substituting the chlorodifluoromethane with a refrigerant composition designed to achieve a phase change,	1:35-36, 45-62.
1.3	the refrigerant composition comprising a combination of refrigerant gases, said refrigerant gases consisting of a blend of tetrafluoroethane and pentafluoroethane,	2:42-4.
1.4	the ratio of the tetrafluoroethane to the pentafluoroethane being selected such that the blend exhibits a dew point at about -32° F or a bubble point at about -41.5^{o} F. at about one standard atmosphere of pressure,	Inherent; Groll ¶88. Since the "consisting" language excludes additional HFCs, the bubble point and dew point are specific to the claimed proportion of R125 and R134a. These numerical limitations would be inherent in the blend that Singh suggests.
1.5	wherein in the substitute refrigerant said pentafluoroethane is present in an amount of 59% to 57% by weight and said tetrafluoroethane is present in an amount of 41% to 43% by	2:50-53.

No.	Limitation	Relevant Art - Powell Ex. 1007
	weight of the combined weight of the pentafluoroethane and tetrafluoroethane on the basis of the combined weights of said pentafluoroethane and said tetrafluoroethane totaling 100%,	
1.6	and wherein the refrigerant composition further comprises non-refrigerant gas components, said non-refrigerant gas components including a lubricating oil,	2:44-46
1.7	wherein the lubricating oil is present up to about 20% by weight of the refrigerant gases and is soluble in chlorodifluoromethane, tetrafluoroethane and pentafluoroethanes	Takigawa Ex. 1006 Claim 1(for 20%); Singh ¶18 for solubility.
1.8	wherein the lubricating oil is selected from the group consisting of mineral oil, synthetic alkyl aromatic lubricants, and mixtures thereof,	Singh ¶32 mineral oil, and alkylbenzene oil, which is a synthetic alkyl aromatic lubricant.
1.9	and the tetrafluoroethane is 1,1,1,2-tetrafluoroethane.	2:43-44

Dr. Groll explains how Powell applies to the independent claim 8 at ¶191. In brief:

No	Limitation	Relevant Art - Powell Ex. 1007
8.1	8. A method for refilling an apparatus designed for use with a chlorodifluoromethane refrigerant, the method comprising:	See 1.1
8.2	(1) selecting a substitute refrigerant composition designed to achieve a phase change and comprising a	See 1.2

	combination of refrigerant gases,	
8.3	the refrigerant gases consisting of a blend of tetrafluoroethane and pentafluoroethane,	See 1.3
8.4	the ratio of the tetrafluoroethane to the pentafluoroethane being selected such that the blend exhibits a dew point at about -32° F or a bubble point at about -41.5 ^{o} F at about one standard atmosphere of pressure,	Inherent; See 1.4
8.5	wherein in the substitute refrigerant said pentafluoroethane is present in an amount of 59% to 57% by weight and said tetrafluoroethane is present in an amount of 41% to 43% by weight of the combined weight of the pentafluoroethane and tetrafluoroethane on the basis of the combined weights of said pentafluoroethane and said tetrafluoroethane totaling 100%,	See 1.5
8.6	(2) supplying the substitute refrigerant composition under pressure, in a cylinder can fitted with an outlet compatible with a chlorodifluoromethane recharging manifold of the apparatus; and	Goble 7:45-53,10:48-59;
8.7	(3) adding to said apparatus via the manifold the substitute refrigerant composition for chlorodifluoromethane, wherein the refrigerant composition further comprises non-refrigerant gas components,	Goble 10:48-51
8.8	said non-refrigerant gas components including a lubricating oil, wherein the lubricating oil is present up to about 20% by weight of the refrigerant gases and is soluble in chlorodifluoromethane,	See 1.6/1.7

	tetrafluoroethane and pentafluoroethane,	
8.9	wherein the lubricating oil is selected from the group consisting of mineral oil, synthetic alkyl aromatic lubricants, and mixtures thereof,	See 1.8
8.10	and wherein the tetrafluoroethane is 1,1,1,2-tetrafluoroethane.	See 1.9

Dr. Groll explains how Powell applies to the independent claim 15 at ¶192.

In brief:

No.	Limitation	Relevant Art - Powell Ex. 1007
15.1	15. A refrigerant composition comprising a combination of refrigerant gases, the refrigerant gases consisting of a blend of tetrafluoroethane and pentafluoroethane,	See 1.3
15.2	the ratio of the tetrafluoroethane to the pentafluoroethane being selected such that the blend exhibits a dew point at about -32° F. or a bubble point at about -41.5^{o} F. at about one standard atmosphere of pressure,	See 1.4
15.3	wherein in the substitute refrigerant said pentafluoroethane is present in an amount of 59% to 57% by weight and said tetrafluoroethane is present in an amount of 41% to 43% by weight of the combined weight of the pentafluoroethane and tetrafluoroethane on the basis of the combined weights of said pentafluoroethane and said	See 1.5

No.	Limitation	Relevant Art - Powell Ex. 1007
	tetrafluoroethane totaling 100%,	
15.4	wherein the refrigerant composition further comprises non-refrigerant gas components, said non-refrigerant gas components including a lubricating oil, wherein the lubricating oil is present up to about 20% by weight of the refrigerant gases and is soluble in chlorodifluoromethane, tetrafluoroethane and pentafluoroethane, wherein the lubricating oil is selected from the group consisting of mineral oil, synthetic alkyl aromatic lubricants, and mixtures thereof	See 1.6/1/7
15.5	and wherein the tetrafluoroethane is 1,1,1,2-tetrafluoroethane.	See 1.9

Dr. Groll explains how Powell applies to independent claim 21 at ¶193. In brief:

No.	Limitation	Relevant Art - Powell Ex. 1007
21.1	15. A refrigerant composition comprising a combination of refrigerant gases, the refrigerant gases consisting of a blend of tetrafluoroethane and pentafluoroethane,	See 1.3
21.2	the ratio of the tetrafluoroethane to the pentafluoroethane being selected such that the blend exhibits a dew point at about -32° F. or a bubble point at about -41.5^{o} F. at about one standard atmosphere of pressure,	Inherent; See 1.4
21.3	wherein in the substitute refrigerant said pentafluoroethane is present in	See 1.5

No.	Limitation	Relevant Art - Powell Ex. 1007
	an amount of 59% to 57% by weight and said tetrafluoroethane is present in an amount of 41% to 43% by weight of the combined weight of the pentafluoroethane and tetrafluoroethane on the basis of the combined weights of said pentafluoroethane and said tetrafluoroethane totaling 100%,	
21.4	wherein the refrigerant composition further comprises non-refrigerant gas components, said non-refrigerant gas components including a lubricating oil, wherein the lubricating oil is present up to about 20% by weight of the refrigerant gases and is soluble in chlorodifluoromethane, tetrafluoroethane and pentafluoroethane, wherein the lubricating oil is selected from the group consisting of mineral oil, synthetic alkyl aromatic lubricants, and mixtures thereof	See 1.7
21.5	and wherein the tetrafluoroethane is 1,1,1,2-tetrafluoroethane.	See 1.9

Dr. Groll explains how Powell applies to independent claim 26 at ¶194. In brief:

No.	Limitation	Relevant Art - Powell Ex. 1007
26.1	15. A refrigerant composition comprising a combination of refrigerant gases, the refrigerant gases consisting of a blend of tetrafluoroethane and pentafluoroethane,	See 1.3

No.	Limitation	Relevant Art - Powell Ex. 1007
26.2	the ratio of the tetrafluoroethane to the pentafluoroethane being selected such that the blend exhibits a dew point at about -32º F. or a bubble point at about -41.5º F. at about one standard atmosphere of pressure,	Inherent; See 1.4
26.3	wherein in the substitute refrigerant said pentafluoroethane is present in an amount of 59% to 57% by weight and said tetrafluoroethane is present in an amount of 41% to 43% by weight of the combined weight of the pentafluoroethane and tetrafluoroethane on the basis of the combined weights of said pentafluoroethane and said tetrafluoroethane totaling 100%,	See 1.5
26.4	wherein the refrigerant composition further comprises non-refrigerant gas components, said non-refrigerant gas components including a lubricating oil, wherein the lubricating oil is present up to about 20% by weight of the refrigerant gases and is soluble in chlorodifluoromethane, tetrafluoroethane and pentafluoroethane, wherein the lubricating oil is selected from the group consisting of mineral oil, synthetic alkyl aromatic lubricants, and mixtures thereof	See 1.6/1.7
26.5	and wherein the tetrafluoroethane is 1,1,1,2-tetrafluoroethane.	See 1.9

Dr. Groll explains how Powell applies to independent claim 31 at ¶195. In brief:

No.	Limitation	Relevant Art - Powell Ex. 1007
31. 1	31. A refrigerant composition comprising a combination of refrigerant gases, the refrigerant gases consisting of a blend of tetrafluoroethane and pentafluoroethane	See 1.3
31.2	the ratio of the tetrafluoroethane to the pentafluoroethane being selected such that the blend exhibits a dew point at about -32° F. or a bubble point at about -41.5° F. at about one standard atmosphere of pressure,	Inherent; See 1.4
31.3	wherein in the substitute refrigerant said pentafluoroethane is present in an amount of 59% to 57% by weight and said tetrafluoroethane is present in an amount of 41% to 43% by weight of the combined weight of the pentafluoroethane and tetrafluoroethane on the basis of the combined weights of said pentafluoroethane and said tetrafluoroethane totaling 100%,	See 1.5
31.4	and wherein the tetrafluoroethane is 1,1,1,2-tetrafluoroethane.	See 1.9

a. The dependent claims

As discussed in Section a VII(A)(a), the dependent claims are either repetitive, a trivial removal of the term “about” or recitations of additives (exhaustively detailed in Singh) or equipment that are well known in the art.

The dependent claims thus do not address the failures of the independent

claims to be valid.

A PHOSITA would thus achieve all the claims of the '179 Patent from a knowledge of Powell, Goble, Singh and Takigawa. Groll ¶198.

D. GROUND 4 – PEARSON AS PRIMARY REFERENCE

Pearson issued on November 18, 1997 and is prior art under pre-AIA 35 U.S.C. § 102(b).

Pearson teaches replacing R22 with a mixture of R125 and R134a with the addition of a hydrocarbon. Ex.1009 at Abstract. Pearson teaches 0.5% to 60% R125 and 30 to 90% R134a. Id. 2:19-29.

Pearson at 1:13-14 discloses domestic refrigerators and car air conditioning systems. Pearson at 1:36-39 teaches vapor compression refrigerators and refrigeration equipment. Pearson Id. 3:66 discloses a water chilling system.

A PHOSITA would thus produce the subject matter of claims 21-37 of the '179 Patent through routine experimentation starting from Pearson. Groll ¶202.

Pearson fails to explicitly disclose a cylinder and manifold (although using cylinders and manifolds for refrigerants is well known in the art). Pearson fails to explicitly disclose a cylinder and manifold (although using cylinders and manifolds for refrigerants is well known in the art). This lack is addressed by Goble Ex. 1008 7:45-48. See also Roberts Ex. 1019 3:44.

Pearson fails to disclose lubricants and additives. As noted above, Singh

teaches the additives claimed in the '179 Patent at Ex. 1011 ¶¶ 0021-0029. Singh ¶0012 discloses mineral oil and alkyl benzene oil. Moreover, Singh ¶0027 teaches a broadly defined "refrigeration system," Singh ¶0021-0029 and claim 4 teaches additives. Singh ¶0038 teaches refrigeration and heat pump applications as well as condensing and evaporating (phase change), Singh ¶0044 teaches a 2 ton air conditioner system.

Pearson and Singh fail to disclose that the lubricant is present up to about 20% by weight. This feature is addressed by Takigawa Ex. 1006 8:59-63.

Dr. Groll explains how Pearson applies to the independent claim 1 at ¶205. In brief:

No.	Limitation	Relevant Art - Pearson Ex. 1009
1.1	1. In an apparatus designed for use with chlorodifluoromethane refrigerant,	Peason Abstract.
1.2	the improvement comprising substituting the chlorodifluoromethane with a refrigerant composition designed to achieve a phase change,	Pearson Abstract.
1.3	the refrigerant composition comprising a combination of refrigerant gases, said refrigerant gases consisting of a blend of tetrafluoroethane and pentafluoroethane,	Pearson Abstract.
1.4	the ratio of the tetrafluoroethane to the pentafluoroethane being selected	Inherent; Groll ¶88. Since the "consisting" language

No.	Limitation	Relevant Art - Pearson Ex. 1009
	such that the blend exhibits a dew point at about -32º F or a bubble point at about -41.5 º F. at about one standard atmosphere of pressure,	excludes additional HFCs, the bubble point and dew point are specific to the claimed proportion of R125 and R134a. These numerical limitations would be inherent in the blend that Singh suggests.
1.5	wherein in the substitute refrigerant said pentafluoroethane is present in an amount of 59% to 57% by weight and said tetrafluoroethane is present in an amount of 41% to 43% by weight of the combined weight of the pentafluoroethane and tetrafluoroethane on the basis of the combined weights of said pentafluoroethane and said tetrafluoroethane totaling 100%,	Pearson 2:19-20,27-28.
1.6	and wherein the refrigerant composition further comprises non-refrigerant gas components, said non-refrigerant gas components including a lubricating oil,	Singh Ex.1011 at ¶ 0036
1.7	wherein the lubricating oil is present up to about 20% by weight of the refrigerant gases and is soluble in chlorodifluoromethane, tetrafluoroethane and pentafluoroethanes	Takigawa Ex. 1006 Claim 1(for 20%); Singh ¶18 for solubility.
1.8	wherein the lubricating oil is selected from the group consisting of mineral oil, synthetic alkyl aromatic lubricants, and mixtures thereof,	Singh ¶32 mineral oil, and alkylbenzene oil, which is a synthetic alkyl aromatic lubricant.
1.9	and the tetrafluoroethane is 1,1,1,2-tetrafluoroethane.	Pearson Abstract

The claim charts for independent claims 8, 15, 21, 26 and 31 are the same as

those set forth for Powell in the previous Section (VII)(C). For brevity, they are not reproduced here.

a. The dependent claims

As discussed in Section VII(A)(a), the dependent claims are either repetitive, a trivial removal of the term "about" or recitations of additives (exhaustively detailed in Singh) or equipment that are well known in the art.

The dependent claims thus do not further distinguish over the art any more than the independent claims.

A PHOSITA would thus achieve all the claims of the '179 Patent from a knowledge of Pearson, Goble, Singh and Takigawa via routine experimentation. Groll ¶209.

E. GROUND 5 – FEDERAL REGISTER AS PRIMARY REFERENCE

As is discussed in the section detailing prosecution history (Section (IV)(B)) and is set forth in great detail at Groll ¶¶9-22, the true priority date is no earlier that August 13, 2007, the date when the 58/42 R125/R134a proportions were added to the application by amendment.

Federal Register Ex 1018 was published on September 28, 2006, less than one year before the August 13, 2007 priority date. Federal Register is thus prior art under 35 U.S.C. § 102(e).

Federal Register at P. 2, first column teaches: "*R-421A is a blend of 48% by weight hydrofluorocarbon (HFC)-125 (pentafluoroethane VASID #354-33-6), and 425 by weight HFC-134a (1,1,1,2-tetrafluoroethane, CAS ID # 811-97-2).*" This reference thus encompasses all the R421 formulations claimed in the '179 Patent.

Federal Register at column 1 also discloses R421A being used in refrigerators, air conditioners, etc.

Federal Register fails to disclose lubricants and additives. It additionally fails to disclose a cylinder and manifold (although using cylinders and manifolds for refrigerants is well known in the art). Federal Register also fails to disclose 20% lubricating oil.

As noted above Goble, Singh, Roberts and Takigawa address these deficiencies.

A PHOSITA would thus achieve all the claims of the '179 Patent from a knowledge of Federal Register, Goble, Singh and Takigawa via routine experimentation. Groll ¶217.

F. GROUND 6 – ROBERTS AS PRIMARY REFERENCE

Roberts has a PCT publication date of June 7, 2001, which makes it prior art to the '179 Patent under pre-AIA 35 U.S.C. § 102(b).

Roberts pertains to refrigerant compositions. Roberts (Ex. 1019) 2:48-52 discloses a refrigerant composition containing 35-60 wt% R134A and 35-60 wt%

R125, which encompasses the 58/42 wt% proportions of R125/R134A of R421A. Roberts in Table 1 has a formulation that is 58.9% R125 and 40.1% R134A. Id. 4:11. This latter formulation is very close to the 58/42% proportion of R421A.

Interestingly, Fig. 1 of Roberts shows performance of R134A (balance R125) with a solvent that shows a steep drop in performance as the concentration of R134A goes above 42%:

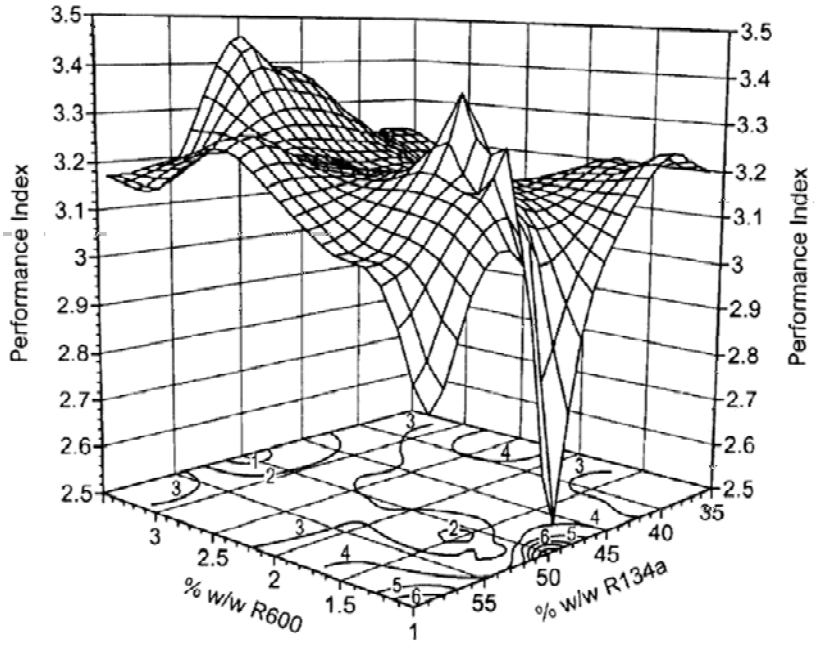


FIG. 1

Moreover, Fig 2 of Roberts shows performance of R134A (balance R125) with a solvent that has an inflection point hovering over 42%:

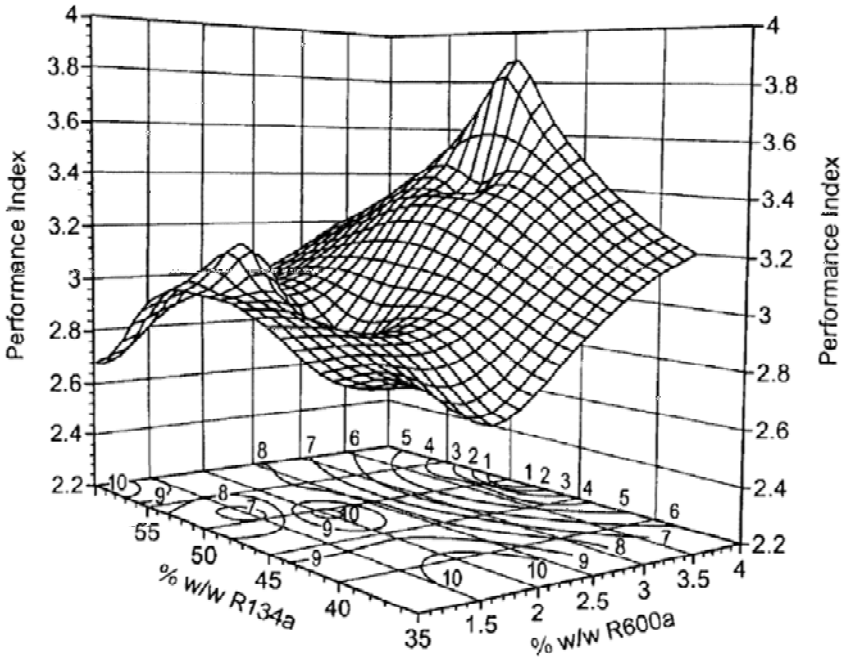


FIG. 2

The information in these graphs would point a PHOSITA in the direction of the 58/42 R125/R134A proportion of R421A. Groll ¶222.

Roberts Id. 1:2-6 discusses replacements in refrigeration equipment For R12 and R22. Ex. 1019 at 1:2-6, lubrication oils, 3:9-20, additives, 3:21-27, and charging from a cylinder, 3:44-45.

Any failures of Roberts are addressed by the secondary references of Goble, Singh and Takigawa, as discussed above in Section VII(A)(a).

A PHOSITA would thus achieve all the claims of the ‘179 Patent from a knowledge of Roberts, Goble, Singh and Takigawa via routine experimentation. Groll ¶225.

G. GROUND 7 – LEMMON AS PRIMARY REFERENCE

Lemmon, entitled "Equations of State for Mixtures of R-32, R-125, R-134a, R-143a, and R-152a," was published on August 30, 2002, more than one year before the filing date of the provisional application of the '179 Patent. Lemmon is thus prior art under 35 U.S.C. § 102(b).

In Table 4, Ex 1020 at P. 27, Lemmon summarizes studies published on mixtures of R125 and R 134a, where ranges of R125 (balance R134a) were studied including mole fractions of R125 of 0.349-0.719, 0.0865-0.923, 0.250-0.751, 0.179-0.776, 0.259-0.649, 0.0001-0.813, 0.254-0.749, 0.0865-0.923, 0.222-0.718, and 0.348-0.693.

All the above mole fractions of R125 (balance R134a) encompass the 0.545 R125 and 0.455 R134a mole fractions of R421A.

Lemmon teaches bubble point and dew point can be calculated. Id. at 2. Moreover, these properties are inherent to R421A.

Lemmon fails to disclose lubricants and additives. Lemmon additionally fails to disclose a cylinder and manifold (although using cylinders and manifolds for refrigerants is well known in the art). Lemmon also fails to disclose 20% lubricating oil.

However, as noted above Goble, Singh, and Takigawa address these deficiencies. The invalidity of the dependent claims is discussed in Section

VII(A)(a).

A PHOSITA would thus achieve all the claims of the '179 Patent from a knowledge of Lemmon, Goble, Singh and Takigawa via routine experimentation. Groll Ex. 1013 ¶232.

VIII. RELIEF REQUESTED

For the foregoing reasons, and as further attested to by Dr. Groll in ¶¶268-271 of his Declaration explaining why the claimed subject matter was an utterly routine application of the prior art by a PHOSITA before the alleged invention was made, with expected results, *Inter Partes* review and cancellation of claims 1-37 of U.S. Patent No. 9,982,179 and cancellation of claims 1-37 is respectfully requested.

DATED: September 22, 2020

Respectfully submitted,

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CERTIFICATE OF SERVICE

The undersigned hereby certifies, pursuant to 37 C.F.R. §§ 42.6(e) and 41.105, that a complete copy of the foregoing Petition for *Inter Partes* Review of U.S. Patent No. 9,982,179, along with all exhibits and other supporting documents, are being served via FedEx on September 24, 2020, upon the patent owner or the patent owner's attorneys of record for the patent at the following addresses:

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