IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE PATENT TRIAL AND APPEAL BOARD

In Re: U.S. Patent No. 9,982,179

Filed: June 11, 2012

Issued: May 29, 2018

DYNATEMP INTERNATIONAL, INC. and
FLUOROFUSION SPECIALTY CHEMICALS, INC.,
Petitioner,

v.

R 421A LLC,
Patent Owner.

Case No. IPR2020-01660
U.S. Patent No. 9,982,179

DECLARATION OF DR. DONALD BIVENS

I, Dr. Donald Bivens, hereby declare and state as follows:

I. Introduction

1. I have been retained by counsel for Patent Owner R 421A, LLC, as an expert witness in connection with the petition for *inter partes* review IPR2020-01660 ("the Petition" or "this IPR") of U.S. Patent No. 9,982,179 ("the '179 Patent") filed by Dynatemp International, Inc. ("Dynatemp") and Fluorofusion Specialty Chemicals, Inc. ("Fluorofusion" and, collectively, "Petitioners").

2. I am being compensated at a rate of $350 per hour for my review, analysis, and opinions regarding this matter. I am also being reimbursed for reasonable and customary expenses associated with my work. My compensation is not contingent on the outcome in this matter or the specifics of my statements and opinions.

II. Background and Experience

3. I received a Bachelor of Science degree in chemical engineering from the University of Tennessee in 1962. I received a master's degree and a doctorate degree from the Georgia Institute of Technology in 1963 and 1966, respectively.

4. I have decades of practical experience working with refrigerants. I was employed at DuPont de Nemours, Inc. ("DuPont") in 1966, and my employment at DuPont continued until 2009. I held technical and managerial positions at DuPont in plastics, fiber intermediates, and fluorochemicals. My work

with fluorochemicals extended from 1981 to 2009 and included process technology management and the research and development of new refrigerants as alternatives to chlorofluorocarbon ("CFC"), hydrochlorofluorocarbon ("HCFC"), and hydrofluorocarbon ("HFC")refrigerants.

5. I have served a number of different positions for professional associations, trade associations, and standards-setting organizations, including the American Society of Heating, Refrigerating, and Air Conditioning Engineers ("ASHRAE") and the Air Conditioning, Heating, and Refrigeration Institute ("AHRI"). I have served as Chair of the ASHRAE Refrigerants Committee, as Chair of the ASHRAE Refrigerants Thermophysical Properties Subcommittee, as Chair of the ASHRAE Refrigerants Research Subcommittee, as Chair of the ASHRAE SSPC34 Designations and Nomenclature Subcommittee, and as Member of the Air Conditioning and Refrigeration Institute ("ARI") Alternative Refrigerants Evaluation Program, among other positions.

6. I have participated in technology evaluation teams for the National Institute of Standards and Technology ("NIST") refrigerant programs and the Oak Ridge National Laboratory ("ORNL") buildings technology programs. Since 2009, I have also served on three Department of Energy Merit Review Committees, evaluating research proposals for improving the energy efficiency of buildings.

7. I have received many awards and honors for my decades of work in the field of refrigerants, including the R.C. Schulze Award for distinguished service from AHRI, the Distinguished Service Award from ASHRAE, a DuPont Company award from DuPont for the development of new refrigerant alternatives, and the Hero of Chemistry award from the American Chemical Society ("ACS") for the development of new alternative refrigerant blends. I was also cited by the Intergovernmental Panel on Climate Change ("IPCC") for contributing to the award of the Nobel Peace Prize in 2007 for my work in the field, among other honors.

8. I have prepared many publications and conducted many presentations related to refrigerant alternatives during my decades of experience. As just one example, I was the lead author for Chapter 4 of the IPCC Working Group III report, titled "Safeguarding the Ozone layer and the Global Climate System." I have worked with refrigeration and air conditioning companies, industry groups, and academic and governmental laboratories to facilitate the safe and environmentally sustainable application of new refrigerants.

9. I am a named inventor on dozens of U.S. and foreign patents directed to refrigerants and related refrigerant and air conditioning systems. I have also acted as an expert consultant in connection with a number of other patent disputes in the United States.

10. Additional details and examples of my work in the field of refrigerants and related refrigerant and air conditioning systems are listed on my Curriculum Vitae, which is attached at the end of this Declaration as Appendix A.

III. Legal Standards

11. In expressing my opinions herein, I have relied upon certain basic legal principles that have been explained to me by counsel.

12. I understand that for an invention claimed in a patent to be patentable, it must be, among other things, new and not obvious from what was known before the invention was made.

13. I understand that materials that can be used to evaluate whether an invention is new and not obvious is generally referred to as "prior art" and includes patents and printed publications (*e.g.*, books, journal and magazine publications, articles on websites, product manuals, *etc*.).

14. I understand that, in this IPR, the claims of the '179 Patent are to be interpreted and construed according to the plain and ordinary meaning as understood by one having ordinary skill in the art in light of the Specification of the '179 Patent. After being interpreted, the claims can then be compared to the prior art.

15. I understand that there are two ways in which the prior art may render a claim of a patent unpatentable. First, the prior art can "anticipate" the claim.

Second, the prior art can demonstrate the claim to have been "obvious" to a person of ordinary skill in the art at the time of the invention.

16. For a patent claim to be "anticipated" by the prior art under 35 U.S.C. § 102, I understand that each and every element or limitation of the claim must be found, expressly or inherently, in a single prior art reference.

17. I understand that a patent claim is obvious and not patentable under 35 U.S.C. § 103 if it would have been obvious to a person of ordinary skill in the field of the invention at the time the invention was made.

18. I understand that the standard for obviousness is defined in 35 U.S.C. § 103(a), as follows:

> A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

19. I understand that the obviousness inquiry should not be done in hindsight, but through the perspective of a person of ordinary skill in the art as of the date of the patent claim.

20. I understand that, to find a patent claim obvious, one must conduct certain factual inquires, referred to as the "Graham factors," regarding the claimed

invention and the prior art, as follows: (A) determining the scope and content of the prior art; (B) ascertaining the differences between the claimed invention and the prior art; and (C) resolving the level of ordinary skill in the pertinent art.

21. I also understand that certain objective evidence may be relevant to the obviousness inquiry. I understand that objective factors indicating non-obviousness, sometimes referred to as "secondary considerations," include evidence of commercial success, long-felt but unsolved needs, failure of others, and unexpected results. I understand that the weight to be given to such evidence is considered on a case-by-case basis. I understand that the mere presentation of such evidence does not mean that it is dispositive of the issue of obviousness.

22. I understand that 35 U.S.C. § 112, first paragraph, states:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same, and shall set forth the best mode contemplated by the inventor of carrying out his invention.

23. For a patent claim to meet the written description requirement of 35 U.S.C. § 112, first paragraph, I understand that the specification must describe the claimed invention in enough detail that one skilled in the art can reasonably conclude that the inventor had possession of the claimed invention at the time of

filing the specification. I also understand that the specification can provide written support for the claimed invention in various ways, including through written description (*i.e.*, written text), data presented various formats, drawings and figures, sequence listings, and other forms of description.

IV. Materials Considered

24. My opinions to date are based on my years of experience and my review of certain materials. In forming my opinions, I have reviewed the Petition (Paper 4), the '179 Patent (EX1001), U.S. Provisional Application Serial No. 60/501,049 (EX1015), filed September 8, 2003 ("the '049 Provisional"), and the Declaration of Dr. Eckhard Groll, dated September 21, 2020 (EX1013)("the Groll Declaration").

25. My review of the materials in this IPR is ongoing, and I will continue to review any new material(s) as provided. This report represents only those opinions I have formed to date for the purposes of Patent Owner's Preliminary Response in this IPR. I reserve the right to update and expand upon my opinions stated herein, particularly if this IPR is instituted by the Board, based on other relevant materials identified by me, Dr. Groll, and the parties for consideration in this IPR. I may rely upon these materials and/or additional materials to respond to arguments raised by Petitioners. I may also consider additional documents and information in forming my opinions, including documents that may not yet have

been provided to me. Thus, I reserve the right to revise, supplement, and/or amend my opinions stated herein based on new information and on my continuing analysis and review of the materials identified herein.

V. Level of Skill in the Relevant Art

26. Based on my experience and review of the '179 Patent, I believe that a person of ordinary skill in the art of the field to which the '179 Patent is directed would have had at least a Bachelor of Science degree in chemistry, chemical engineering, or a related field or, as a substitute, at least three years of work or research experience in refrigerant formulation.

VI. Overview of the '179 Patent

27. Chlorodifluoromethane is a hydrochlorofluorocarbon ("HCFC") and is also known as HCFC-22, R-22, or CHClF2. R-22 was commonly used as a propellant and refrigerant, but R-22 is banned for production and importation into the United States today. R-22 was once used as a refrigerant in residential air conditioners, refrigerators, freezers, window air conditioning units, and other systems as an alternative to the very highly ozone-depleting chlorofluorocarbon ("CFC") CFC-11 and CFC-12 compounds. However, R-22 also contributes to the depletion of the Earth's ozone layer, and even the lower ozone depletion potential of R-22 is no longer considered acceptable.

28. I understand that the ban on the production and import of R-22 in the United States was effective as of January 1, 2020. The continued servicing of R-22-based refrigerant systems now relies upon recycled or stockpiled quantities of R-22, to the extent available, unless those R-22-based refrigerant systems are charged with a suitable replacement refrigerant or refrigerant blend.

29. Owners and operators of R-22-based air conditioning, refrigeration, and freezer systems have no choice at this time other than to obtain reclaimed R-22 or to seek replacement refrigerants, as the remaining stockpile of R-22 is diminished in the United States. Thus, service technicians have already started to retrofit existing R-22-based systems with new, non-R-22 refrigerants.

30. The '179 Patent is titled "Refrigerant with Lubricating Oil for Replacement of R22 Refrigerant." The '179 Patent is directed to a "substitute refrigerant [that] has a temperature-pressure relationship similar to that of [R-22] chlorodifluoromethane, making the substitute refrigerant suitable for use with chlorodifluoromethane-based air-cooling systems." EX1001, Abstract. The substitute refrigerant can be "mixed with a relatively small percentage of a lubricating oil which is compatible with both the unit refrigerant and typical R-22 system design." *Id*.

31. The invention of the '179 Patent offers a number of benefits. According to the '179 Patent, "[i]t is expected that the present invention will

gradually replace Refrigerant R-22 (chlorodifluoromethane) in Refrigerant R-22 (chlorodifluoromethane)-based air-cooling systems, without the need to retrofit existing Refrigerant R-22 (chlorodifluoromethane)-based systems for non-Refrigerant 22 replacement refrigerants." *Id*., at 6:58-63.

32. The ability to replace R-22 in R-22-based refrigerant systems with less (or sometimes no) need for mechanical alterations, flushing refrigerant lines, adding alternative lubricants, or taking other steps is a significant benefit.

33. The invention of the '179 Patent can be "utilized to replace Refrigerant R-22 ... that has escaped from [R-22-based refrigerant systems]" and also "utilized to completely refill apparatus that have been designed for use with Refrigerant R-22 ... , since the refrigerant has a temperature-pressure profile that closely approximates that of Refrigerant R-22." EX1001, 5:7-14.

34. The invention of the '179 Patent also offers benefits attributable to the inclusion of a lubricating oil. According to the '179 Patent, "[t]he lubricating oil of the present system is miscible with the pentafluoroethane and tetrafluorethane blend and with R-22 refrigerant" (*id*., 6:4-6), meaning that it mixes with the both the new substitute refrigerant blend and also with the R-22 refrigerant it replaces, without separation.

35. Turning to the claims of the '179 Patent, Claims 1 and 21 are directed to an apparatus in which R-22 is substituted with a refrigerant composition

consisting of a ratio of R-125 (pentafluoroethane) and R-134a (tetrafluoroethane). *Id*., 10:1-30 & 12:9-27. Claims 8 and 26 are directed to a method of refilling an apparatus designed for use with R-22 with a refrigerant composition consisting of a ratio of R-125 and R-134a, wherein the tetrafluoroethane is 1,1,1,2-tetrafluoroethane. *Id*., 10:50-11:16 & 12:40-65. Claims 15 and 31 are directed to a refrigerant composition consisting of a ratio of R-125 and R-134a, wherein the tetrafluoroethane is 1,1,1,2-tetrafluoroethane. *Id*., 11:35-58 & 13:10-14:3.

36. The refrigerant composition in independent Claims 1, 8, 15, 21, 26, and 31 consists of "pentafluoroethane ... in an amount of 59% to 57% by weight" and "tetrafluoroethane ... 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%." *Id*., 10:13-20 & 60-68; 11:43-50; 12:20-26 & 50-58; 13:16-14:2. This refrigerant blend fits ASHRAE's definition of R-421a. Dependent Claims 5, 12, 18, 25, 30, and 35 further narrow the refrigerant compositions to "pentafluoroethane ... present in the ratio of about 58% by weight to said tetrafluoroethane present in an amount of about 42% by weight."

37. Claim 1 of the '179 Patent also recites that "the ratio of the tetrafluoroethane to the pentafluoroethane [is] selected such that the blend exhibits a dew point at about -32˚F or a bubble point at about -41.5˚F," and the other

independent Claims 8, 15, 21, 26, and 31 identify the same characteristics. *Id*., 10:1-14:21.

38. Claim 1 of the ’179 Patent also recites “lubricating oil ... present up to about 20% by weight of the refrigerant gases,” which is soluble in [R-22] chlorodifluoromethane, [R-134a] tetrafluoroethane and [R-125] pentafluoroethane.” *Id*., 10:23-26. Claims 8 and 15 recite a similar lubricating oil. *Id*., 11:9-13 & 52-55. The benefits attributable to the lubricating oil are discussed below.

VII. Scope of Opinions to Date

A. Introduction

39. In my years of experience in refrigerant formulation, I have found that the development of refrigerants includes regulatory, technical, safety, efficiency, and practical considerations and concerns. I spent years working with precise amounts of hydrocarbons, such as methanes, ethanes, propanes, and other organic and inorganic compounds, among other components, to form zeotrope and azeotrope refrigerant blends.

40. The refrigerants and refrigerant blends I worked with evaporate at many different temperatures (and across temperature ranges). The refrigerants and refrigerant blends are typically used and characterized under pressure at temperature ranges from -60˚F to 200˚F.

41. I would not have overlooked even one refrigerant gas component in the development of a new refrigerant gas blend. My experience has been that every single refrigerant component, even in very small amounts, impacts the characteristics and properties of the resulting refrigerant blend.

B. Written Support for the '179 Patent in the '049 Provisional

42. I see that the refrigerant composition claimed by the '179 Patent consists of R-125 "in an amount of 59% to 57% by weight" and R-134a "in an amount of 41% to 43%," or a narrower range of those components. EX1001, 10:1-14:21. The ratio of the R-125 and the R-134a in the refrigerant composition is also "selected such that the blend exhibits a dew point at about -32˚F or a bubble point at about -41.5˚F." *Id*.

43. Based on my review of the '049 Provisional, I see that it describes characteristics exhibited by the refrigerant blend claimed by the '179 Patent. Among other characteristics, the '049 Provisional describes a refrigerant composition in which a ratio of R-125 and R-134a is selected such that the blend exhibits a dew point at about -32˚F and/or a bubble point at about -41.5˚F, claimed by the '179 Patent. Those dew point and bubble point characteristics are present only in a refrigerant blend of R-125 and R-134a if the R-125 is included "in an amount of 59% to 57% by weight" and the R-134a is included "in an amount of 41% to 43%," or a narrower range of those components. Thus, I believe that a

person of ordinary skill in the art would reasonably conclude that the inventors of the ’179 Patent had possession of the refrigerant composition claimed by the ’179 Patent as of the filing date of the ’049 Provisional on September 8, 2003.

44. I see that the ’049 Provisional states:

> This invention shows the following points of interest concerning this blend for the
>
> Dew Point @ -32F
>
> Bubble Point @ -41.5F
>
> Glide @ 9.5 F

(EX1015, 14).

45. The dew point of -32˚F and the bubble point of -41.5˚F in a two-component refrigerant blend consisting of R-125 and R-134a can be found, according to Raoult’s Law, only for the ratio of R-125 and R-134a claimed by the ’179 Patent (*i.e.,* within a ratio consisting of R-125 “in an amount of 59% to 57% by weight” and R-134a “in an amount of 41% to 43%” or a narrower range of those components).

46. I have confirmed the statement in ¶ 45 by calculations using the National Institute of Standards and Technology (“NIST”) Reference Fluid Thermodynamic and Transport Properties (“REFPROP”) Standard Reference Database 23 computer program, version number 10.0.

47. Dr. Groll has also confirmed the statement in ¶ 45 by Raoult’s Law. EX1013, ¶¶84-88, 88 (stating that “the -32˚F dew point and the -41.5˚F bubble

point recited in the claims of the'179 Patent are inherent properties of the R421A formulation.").

48. The reverse blend of 41% to 43% R-125 and 59% to 57% R-134a does not exhibit the dew point and bubble point characteristics described in the '049 Provisional. The reverse blend instead exhibits a -26˚F dew point and a -35.2˚F bubble point.

49. I have confirmed the statement in ¶ 48 by calculations using the National Institute of Standards and Technology ("NIST") Reference Fluid Thermodynamic and Transport Properties ("REFPROP") Standard Reference Database 23 computer program, version number 10.0.

50. I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information or belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code.

Dated: January 21, 2021

Respectfully submitted,

By Dr. Donald Bivens
Dr. Donald Bivens