

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

SMAXTEC INC. and
SMAXTEC ANIMAL CARE GMBH,
Petitioners

v.

ST REPRODUCTIVE TECHNOLOGIES, LLC,
Patent Owner

Case IPR2024-00885
Patent No. 8,823,515

DECLARATION OF TIMOTHY J. BOWSER, PH.D.

TABLE OF CONTENTS

I.	INTRODUCTION	1
II.	QUALIFICATIONS AND BACKGROUND.....	3
III.	MATERIALS CONSIDERED	7
IV.	LEGAL PRINCIPLES APPLIED.....	7
A.	Person of Ordinary Skill in the Art.....	7
B.	Claim Construction.....	9
C.	Anticipation	9
D.	Obviousness.....	10
E.	Public Accessibility of a Reference.....	11
V.	THE '515 PATENT.....	11
A.	The Patent Specification.....	11
B.	The Challenged Claims	15
VI.	CLAIM INTERPRETATION	17
VII.	SUMMARY OF THE ASSERTED ART.....	17
A.	Trevarthen (Ex. 1005)	17
B.	Laitinen (Ex. 1006).....	21
C.	Additional References	27
VIII.	PUBLIC ACCESSIBILITY OF TREVARTHEN.....	27
A.	Trevarthen Was Not Available by Keyword Searching Internet Search Engines	28
B.	The Munford Declaration.....	39
C.	The Wayback Machine Archives.....	41
D.	The International Search Report	42
IX.	GROUND 1 – ANTICIPATION OR OBVIOUSNESS OF CLAIMS 1–2 BASED ON TREVARTHEN	44
A.	General Comments on Petitioners’ “Anticipation or Obviousness” Ground.....	44
B.	Elements 1[E] and 1[F]: Inserting “Logical Variables” Incorporating “an Amount of Milk Production Information or an Amount of Days Milked” into a “Logical Expression”	47
1.	Trevarthen’s Discussions of Milk Meters and Milk Production	47
2.	Trevarthen Does Not Disclose Elements 1[E] and 1[F]	52

3.	Trevarthen Does Not Render Obvious Elements 1[E] and 1[F].....	54
C.	Element 1[A]: “Connecting a Computer to an RFID Device Reader”	57
D.	Element 1[B]: “Reading an RFID Device Implanted in an Animal With Said RFID Device Reader”	61
E.	Element 1[C]: “Retrieving an Amount of Animal Identification Information From Said RFID Device Implanted in an Animal”	63
X.	GROUND 2 – OBVIOUSNESS OF CLAIMS 3–4 BASED ON TREVARTHEN AND BRUNE	63
XI.	GROUND 3 – OBVIOUSNESS OF CLAIMS 15–25 BASED ON TREVARTHEN AND ROLLINS	64
XII.	GROUND 4 – OBVIOUSNESS OF CLAIMS 1–2 BASED ON LAITINEN, BUCHANAN, AND LIAO.....	65
A.	Elements 1[E] and 1[F]: POSAs Would Have Had No Reason to Include “An Amount of Milk Production Information or an Amount of Days Milked” in the Alleged “Logical Expressions”	65
B.	Element 1[B]: “Reading an RFID Device Implanted in an Animal With Said RFID Device Reader”	77
C.	Element 1[C]: “Retrieving an Amount of Animal Identification Information from Said RFID Device Implanted in an Animal”	84
XIII.	GROUND 5 – OBVIOUSNESS OF CLAIMS 3–4 BASED ON LAITINEN, BUCHANAN, LIAO, AND BRUNE	85
XIV.	GROUND 6 – OBVIOUSNESS OF CLAIMS 3–4 BASED ON LAITINEN, BUCHANAN, LIAO, AND ROLLINS.....	86
XV.	CONCLUSION.....	87

I. INTRODUCTION

1. My name is Dr. Timothy J. Bowser. I have been retained by ST Reproductive Technologies, LLC (the “Patent Owner” or “ST Repro”) as an independent expert consultant in this proceeding before the United States Patent and Trademark Office. I have served as an expert in *inter partes* review (“IPR”) proceedings in IPR Case No. 2016-01435, *Henny Penny Corp. v. Frymaster LLC*, United States Patent & Trademark Office before the Patent Trial and Appeal Board.

2. As a sub-contractor to United Expert Holdings, LLC d/b/a Round Table Group (“RTG”), I was retained in this matter by ST Repro to provide analysis, opinions, and observations regarding animal management and tracking, including in relation to U.S. Patent No. 8,823,515 (the “’515 Patent”) and IPR2024-00885. RTG is being compensated at the rate of \$405 per hour for my work, of which I receive \$250 per hour, which is my standard consulting rate. RTG is also being compensated at the rate of \$375 per hour for my travel time (five hour minimum), of which I receive \$250 per hour. My fee is not contingent on the outcome of this matter or on any of the positions I have taken, as discussed below. Although I am being compensated at my standard consulting rate for the time I spend on this matter, I have no personal financial interest in any of the entities involved in this proceeding, and my compensation does not depend in any way on my testimony, my conclusions, or the outcome of this proceeding.

3. For this declaration, I have been asked to review and respond to statements made in the Petition filed in IPR2024-00885 and to the opinions provided in the Declaration of Tami M. Brown-Brandl, Ph.D (Ex. 1003) filed in connection with the Petition. I understand Dr. Brown-Brandl is the expert witness engaged on behalf of Petitioners. I have also been asked to consider and provide my opinions regarding the references Petitioners assert against the '515 Patent, and to compare those references to the claims of the '515 Patent that have been challenged in the Petition. I have also been asked to consider and provide opinions regarding the public accessibility of one of Petitioner's references, Ex. 1005 ("Trevarthen"). My opinions and the basis for those opinions are outlined below. The testimony I may provide about scientific principles relating to my analysis and opinions includes subjects relating to, for example, herd management, animal monitoring, and the use of radiofrequency devices in such activities.

4. I reserve the right to revise or supplement my opinions if additional information makes either appropriate, or if Petitioners or Dr. Brown-Brandl revise or supplement their allegations or opinions.

5. A list of the documents and material I have considered in developing my opinion can be found in the Appendix below.

II. QUALIFICATIONS AND BACKGROUND

6. Attached as Exhibit 2002 is my curriculum vitae, incorporated by reference within this declaration. The following is a brief summary of my qualifications.

7. I received a Bachelor of Science (B.S.) degree in Agricultural Engineering from The Pennsylvania State University in May 1984. I then received a Master of Science (M.S.) degree in Agricultural Engineering from The Pennsylvania State University in December 1986. I further received a Doctorate (Ph.D.) in Agricultural Engineering from The University of Tennessee in May 1994, with my thesis titled “Thin film drying on a permeable surface.” I am also a Professional Engineer in the State of Oklahoma (registration number 19992) and the State of Texas (registration number 145885).

8. In October, 1986, I joined the Gerber Products Company as an Assistant Process Engineer in their R&D department in Fremont Michigan. Later in 1988, I moved to their flagship plant in Fort Smith, Arkansas as a Process Engineer. The Gerber Products Company was at the forefront of the industry in product quality and safety. At Gerber, I learned the critical nature of traceability in the food system, which refers to the ability to trace an item’s history, application, use, and location, or its characteristics through recorded identification data. RFID technology and

methods can be used to capture such traceability data. Gerber was a pioneer of ingredient and product traceability.

9. After receiving my Ph.D. in May 1994, I worked as an Engineering Consultant at Lockwood Greene Engineers in Spartanburg, South Carolina until December 1996. At Lockwood Greene, I served in the process engineering department in their food and pharmaceutical group. I was a Consulting Engineer with responsibilities for the design and layout of food processes and facilities and how they interfaced with plant utilities and services. The traceability of food and pharmaceutical ingredients and products were an important aspect of my daily work.

10. Since January 1997, I have worked for Oklahoma State University in Stillwater, Oklahoma in various roles in the university's Biosystems and Agricultural Engineering department. Specifically, from June 2004 until May 2012, I was an Associate Professor, where I worked in the Robert M. Kerr Food & Ag Products Center (FAPC). The FAPC was built and staffed to help add value to agricultural products grown and processed in Oklahoma. I assisted clients with the engineering development of their food and agricultural processes and facilities. I developed food processing equipment and methods, including a patented size-reduction and separation device. I also and taught and advised industrial clients through workshops and on-site visitation and graduate students on and off campus. Traceability has consistently been an important component of my work at Oklahoma State. Due to

the importance of animal production to the State (beef, pork and chicken), development and use of animal traceability has been essential. FAPC has its own abattoir and further process facilities that have always included identification and traceability systems for animals and animal products.

11. Since June 2012, I have been a Professor in Oklahoma State's Biosystems and Agricultural Engineering department. I continued to work in FAPC, expanding my knowledge and industry experience, including with respect to animal management and tracking and the use of RFID technology.

12. Moreover, in May 2003, I co-founded a company called PetMech, LLC in Stillwater, Oklahoma. PetMech makes a business of developing, pilot producing, and testing pet products, including chews, treats, and accessory products. Since 2015, PetMech began using "smart collars" in pet and animal studies where physiological data of the animal was sensed, recorded, and wirelessly communicated from the collar to a remote computer for long-term recording and analysis. Data collected included pulse, temperature, and movement. The information was used to study the use and efficacy of animal products.

13. I have significant experience researching and evaluating RFID tracking and sensor systems. Since 1997, at Oklahoma State's FAPC, I have continuously worked with the personnel at the FAPC, the Animal and Food Sciences Department, Biosystems Engineering, outside vendors, and consultants to develop traceability

systems for livestock, carcasses and meat products. From 2011 to 2014 I served as Co-Principal Investigator, along with Dr. Mike Buser, on a grant funded by the USDA-NIFSI. We studied the advancement of a whole-chain, stakeholder-driven traceability system for agricultural commodities that focused on beef and relied on RFIDs, sensor technologies, mobile devices, social media, and data management systems. In 2013, I coauthored a presentation about a stakeholder-driven whole-chain traceability system for beef cattle. In 2015, I coauthored an overview of our whole chain traceability system for beef that was presented to The China Agricultural University. In 2017, I coauthored a fact sheet on how traceability is used in beef carcass processing. My experience with dairy operations began in 1997 when I joined FAPC. Oklahoma has a significant dairy industry and I have been involved with dairy projects spanning the range of growing feed, processing feed, dispensing feed, milking, parlor design, refrigeration, pasteurizing systems, cleaning systems, fluid milk, ice cream, spreads, yogurt, cheese, and meat. Operations ranged in size from over 14,000 milking heads to as few as 50. I have taught workshops on dairy herd management and cheese-making internationally.

14. I am the inventor or co-inventor on 1 issued United States patent and one U.S. Provisional Patent Application. A full list of my publications, patents, and patent applications is included in Exhibit 2002.

III. MATERIALS CONSIDERED

15. My opinions are based on my years of education, research and experience, as well as my investigation and study of relevant materials. In forming my opinions, I have considered the materials I identify in this declaration and those listed in the Appendix below.

IV. LEGAL PRINCIPLES APPLIED

A. Person of Ordinary Skill in the Art

16. Some of my opinions refer to the perspective of one of ordinary skill in the art (“POSITA” or “POSA”) at the time of the invention. I understand Petitioners and Dr. Brown-Brandl define a POSA as having, as of the claimed priority date, “at least a bachelor’s degree in animal science, biological engineering, electrical engineering, or computer science, or a related or equivalent field, and three or more years of experience researching, developing, designing and/or evaluating RFID tracking and sensor systems for livestock management.” Pet. at 6; Ex. 1003 ¶ 24. At ST Repro’s request, I have adopted and applied that definition herein solely for purposes of this proceeding, with the understanding that neither ST Repro nor I have undertaken an analysis of its accuracy, and that we both reserve the right to revisit its accuracy at a later date if necessary. I consider myself an expert in this area.

17. Dr. Brown-Brandl further states:

I have been asked by counsel to consider the perspective of a POSA one year before the earliest September 15, 2009 filing date, September

15, 2008. My opinion is, however, that the knowledge of the POSA relating to the technology claimed in the '515 patent was not significantly different in September 2008 versus September 2009.

Ex. 1003 ¶ 27, n. 1. I have also considered the perspective of a POSA as of September 15, 2008, in forming my opinions.

18. Dr. Brown-Brandl further states:

The POSA prior to September 2008,¹ would have routinely searched for scientific literature in library catalogs or online journals. The POSA prior to September 2008 would have also used internet search engines, such as Google, Google Scholar, Yahoo, and Scopus to locate relevant literature. I personally used such methods to identify relevant literature prior to September 2008, and continue to do so. The POSA prior to September 2008 would have searched for numerous types of sources, including, for example, scholarly peer-reviewed journal articles, theses, dissertations, conference publications and abstracts, textbooks, and articles.

Ex. 1003 ¶ 27 (footnote omitted).

19. To the extent Dr. Brown-Brandl's statement is intended to suggest that POSAs would have found every reference that she relies on in her declaration, I disagree. In particular, as explained in Section VIII, I have not seen sufficient evidence showing that a POSA would have found Trevvarthen.

B. Claim Construction

20. I understand that the terms of a claim must be interpreted or “construed” and that, after such construction, the claims are then compared to the prior art for purposes of determining anticipation and/or obviousness.

21. I understand that patent claim terms are given their ordinary and customary meaning as would be understood by one of ordinary skill in the art. I further understand that the ordinary and customary meaning always applies unless a different meaning is clearly indicated by the patentee (such as by an express definition of a term in the patent specification or clear disclaimer of subject matter during prosecution).

22. Also, I understand that in determining the ordinary and customary meaning, the term should be read in light of “intrinsic” evidence, namely the patent specification and prosecution history. If intrinsic evidence is not sufficient to inform a person of skill of the ordinary and customary meaning of a term, “extrinsic” evidence may be consulted (e.g., a dictionary).

C. Anticipation

23. I understand that for a patent claim to be invalid as anticipated, a single piece of prior art must disclose each and every element of the claim, arranged in the same manner as claimed. I further understand that, where a prior art reference does not disclose a particular element of a claim, it can still anticipate if the missing

element is “inherent” in the prior art reference, meaning that it is necessarily present in or is the natural result of the elements explicitly disclosed by the prior art. I further understand that inherency requires more than just the missing material being probably present or possibly present in the prior art.

D. Obviousness

24. I understand that obviousness is assessed from the view of a person of ordinary skill in the relevant art at the time the invention was made. I understand that the prior art does not need to render obvious every possible embodiment within the scope of the claim. I further understand that in determining whether a patent claim is invalid because of obviousness, one must consider the scope and content of the prior art, the differences between the prior art and the claimed invention, and the level of ordinary skill in the art. To make these assessments, I understand that surrounding circumstances, like “objective indicia” or “secondary considerations” should be evaluated.

25. I understand that an invention may be obvious because a skilled artisan pursues known options from a finite number of identified, predictable solutions, or because the claimed improvement is nothing more than the predictable use of prior art elements according to their established functions. I understand that a claim is obvious if the person of ordinary skill in the art was motivated or had reason to combine the teachings of the prior art with a reasonable expectation of success. And

I understand that obviousness does not require absolute predictability of success; only a reasonable expectation.

E. Public Accessibility of a Reference

26. I understand that petitioners have the burden of establishing that a reference qualifies as a prior art “printed publication.” I further understand that, for each reference they assert, petitioners must identify evidence sufficient to establish a reasonable likelihood that the reference was “publicly accessible” before the critical date of the challenged claims, and a reference is considered publicly accessible if it was disseminated or made available to the extent that persons interested and ordinarily skilled in the subject matter or art, exercising reasonable diligence, can locate it. I further understand that assessing public accessibility involves a case-by-case assessment of the facts.

V. THE ’515 PATENT

A. The Patent Specification

27. The title of the ’515 Patent is “Computer Implemented Animal Management System.” Ex. 1001. I understand the patent was filed as a “PCT” application on September 14, 2010 and issued on September 2, 2014. *Id.* The patent claims the benefit of to Provisional Patent Application No. 61/276,723, filed on September 15, 2009. Based on the date of the provisional application, I have used September 15, 2009 as the date of the invention throughout this declaration.

However, as noted in Section IV.A above, I have also considered the perspective of a POSA as of September 15, 2008. My opinions herein are the same for either date.

28. The Abstract of the '515 Patent explains that the patent relates to “a computer implemented animal management program having modules which function to match animal information retrieved from a radiofrequency identification device(s) implanted in an animal(s) with animal information retrieved from a database of at least one computer to assess animal condition and time treatment events.” Ex. 1001 at Abstract. The Technical Field of the patent similarly relates to “a computer implemented animal management method which matches animal information retrieved from a radiofrequency identification device implanted in an animal with animal information retrieved from a database of at least one computer.” *Id.* at 1:13–18.

29. The Background of the '515 Patent also describes two significant problems in the prior art, namely:

A significant problem with RFID devices can be that the memory in which data can be stored is limited. As a non-limiting example, the 128 bit ROM above-described can only store one unique 38 digit identification number. Understandably, as the number of bits which can be encoded on a RFID increases so does the cost and the size of the RFID. Accordingly, the ROM of RFID devices utilized for tracking, locating and identification of goods remains between 100 and 200 bits

and certain ROM of RFID devices include even fewer bits such as 50-100 bits ROM, or even fewer bits.

Another significant problem with RFID devices may be that there is no computer implemented animal management system available for encoding and updating RFID information of an RFID implanted in an animal and integrating the RFID information with relational and storage databases in a server or remote computer for the purpose of remotely monitoring, tracking, sorting, diagnosing, or treating each RFID implanted animal.

Ex. 1001 at 1:65–2:16.

30. The patent then explains that “[t]he inventive computer implemented animal management system described herein addresses each of these problems by providing computer implemented functions which provide a method which matches animal information retrieved from a radiofrequency identification device implanted in an animal to animal information retrieved from a database of at least one computer.” *Id.* at 2:17–23. For example, “a broad object of the invention is to provide an inventive RFID implantable in an RFID object such as an animal or other asset and a RFID reader which can retrieve RFID information from the implanted RFID and computer implemented animal management program (also referred to as an animal management application) which provides executable program instructions in the form of various program modules each of which function to integrate retrieved RFID data with data in relational database tables and storage database tables or

analyze the RFID data and data from relational databases for each RFID implanted in an animal.” *Id.* at 2:27–38.

31. The claims of the patent describe a “computer implemented method of animal tracking” with specific steps to retrieve and integrate information from a radiofrequency identification (“RFID”) device “implanted in an animal.” *See, e.g.*, claim 1. After being retrieved, the animal information is integrated into a “logical expression” with additional information stored in a database, which can include “an amount of milk production information or an amount of days milked.” *Id.* The logical expression is then solved to provide alerts to farmers that are specific to the animals in their herds, including alerts that signal when a cow is ill. *See, e.g.*, Ex. 1001 at 13:51–14:44.

32. In my opinion, the claimed inventions allow farmers to track the status of their herd in real-time, which is particularly useful in the livestock industry where assets are high value (thousands of dollars per head of cattle) and remedies for issues are time dependent (e.g. retrieval of strays, diagnosis and treatment).

33. Dr. Brown-Brand quotes a portion of the specification referring to “conventional radiofrequency identification device (‘RFID’ or ‘RFID device’).” Ex. 1003 ¶ 89 (citing Ex. 1001 at 1:22-56). To the extent Dr. Brown-Brandl is suggesting that the animal tracking methods claimed in the ’515 Patent consist of conventional components, I disagree. The claims comprise unconventional components arranged

in unconventional ways, as demonstrated by my comparison of the claims to Petitioners asserted art below.

34. Moreover, when the patent uses the word “conventional,” it is clearly describing prior art RFID devices only, and not any aspect of the claimed invention. Here is the full context of the statement that Dr. Brown-Brandl quotes, which is the first sentence of the “BACKGROUND” section of the patent:

A conventional radiofrequency identification device (“RFID” or “RFID device”) is an object that can be attached to or incorporated into a product, animal, or person typically for the purpose of locating and identification of that object using radio waves.

Ex. 1001 at 1:22–26. This would not suggest to a POSA that the claimed systems are conventional in any way. In fact, as explained above, the background describes significant problems with such prior art and then explains that the disclosed inventions solve those problems. *See, e.g.*, Ex. 1001 at 1:22–2:38.

B. The Challenged Claims

35. The Petition challenges claims 1–4 and 15–25 of the ’515 Patent. My analysis focuses mainly on independent claim 1, which is reproduced below. In the left column, I include the shorthand identifier for each “claim element,” which I will refer to throughout this declaration.

1[Pre]	1. A computer implemented method of animal tracking, comprising:
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1[A]	connecting a computer to an RFID device reader;
1[B]	reading an RFID device implanted in an animal with said RFID device reader;
1[C]	retrieving an amount of animal identification information from said RFID device implanted in an animal;
1[D]	linking an amount of animal information of said animal stored in a data base of said computer to said amount of information retrieved from said RFID device implanted in said animal, said amount of animal information stored in said data base of said computer comprising an amount of milk production information or an amount of days milked;
1[E]	converting said amount of animal information of said animal stored in said database of said computer linked to said amount of information retrieved from said RFID device implanted in said animal into one or more logical variables;
1[F]	inserting at least one of said plurality of logical variables into at least one logical expression; and
1[G]	obtaining a logical value relating to said animal.

36. The remaining challenged claims (2–4 and 15–25) all depend from claim 1 and specify various additional limitations. Because the references asserted by Petitioners and Dr. Brown-Brandl do not anticipate or render obvious independent claim 1, and I understand that all limitations of an independent claim are required in its dependent claims, I have focused my analysis below on claim 1.

37. For all the reasons herein, I disagree with Dr. Brown-Brandl’s opinion that any of the challenged claims are anticipated or obvious.

VI. CLAIM INTERPRETATION

38. In accordance with the standards for interpreting patent claim terms discussed above in Section IV.B, I have interpreted the claims based on their ordinary and customary meaning as understood by a POSA in view of the ’515 Patent and its prosecution history.

VII. SUMMARY OF THE ASSERTED ART

A. Trevarthen (Ex. 1005)

39. “Trevarthen” is a 169-page undergraduate thesis authored by Mr. Adam Trevarthen. The exhibit states that the thesis was provided “in fulfilment of the requirements for the award of the degree Bachelor [sic] of Information and Communication Technology” at the University of Wollongong in Australia. Trevarthen at Abstract (“Publication Details”). I note that, to be consistent with Petition and Dr. Brown-Brandl’s declaration, the page numbers from Trevarthen cited herein are Trevarthen’s original page numbers, not the “stamped” exhibit page numbers.

40. Petitioners and Dr. Brown-Brandl use Trevarthen in Grounds 1–3. For Ground 1, they argue that Trevarthen, on its own, anticipates or renders obvious claims 1–2 of the ’515 Patent. For Ground 2, they argue that Trevarthen in combination with Brune renders obvious claims 3–4. For Ground 3, they argue that

Trevarthen in combination with Rollins renders obvious claims 15–25. As explained below, it is my opinion that Petitioners and Dr. Brown-Brandl have not provided evidence showing that Trevarthen was publicly accessible by the patent’s priority date. Thus, based on my understanding of the law, Trevarthen does not qualify as prior art to the ’515 Patent for these proceedings and cannot be used to show that the challenged claims are unpatentable. It is also my opinion, as explained below, that Trevarthen does not disclose or render obvious any of the challenged claims.

41. The Trevarthen undergraduate thesis consists of eight chapters. Trevarthen at ii-v (Table of Contents). Chapter 6 discusses a “theoretical framework” proposed by Trevarthen with “possible enhancements and future developments” for hypothetical dairy farms. Trevarthen at ix (Abstract). In my opinion, a POSA would not consider Trevarthen’s “theoretical framework,” overall, as a standalone animal management system. Chapter 6 is a series of sub-sections that consists primarily of separate discussions of potential discrete individual features of future hypothetical systems. For example, Trevarthen describes its theoretical framework as follows:

While the cross-case comparison study will be designed so as to be functional and practical, ***aspects of it may be considered idealistic*** in the current farming and technological environment. As such, ***the framework suggested may be considered a possible long term goal*** for dairy farm management practices, considering developments in electronic identification technology such as RFID technology are expected to bring about a reduction in costs for the technology as well

as increased functionality. This framework may also serve to provide ***possible direction for future research*** into this field.

Trevarthen at 40 (emphasis added); *see also id.* at 8–9.

42. As another example, Trevarthen further states that:

Utilising these case studies as a basis, a ***theoretical framework*** for implementing RFID on dairy farms is then proposed, identifying mandatory and optional components for RFID implementation. ***Possible enhancements and future developments*** for RFID components are also identified and suggested throughout this framework.

Trevarthen at ix. Such statements, e.g., calling the framework “theoretical,” “idealistic” and a “possible long term goal” that could provide “possible direction for future research” or “possible enhancements and future developments” are speculative. They demonstrate to a POSA that Trevarthen’s theoretical framework, overall, was not achievable as a complete “system” when it was written. These statements also show, more generally, that Trevarthen’s theoretical framework does not disclose a single cohesive computer-implemented animal management system.

43. Notably, as discussed more below, for several claim elements, the Petition and Dr. Brown-Brandl rely on Trevarthen’s possible future and idealistic features that were not actually incorporated into any existing or proposed RFID-based management system. For example, Petitioners and Dr. Brown-Brandl rely on Trevarthen’s discussion of the potential use of “milk meters” in combination with

“automated feed bins” to suggest that integrating milk production information with sensed animal data acquired from an RFID device would have been obvious. But Trevarthen explicitly states that doing so was “[b]eyond their current abilities” and never discusses the integration or potential integration of such data. Trevarthen at 109, which is the start of § 6.3.3.2 (titled “Enhancing Capabilities”). In full, Trevarthen states, “Beyond their current abilities, it is believed that future development of these automated feed bins could provide enhanced benefits for the farmers. Firstly, the use of milk meters to record the amount of milk produced by each cow at every milking session will also enable greater possibilities for extending the capabilities of feed bins.” *Id.* A POSA would understand this to mean that using milk meters in this manner was not achievable in the art at the time.

44. As quoted above, Trevarthen states that he used “case studies as a basis” for the proposed “theoretical framework.” See Trevarthen at ix. These two case studies are discussed in Chapters 4 and 5 of Trevarthen, and they involve systems employed at existing dairy farms in Australia. Notably, the two “case study” systems are separate, and are discussed completely separately, from Trevarthen’s proposed theoretical framework (which is not an actual or existing system). Specifically, Trevarthen states that he “investigate[d]” the “Strong Dairy Farm” and the “Cochrane Dairy Farm” in Australia, which employ different levels of RFID technology. See Trevarthen at Chapter 4 (describing the Strong Dairy Farm); Chapter

5 (describing the Cochrane Dairy Farm). As explained further below, Grounds 1 and 2 in the Petition are based on a combination of aspects of the two case studies and on Trevarthen’s theoretical (and speculative) framework. In addition, neither Dr. Brown-Brandl nor Petitioner argue that the concepts discussed in Trevarthen’s Chapter 6 describing his theoretical framework for the use of RFIDs on dairy farms must be applied in the practical applications described in Chapter 5, which discusses the workings of the Cochrane Dairy. For example, the theoretical framework has brief discussions of boluses and microchips, in addition to discussion of basic ear tags. Ex. 1005, § 6.2.1, 99. The Cochrane Dairy uses RFID ear tags for identification only. *Id.* 1005, 5.1.1. POSAs would not have had a reason to include the boluses and microchips briefly discussed in Chapter 6, for example, in Cochrane Dairy’s system.

B. Laitinen (Ex. 1006)

45. “Laitinen” is a U.S. Patent titled “Surveillance System for Animals.” For Ground 3, Petitioners and Dr. Brown-Brandl rely on Laitinen in combination with “Buchanan” and “Liao” in contending that claims 1–4 and 6 are obvious. For Ground 4, they rely on Laitinen in combination with “Brune” in contending that claims 17–20 are obvious. As explained below, Laitinen in combination with any other asserted reference does not disclose or render obvious any of the challenged claims.

46. Laitinen discusses a “surveillance system” for allowing governments and other interest groups to monitor groups of animals at a “global level.” Laitinen at Abstract. Laitinen’s surveillance system requires “three technology levels,” namely the “local, global and pico level[s],” which Laitinen describes as “the basic principle of a system based on the invention.” Laitinen at, 3:21–27.

47. In a section titled “Background of the Invention,” Laitinen describes examples of prior art systems, such as:

The US patent application US2001/0016681 describes a system with which it is possible to keep health records of individual animals and to, for example, obtain information about the medication used for treating each animal. Animal identification is based on a code (e.g. bar code) in the earmark, which can be read with a manual scanner. Patent U.S. Pat. No. 5,818,354, on the other hand, features a telemetric system for the individual surveillance of the physical condition of each animal in a larger group, as indicated by heart rate and body temperature. Each animal wears a collar with sensors and a transmitter that sends the measured data to a portable receiver.

Laitinen at 1:63–2:8.

48. Laitinen then describes “downsides” of such systems, namely:

One of the downsides of these known solutions is their locality, that is to say, the fact that they offer surveillance and other information only locally, within a certain environment (e.g. one producer) and with regard to a certain purpose. Practicing animal husbandry always

necessitates the interaction of different reference groups with differing interests as far as the size of the group to be controlled and the desired measures are concerned. In addition to tenders and farmers, authorities and specialists of different fields, for example, often partake in the processes and if they wish to single out the animals of a certain producer, or a specific animal, for control or other measures, it is nowadays necessary that they go physically to the farm in question.

Laitinen at 2:9–12.

49. A POSA would understand this as disparaging systems that employ a different “basic principle” than the three-level hierarchical system discussed in Laitinen. Laitinen further disparages such systems for requiring authorities and specialists to “go physically to the farm in question” to control a particular farm or its animals. *Id.* at 2:17–22. Laitinen states that it “aims to create a new kind of a surveillance system which is not hampered by the before-mentioned flaws,” which a POSA would have understood is based on the above perceived deficiencies. *Id.* at 2:23–27. Additionally, according to Laitinen, “[p]racticing animal husbandry always necessitates the interaction of different reference groups with differing interests as far as the size of the group to be controlled and the desired measures are concerned,” which Laitinen believes is not achievable without his specific three-level structure. *Id.* at 2:13–17. A POSA would thus be discouraged from following a path other than the three-level hierarchical system proposed by Laitinen.

50. The three “levels” in Laitinen are described as three distinct systems: the “pico level” system, the “local level” system, and the “global level” system. Laitinen at Figs. 1–3, 3:21–5:3.

51. The pico level system includes a device used “directly with the animals.” Laitinen at 3:28–29. Laitinen further identifies two distinct pico-level devices, one that is “external” and one that is “implanted inside the animal’s tissue (100b).” *Id.* at 5:38–43.

52. Laitinen states that the external device can “measure the animal’s body temperature (with a temperature [s]ensor) or movements (various motion [s]ensors, such as acceleration [s]ensors), or determine the animal’s location.” *Id.* at 5:44–49. However, Laitinen does not explain how the “body temperature” or “movement” are measured. Laitinen also does not explain how the “animal’s location” or “movement” is determined. Nor does Laitinen identify specific devices capable of taking such measurements.

53. Petitioners and Dr. Brown-Brandl rely only on the use of an external device in a “heat control” application. Laitinen at 8:5–15. For that application, Laitinen states that a “[c]ensor” measures “body temperature and movement” and triggers an alarm at the pico level when preset “alarm limit(s) have been reached.” *Id.* at 8:5–15. Laitinen is necessarily discussing only an external device because the only device that Laitinen describes as capable of measuring temperature and

movement is the “external device.” *Id.* at 5:38–49; Fig. 3. Likewise, the only device that Laitinen describes as having an “alarm limit,” such as the one used in the heat control application, is the “external device.” *Id.* at 5:60–64. Notably, however, Laitinen does not provide examples of an alarm triggered by entering variables into and solving a logical expression, which is required by the ’515 Patent claims.

54. Laitinen also refers to “implanted” or “internal” devices. Laitinen at 3:51–62; 5:38–43; 5:50–6:4; Fig. 2. In particular, Laitinen does not explain, discuss, or suggest that its internal device measures temperature. Nor does Laitinen explain, discuss, or suggest that any internal device measures location or movement. Also, Laitinen does not describe its internal device as featuring any “alarm limit.” The only functions Laitinen associated with the internal device is that it enables “the use of an EKG analysis for the surveillance of the animal’s heart rate or an EMG (Electromyography) conveying its muscular tension or level of fatigue,” as well as “the use of optical [s]ensors for the measuring of oxygen saturation, for instance.” Laitinen and 5:50–55. In my opinion, these limited uses of Laitinen’s internal device is what would allow it to “use[] very little power (about 1 mW),” as discussed by Laitinen. *Id.* at 58–60. In my review of Laitinen, I did not find a description of any particular embodiment or application that employs the internal device.

55. Notably, it is not clear how or where the “internal device” mentioned in Laitinen would be inserted or how it would measure data. At the time of the

invention, POSAs would have most likely understood an “internal device” to imply an under-the-skin device. *See, e.g.*, Ex. 1006 at 5:38–55. As discussed below, POSAs would not have had reason to use such devices to measure temperature with a reasonable expectation of success.

56. The “global level” tier is critical to the Laitinen system. The global level is what receives data from multiple local levels to achieve the “surveillance” objective at the core of Laitinen’s system.

57. One example of a feature contained in the global level is a so-called “inverse function $x=f^1(y,z)$.” Petitioners and Dr. Brown-Brandl cite this “inverse function” as an alleged equation for analyzing data acquired from multiple local levels. *Id.* at 7:6–9, 7:35–56. In particular, Petitioners and Dr. Brown-Brandl rely on the so-called inverse function’s incorporation of “temperature” data. As noted above, Laitinen claims that such data is only acquired with its “external” device. Additionally, it is noteworthy that the “inverse function” as described in Laitinen is not a mathematical construct or logical expression as suggested by Petitioners and Dr. Brown-Brandl. Instead, the specific “inverse function” described in Laitinen represents an output from a “self-learning system” (*see* Ex. 1006 at 6:56), also known as a Counter Propagating Network (*Id.* at 7:38–39), or Neural Calculator (*Id.* at Fig 3). I discuss this in more detail below.

C. Additional References

58. Petitioners and Dr. Brown-Brandl use Brune (Ex. 1008), Liao (Ex. 1010), Buchanan (Ex. 1011), and Rollins (Ex. 1037) as references in combination with Trevarthen or Laitinen in various Grounds. These references will be discussed below with respect to such proposed combinations.

VIII. PUBLIC ACCESSIBILITY OF TREVARTHEN

59. In my opinion, based on my understanding of the relevant standards, Petitioners and Dr. Brown-Brandl do not show that Trevarthen qualifies as prior art to the challenged claims of the '515 Patent.

60. I understand that Petitioners allege that a copy of Trevarthen was “available for download on October 22, 2006” because the University of Wollongong’s “Research Online” tool “ensures that ‘a digital copy’ of each reference of [sic] published in the digital repository ‘is available universally on the Internet and located through search engines such as Google and Yahoo.’” See Pet. at 7–8 (quoting EX1031, “Munford” ¶¶ 16–20 (citing Ex. 1027, 149)). Petitioners also state that “[o]nce a publication, like Trevarthen, is ‘loaded onto Research Online [it] is usually available on Google the following day.’” Pet. 8 (citing Munford, ¶19 (citing Ex. 1030, Ex. A)). I have seen no evidence that Trevarthen itself was actually “available universally on the Internet and located through search engines such as Google and Yahoo.” In fact, as discussed below, I performed my own Google search

using Dr. Brown-Brandl's suggested search terms and found that Trevarthen was *not* locatable on Google before September 15, 2008 (or September 15, 2009).

61. I further understand that, in addition to certain paragraphs from Dr. Brown-Brandl's declaration, Petitioners rely on three pieces of evidence:

- **Ex. 1031:** Declaration of June Munford, a librarian;
- **Ex. 1030:** Affidavit of Nathaniel E Frank-White relating to "Wayback Machine" archives; and
- **Exs. 1028–1029:** an International Search Report of the Australian Patent Office.

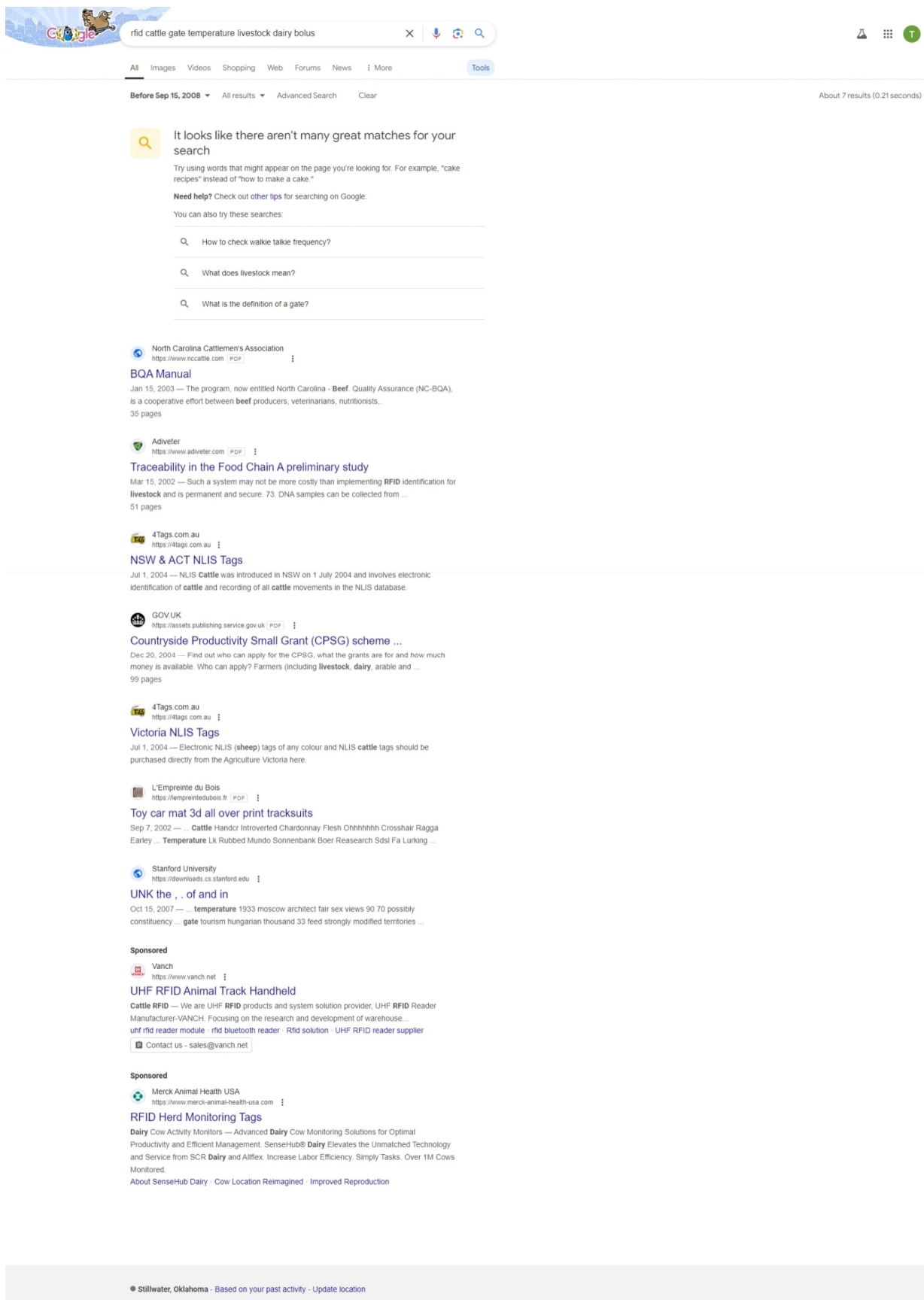
62. In my opinion, as explained below, none of this evidence independently or collectively shows that Trevarthen was publicly accessible before September 15, 2008 (or September 15, 2009) as contended by Petitioners and Dr. Brown-Brandl.

A. Trevarthen Was Not Available by Keyword Searching Internet Search Engines

63. I personally attempted to recreate the search that Petitioners suggest would have been conducted by a POSA on or before September 15, 2008, and, in doing so, I failed to locate Trevarthen. Specifically, Dr. Brown-Brandl states that "the POSA prior to September 2008 searching for literature regarding livestock management sensor systems on internet search engines would have used terms such as 'rfid,' 'cattle,' 'gate,' 'temperature,' 'livestock,' 'dairy,' 'bolus.' These terms appear in many places throughout Trevarthen, so based on my experience it likely

the POSA would have located Trevarthen using such terms, or similar search terms.” Ex. 1003 ¶ 69. Notably, I see no evidence that Dr. Brown-Brandl or anyone else actually performed any test to support Dr. Brown-Brandl’s hypothesis that finding Trevarthen was “likely” based on inputting her search terms in a search engine. As explained below, I tested Dr. Brown-Brandl’s hypothesis using her search terms and Google’s search engine and determined that Trevarthen would not have been locatable.

64. To test Dr. Brown-Brandl’s hypothesis, I input her search terms into Google’s search engine and limited the search to “before Sep 15, 2008” as shown below in the screenshots that I captured from my computer:



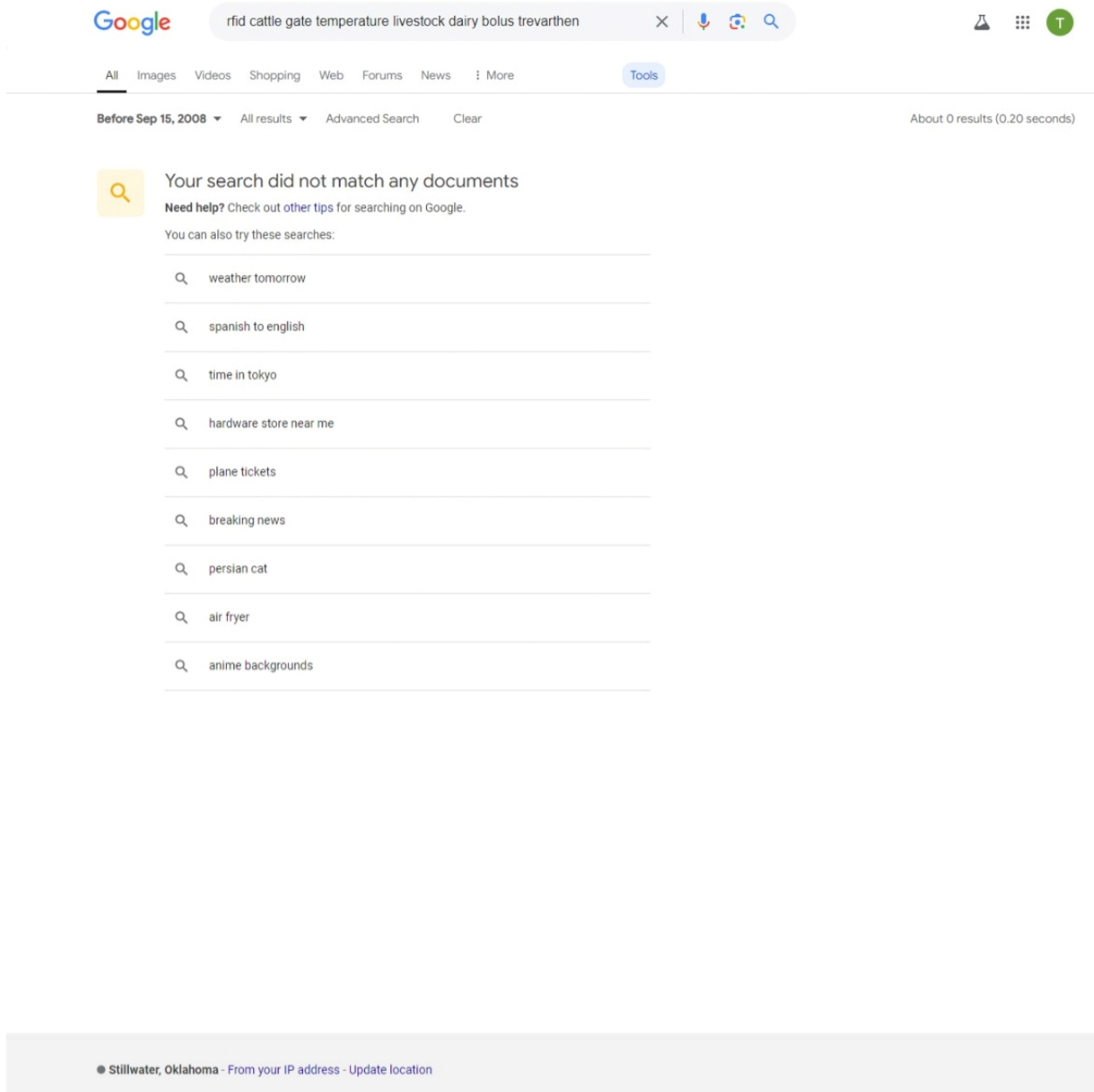
65. As shown, Dr. Brown-Brandl's search terms returned one page of results in Google's search engine, none of which are Trevarthen.

66. I performed the same test except with the date changed to "before Sep 15, **2009**" and again Trevarthen was not included in Google's search results.

67. Neither Dr. Brown-Brandl nor Petitioners provide any suggestions on whether or how a POSA might combine the various search terms offered by Dr. Brown-Brandl. However, as a further test, I added an "OR" connector between each of Dr. Brown-Brandl's terms to determine whether that would turn up Trevarthen, and it did not. As shown below, a search that includes any of Dr. Brown-Brandl's terms returned 164,000,000 results:

It would be impossible and unreasonable for a POSA or other interested person to review 164,000,000 results. However, I reviewed the first 10 pages of Google's results and did not see Trevarthen. Thus, even an expanded search that includes any of Dr. Brown-Brandl's search terms did not reasonably uncover Trevarthen. I performed the same test except with the date changed to "before Sep 15, **2009**," which returned 211,000,000 results. And, again, Trevarthen was not included in Google's search results on the first 10 pages.

68. To determine whether Trevarthen was locatable on Google at all, I conducted another search where I added "trevarthen" to Dr. Brown-Brandl's search term list "before September 15, 2008," which again did not find Trevarthen:

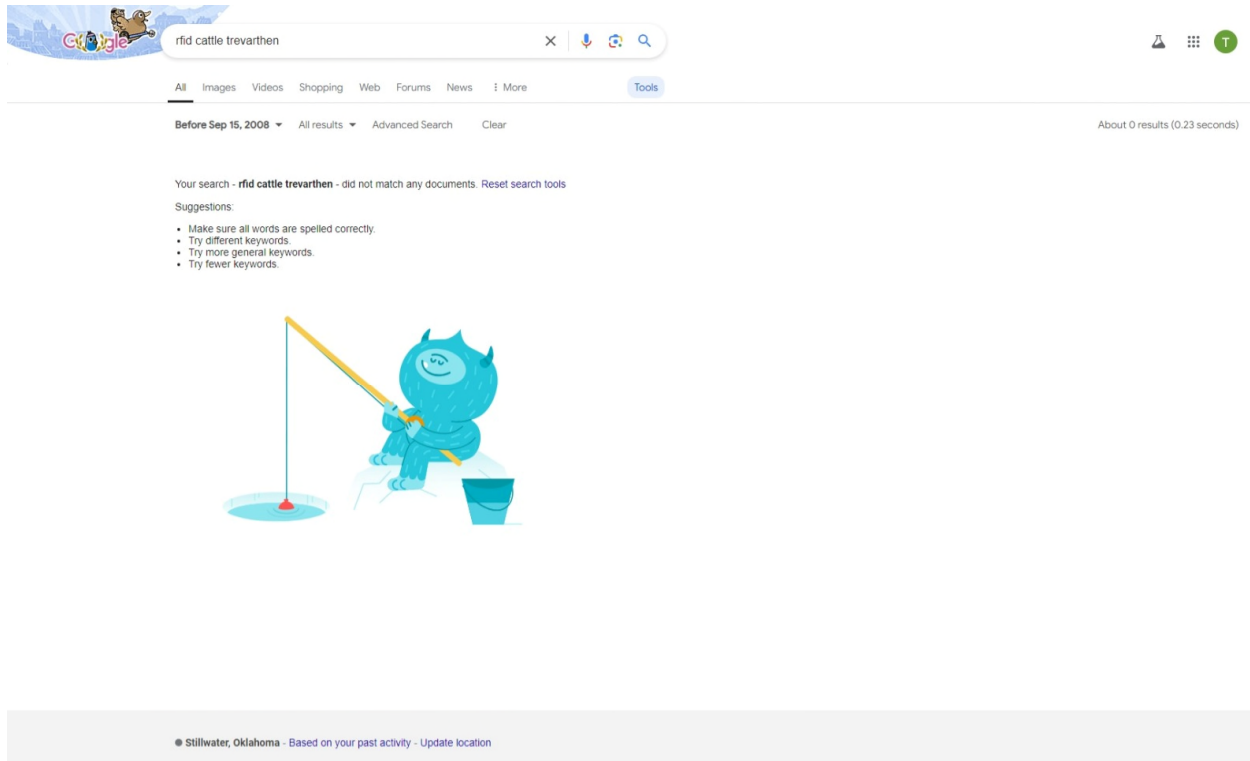


69. I obtained the same result when I changed the date to “before September 15, **2009**.”

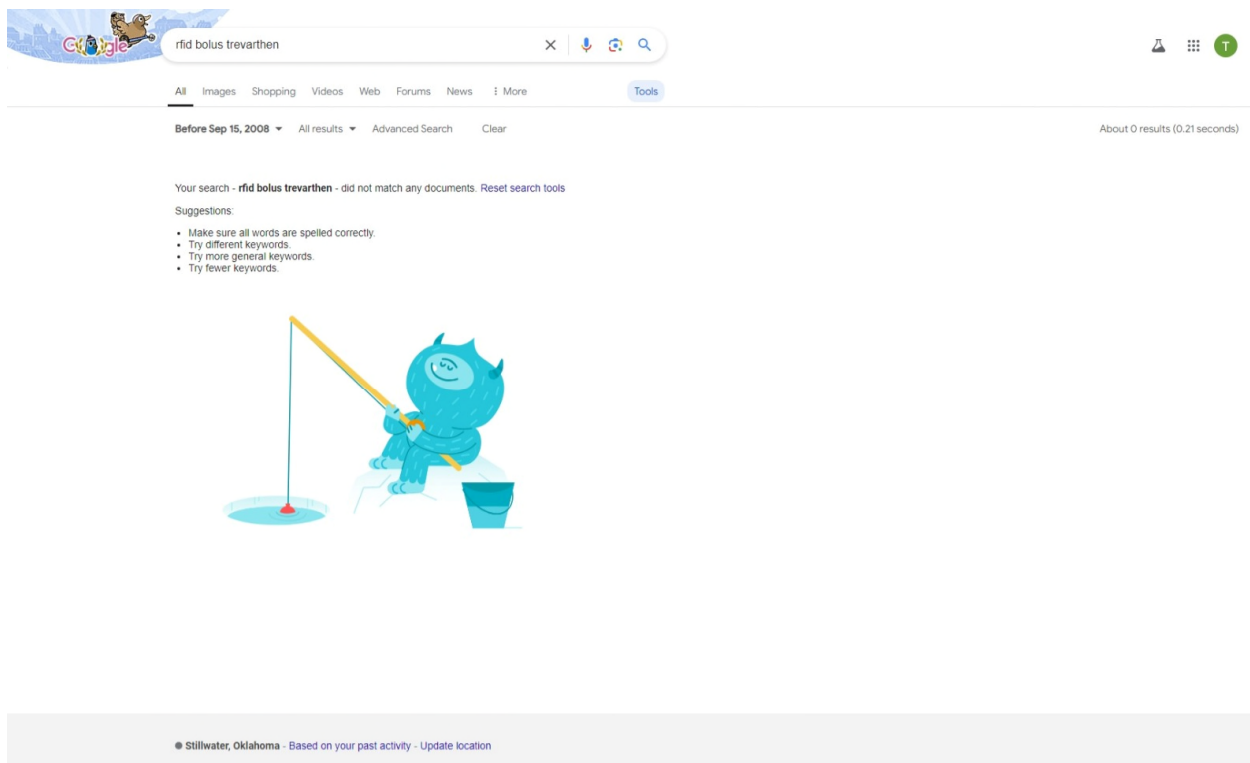
70. I also tested Dr. Brown-Brandl’s theory by choosing what I believe are the most relevant terms from her suggested list (RFID, cattle,

and/or bolus) and adding them to “Trevarthen” to see if Trevarthen would turn up at all. Once again, Trevarthen did not turn up.

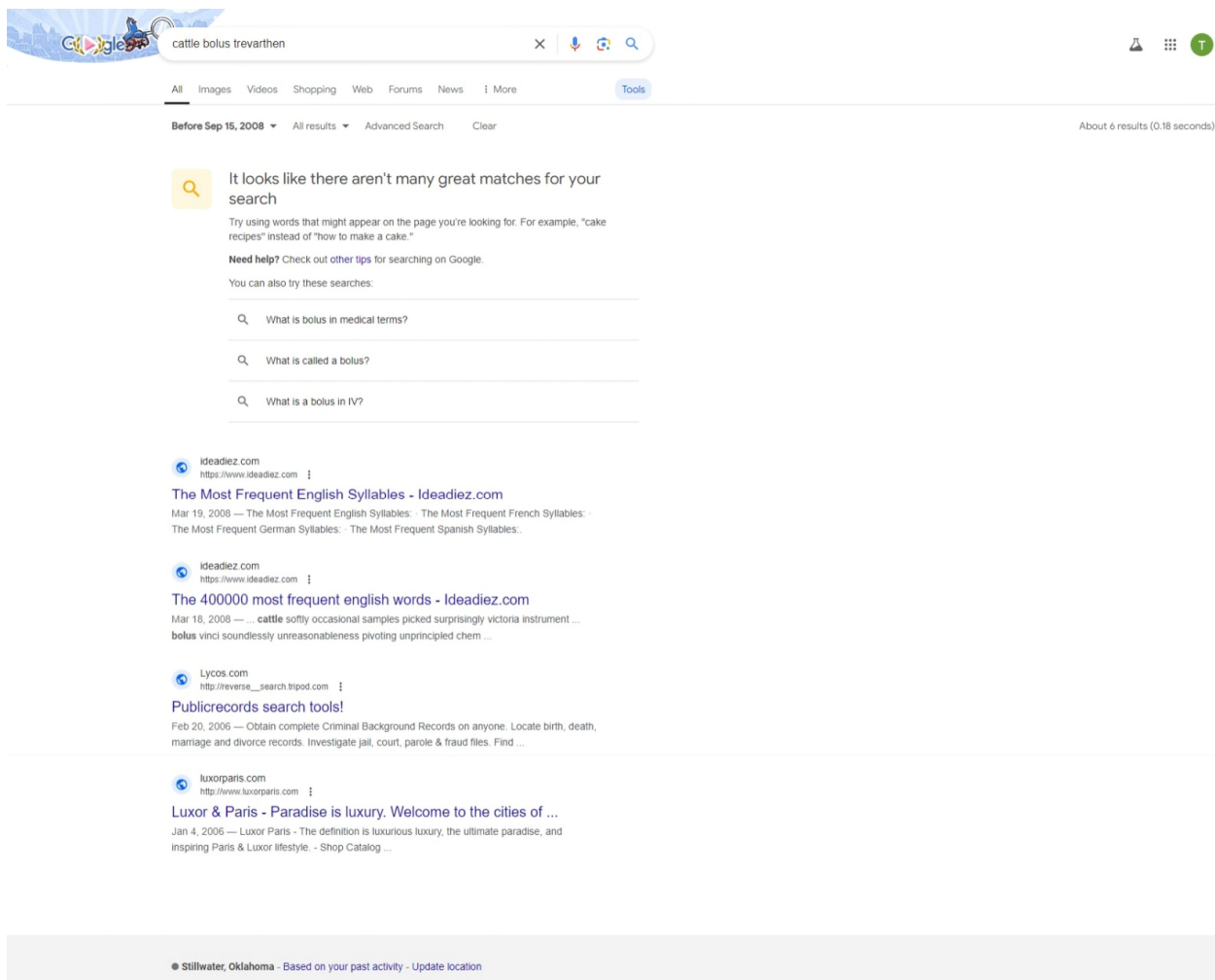
71. First, I searched for “rfid cattle Trevarthen,” and nothing turned up:



72. Second, I searched for “rfid bolus Trevarthen” and nothing turned up:



73. Third, I searched for “cattle bolus Trevarthen” and Petitioners’ Trevarthen reference did not turn up:



74. Finally, I searched each of Dr. Brown-Brandl’s proposed terms individually “before September 15, 2008,” and found that they returned the following number of results:

- rfid: 1,450,000
- cattle: 14,600,000
- gate: 95,000,000
- temperature: 96,700,000
- livestock: 8,710,000

- dairy: 13,100,000
- bolus: 70,300

Again, it would be impossible and unreasonable for a POSA or other interested person to review every result for each term. However, I reviewed the first 10 pages for each term, and did not see Trevarthen. Thus, a search that includes any one of Dr. Brown-Brandl's search terms did not reasonably uncover Trevarthen.

75. Petitioners and Dr. Brown-Brandl further state that "Google and Google Scholar" increase the "visibility" of publications, though it is unclear if they are suggesting that Trevarthen was available on Google Scholar. Pet. at 8; Ex. 1003 ¶¶ 27, 68–69. I have seen no evidence that Trevarthen was uploaded to or available on Google Scholar before September 15, 2008 or September 15, 2009.

76. Based on the above, I see no grounds to conclude that Trevarthen was reasonably discoverable or would have likely been discovered using a search engine or Google Scholar.

77. In summary, based on my review of Petitioners' evidence and the searches suggested by Petitioners and their expert, I do not believe Petitioners have provided enough evidence to show that Trevarthen was publicly accessible before September 15, 2008 (or before September 15, 2009).

78. Below I provide additional opinions and observations regarding the specific evidence that Petitioners provide.

B. The Munford Declaration

79. Petitioners submit a declaration from June Munford. Ex. 1031. I understand Ms. Munford has a degree in Library and Information Science from the University of Wisconsin-Milwaukee. *See* Pet. at 7–9; Ex. 1031 at 3. I have reviewed Ms. Munford’s declaration. I do not see any evidence that Ms. Munford has personal experience with the University of Wollongong’s Research Online tool that Petitioners contend was publicly accessible. *See, e.g.*, Ex. 1031 at 24–25. I also do not see any evidence that Ms. Munford is a POSA or has expertise regarding whether or not a member of the relevant public, such as a POSA, would look to the University of Wollongong or its Research Online for a document such as Trevarthen. Notably, Ms. Munford seems to rely on a 2009 article to explain how the Research Online tool functions. *See* Ex. 1031 at 6 (citing Ex. 1027). However, in my opinion, understanding or knowing how Research Online functioned in 2009 does not suggest or show that a POSA would have had any reason to use Research Online to find a document in the relevant field, such as Trevarthen. The Munford Declaration, and the other evidence provided by Petitioners, does not explain *how* a POSA would have located Trevarthen using Research Online. In fact, the Petition never explains any searching functionality or indexing available on Research Online during the relevant period.

80. It is also noteworthy that the University of Wollongong was not known by POSAs for producing relevant work in the field of herd management, and the Research Online tool is limited to only those reports and theses affiliated with the University of Wollongong. This is consistent with Mr. Trevarthen himself seeking a “Bachelor of Information and Communication Technology,” not an agricultural or dairy-related degree. Trevarthen at Cover (exhibit page 3 of 169); *see also id.* at Publication Details (exhibit page 2 of 169). Similarly, his thesis advisor was Dr. Katina Michael, who was in the “Faculty of Informatics,” not an agricultural or dairy-related department. *Id.* at Publication Details (exhibit page 2 of 169).

81. Ms. Munford makes a statement that interested persons would have located Trevarthen on a search engine “by entering terms found in the full text of Trevarthen.” *See* Ex. 1031 at 10. This does not make sense to me, as it would require that the interested person knows the text of Trevarthen *before* locating it, which is not reasonable. Moreover, as I have shown above, Petitioners’ suggested search failed to return Trevarthen.

82. The Munford Declaration also states that Trevarthen was downloaded hundreds of times. Ex. 1031 ¶¶ 21–26. However, I see no evidence that such downloads were made by POSAs or the interested public before September 15, 2008. For example, downloads could have been initiated by the author, his friends and

family, his faculty advisors, or persons interested in other aspects of Trevvarthen's work, like his review of literature.

C. The Wayback Machine Archives

83. Petitioners submit an affidavit from Nathaniel E. Frank-White. Ex. 1030 ("the White Affidavit"). I understand that Mr. Frank-White is a Records Request Processor at "the Internet Archive." After reviewing the White Affidavit, I do not believe it can establish public accessibility of Trevvarthen.

84. The White Affidavit states that Trevvarthen was available based on archived webpages of Research Online from at least September 7 and 12, 2007, and March 22, 2008. Ex. 1030 at Ex. A. Mr. White further states that he located these archives by searching the "URL" for the Research Online copy of Trevvarthen on the Wayback Machine. Ex. 1030 at 1. Notably, however, Mr. White does not explain how a POSA would have obtained the URL in the first place. And, in my opinion, a POSA would not have had any means of reasonably obtaining the Trevvarthen URL. In other words, a person interested in the field of the '515 Patent would not have been independently aware of the web address for Trevvarthen on Research Online. In addition, the Research Online tool is described as "...an open access digital archive, or institutional repository, promoting the scholarly output of the University of Wollongong." Ex. 1030 at Ex. A.

D. The International Search Report

85. Petitioners also rely on a citation to an International Search Report for a New Zealand-based international patent application, which “identified Trevarthen as reference D1.” Pet. at 9 (citing Exs. 1028 and 1029). I understand that the International Search Report was conducted by the Australian Patent Office regarding a New Zealand applicant. See Exs. 1028 and 1029. Based on my review of Exhibits 1028 and 1029, I do not agree that those documents “corroborate” that Trevarthen was publicly accessible. As discussed above, I have not seen evidence that Trevarthen was publicly accessible, and these additional exhibits could not “corroborate” that Trevarthen was publicly accessible. Moreover, as discussed below, Exhibits 1028 and 1029 do not independently show that Trevarthen was publicly accessible.

86. Exhibit 1028 is an “International Search Report” conducted by “P. Thong” of the Australian Patent Office. Ex. 1028 at 1. The document lists “electronic data bases” that were used, and “where practicable, search terms used.” Those data bases include “DWPI,” “internet,” “AusPat,” “Patent Lens,” “PCT Gazette,” “Esp@cenet,” and “GetThePatent.” The “search terms used” includes “cattle, rfid, gate, etc.” Neither Dr. Brown-Brandl nor Petitioners list any of these resources as a place where an interested person or POSA would search for relevant literature, except to the extent the “internet” includes search engines such as Google.

In my opinion, a POSA or interested person would not look for literature using “DWPI,” “AusPat,” “Patent Lens,” “PCT Gazette,” “Esp@cenet,” or “GetThePatent.” In fact, I attempted to access each of these and, when the resource was accessible, I was not able to find Trevarthen using Dr. Brown-Brandl’s or the Australian Patent Office’s keywords. For example, “AusPat” I understand is <https://inspire.wipo.int/auspat>. I was unable to use any of the tools available to locate Trevarthen (or any other non-patent literature). Moreover, DWPI I understand to be “Derwent World Patent Index” (see <https://clarivate.com/products/ip-intelligence/ip-data-and-apis/derwent-world-patents-index/>), which was not accessible apparently without a subscription. Thus, a POSA or interested person would not have used it at all. I was unable to locate Trevarthen using any of the other resources, either.

87. I note that “cattle, rfid, gate” (the search terms indicated to be used by the Australian Patent Office) were included in Dr. Brown-Brandl’s suggested search terms. As I determined above, those search terms would not uncover Trevarthen in a reasonable search of Google. Thus, it is highly unlikely that the examiner’s searches using such terms on the “internet” would have uncovered Trevarthen.

88. I further note that Ex. 1028 provides a full URL for Trevarthen: “<<http://ro.uow.edu.au/cgi/viewcontent.cgi?article=1000&context=thesesinfo>>.” Given that Exhibits 1028 and 1029 do not provide specific details on exactly how

Trevarthen was located, and that I was unable to locate Trevarthen using Petitioners’ or the Australian Patent Office’s keywords or databases, it is entirely possible and reasonable to conclude that the examiner at the Australian Patent Office was provided with a URL address from an Australian University.

IX. GROUND 1 – ANTICIPATION OR OBVIOUSNESS OF CLAIMS 1–2 BASED ON TREVARTHEN

89. As discussed above, Trevarthen cannot anticipate or render obvious claims 1 or 2 of the ’515 Patent because Petitioners have not shown that Trevarthen is publicly accessible. *See* Section VIII. Below I provide additional reasons why I disagree with Petitioners and Dr. Brown-Brandl that Trevarthen anticipates or renders obvious claims 1 or 2 of the ’515 Patent.

A. General Comments on Petitioners’ “Anticipation or Obviousness” Ground

90. In Ground 1, Petitioners and Dr. Brown-Brandl pick and choose from aspects of unrelated discussions in Trevarthen that relate to unrelated systems. For example, for claim element 1[A], Petitioners rely on “computer screens” and an “RFID reader” used at Cochrane Dairy. Ex. 1003 ¶ 97; Pet., 12 (citing Trevarthen, 78–79). Cochrane Dairy is discussed in Trevarthen Chapter 5, which spans Trevarthen pages 69–98. For other elements, Petitioners and Dr. Brown-Brandl rely on discussions from different chapters in Trevarthen that describe systems (or hypothetical systems) that are distinct from Cochrane Dairy. For element 1[B],

Petitioners rely on Trevarthen’s discussions of “boluses” and “microchip” RFID devices from Chapters 2 and 6. Ex. 1003 ¶ 99; Pet., 13 (citing, e.g., Trevarthen, 20, 22, 24–25, 99–100). Those discussions are not related to Cochrane Dairy because Cochrane Dairy does not use boluses or microchips at all. Instead, the Cochranes use an “RFID tag attached to their [cows’] right ear.” Trevarthen, 69. Such RFID tag would be external to the cow, not implanted in it. Using Cochrane Dairy’s system therefore does not involve every step of claim 1. Moreover, element 1[D] and 1[E] require “linking” and “converting” and “amount of animal information of said animal stored in a data base of said computer.” “Said computer” must be the computer that was connected to the RFID device reader of element 1[A]. However, when Petitioners and Dr. Brown-Brandl discuss elements 1[D] and 1[E], they are discussing the theoretical framework and not Cochrane Dairy. *See* Pet. at 14–17; Ex. 1003 ¶¶ 103–111. Any computer identified for those claim elements therefore would not be the computer of element 1[A], which the claims require.

91. I understand that to show obviousness, Petitioners and Dr. Brown-Brandl need to identify differences between the claims and the prior art and must explain how and why a POSA would modify the prior art to meet the claims. I have reviewed the Petition and Dr. Brown-Brandl’s declaration and have not seen an identification of differences between the claims and Trevarthen or an explanation of how or why a POSA would modify Trevarthen to include any missing or different

elements. Dr. Brown-Brandl does not identify any claim elements that are missing. She states the following:

My analysis indicates that Trevarthen alone meets every element of claims 1-2, and therefore would be considered to anticipate claims 1-2. However, to the extent that one or more of the limitations is not found in the claims, any modifications to the Trevarthen to reach the claim would have been the result of predictable modifications to Trevarthen's system. Based on the POSA's own knowledge, the POSA would have been motivated to make such modifications and reasonably expected to have been able to successfully make such modifications as explained herein.

Ex. 1003 ¶ 94.

92. Petitioners state that “to the extent that the Board does not find that Trevarthen expressly discloses any element, for example the logical variable, logical expression, and logical value of 1[F]-1[G] . . . configuring Trevarthen's systems to solve well established mathematical relationships, renders these elements obvious.” Pet., 6–7. When discussing elements 1[F] and 1[G], Petitioners contend that Trevarthen discloses the elements. They do identify a second reference, de Mol. However, they state that de Mol simply discloses a more “complex” version of those elements. Pet., 19–20.

93. Dr. Brown-Brandl also states Trevarthen discloses elements 1[E] and 1[F]. Ex. 1003 ¶¶ 110–113. For element 1[F], she further states that “Trevarthen in

view of the prior art generally further renders element 1[E] obvious.” *Id.* ¶ 114. She also states that “Trevarthen also describes a logical expression that can detect reduced cow’s milk production that may indicate illness or another issue that requires attention from the farm operator” and “Trevarthen teaches that the logical expression need only perform simple calculations such as computing an average and making a comparison to that average.” *Id.* ¶¶ 112, 115. While I disagree with those statements, I also do not see any indication from Dr. Brown-Brandl that Trevarthen was missing an element that needed to be supplied by de Mol or reconfigured.

94. In summary, I do not see that Petitioners or Dr. Brown-Brandl identify any specific differences between Trevarthen and the claims. I also do not see that they have supplied a reason to modify Trevarthen or to combine it with de Mol.

B. Elements 1[E] and 1[F]: Inserting “Logical Variables” Incorporating “an Amount of Milk Production Information or an Amount of Days Milked” into a “Logical Expression”

95. For the reasons below, in my opinion, Trevarthen does not disclose or render obvious the claim elements 1[E] or 1[F].

1. Trevarthen’s Discussions of Milk Meters and Milk Production

96. Petitioners and Dr. Brown-Brandl rely on Trevarthen’s discussions of “milk meters” that are separate from its discussions of RFID technology and software. For example, Petitioners rely on Trevarthen’s discussion of “milking meters” at Cochrane Farm, which was one of the two “case studies” from

Trevarthen's thesis that is separate from the discussion of Trevarthen's "theoretical framework." See Section VII.A. Dr. Brown-Brandl specifically quotes Trevarthen's statement that "[f]or example, a cow producing significantly less milk than her calculated average may be suffering from an illness, or other stress factor that is reducing her milk production abilities." Ex. 1003 ¶ 112 (citing Trevarthen at 98). I disagree that this statement supports Dr. Brown-Brandl's incorrect suggestion that "Trevarthen also describes a logical expression" as claimed. Ex. 1003 ¶ 112. Trevarthen's statement was not referring to any logical expression like the ones claimed in the '515 Patent. Instead, Trevarthen was referring to the Cochrane's potential "implementation of milking meters for every milking bail" at their farm, which was a system unrelated to RFID technology. Trevarthen, 98 ("However, the only advancement that they are realistically considering is the implementation of milking meters for every milking bail.").

97. Moreover, even if the milking meters were implemented at Cochrane Farm, they would *not* have been used with an RFID device "implanted in an animal" as claimed because the Cochranes employed basic ear tags that were external to the cow, not implanted in it. See, e.g., Trevarthen, 69 ("All cows in the [Cochrane's] herd have an NLIS-compliant RFID tag attached to their right ear."). The ear tag used at Cochrane Farm would have been understood to be a type of basic ear tag that is attached to an animal's (e.g., a cow's) ear. At the time of the invention, ear tags

such as those discussed at Cochrane Farm were typically rectangular in shape and around the size of a credit card but could have also been circular and around the size of a silver dollar. In any case, basic ear tags are attached to an animal's ear with a fastener that pierces the ear and is secured on the other side. A POSA would have understood that ear tags could include a low frequency RFID transponder to identify the animal. Typically, identification information was gathered at the entrance of a barn or milking parlor. *See, e.g.,* Trevarthen, 3, 20, 25–26, 69–70. Importantly, basic ear tags like those employed at Cochrane Farm could not have been used to achieve the claims. For example, those ear tags would have been externally attached to the ear on the outside of the animal. Under no circumstance would they have been “implanted” or “in an animal.”

98. Moreover, the examples of “milk” information relied on by Petitioners and Dr. Brown-Brandl would not have disclosed or suggested the claimed invention.

99. For example, the Cochranes were seeking to implement milking meters to “provide the ability to record the amount of milk each cow has provided at every milking session.” *See* Trevarthen, 98. They were not seeking to integrate that information with data from a separate RFID-based system or providing that information as part of any alert or logical expression. *Id.* Instead, the Cochranes were considering using milk meters to more regularly “record the amount of milk each cow has provided at every milking session . . . in contrast to the current practice of

only gaining these figures once a month through the use of the herd recording services of Dairy Express.” Trevarthen, 98.

100. Also, Trevarthen’s discussion of “patterns in the production of each cow” cited by Dr. Brown-Brandl relates to the use of milk meters separate from any disclosed RFID-based system and would not have been viewed by a POSA as disclosing or suggesting any alert or logical expression. *See* Ex. 1003 ¶¶ 111–113 (citing Trevarthen, 109). At page 109 of Trevarthen (which was cited by Dr. Brown-Brandl), Trevarthen was speculating about possible future capabilities of “Automated Feed-Dropping Control Units (Feed Bins)” in which milking meters are combined with automatic feed bins. Trevarthen, 108–109, § 6.3.3. This would not have suggested to a POSA that combining feed bins and milking meters could or would be integrated into an animal management software or an animal management system arranged as claimed. In fact, Trevarthen admits that combining feed bins and milking meters was “[b]eyond their current abilities.” Trevarthen, 109. A POSA would view this as speculation about what might or may occur in relation to feed bins in the future. It provides no teaching or suggestion to a POSA of any logical expression or any means of providing an alert or incorporating data from an RFID device implanted in an animal. Moreover, even if there were a reason to integrate milking meters and automatic feed bins into animal management software, in light of Trevarthen’s admission that this was beyond current abilities, a POSA would not

have seen a reasonable expectation of success in using this teaching to achieve the claims.

101. Dr. Brown-Brandl also relies on a statement regarding Trevarthen's theoretical framework that "milk meters" can "aid to identify any problems that may arise in the herd (such as illness)." Ex. 1003 ¶¶ 112, 118 (citing Trevarthen, 115).

Below is the full context of the statement:

Utilising milk meters will also aid to identify any problems that may arise in the herd (such as illness). For example, if a cow provides a significantly lower amount of milk than their usual output, the system will be able to identify this disparity and alert the operators to check this cow when milking has completed. In this way, any illnesses or problems occurring with cows can be identified quickly and easily, subsequently enabling rapid treatment. The quicker that such issues are identified and treated, the sooner the cow can return to her normal milking and health, and thus minimise the loss of production for the dairy on the whole.

Trevarthen at 115. That statement does not say anything about whether milk production information is stored, whether the system makes any calculations based on a logical expression, whether the milk meters are used as part of an overall system incorporating implanted RFID devices as claimed, or how a POSA might implement or integrate the milk meters into the system. In my opinion, a POSA would have

viewed Trevarthen as speculating on what data “might” or “may” be desirable to a farmer.

2. Trevarthen Does Not Disclose Elements 1[E] and 1[F]

102. As noted above in Section IX.C.1, Petitioners and Dr. Brown-Brandl rely on Trevarthen’s discussion of “milk meters” at the Cochrane Farm. But those milk meters were not incorporated into an overall system like the one in the claims. See Brown-Brandl ¶ 112. The Cochrane Farm used basic “ear tags” to identify cows. Trevarthen, 69–70. However, such ear tags are not “implanted in an animal” as required by the claims.

103. In addition, there is no discussion of the Cochranes using milk information as logical variables in a logical expression. That is, even if Trevarthen teaches to acquire milk production information, it does not discuss integrating such data into a method as claimed. Instead, POSAs would have understood that the Cochranes were seeking to *potentially* use milk meters to gather milk production information on a more regular basis, without relying on a third party service. Trevarthen, 98. As Trevarthen states:

The Cochrane’s have found great benefits from their use of RFID currently, and are interested in further advancing their RFID operations in the future. However, the only advancement that they are realistically considering is the implementation of milking meters for every milking bail. Implementing these milking meters will provide the ability to record the amount of milk each cow has provided at every milking

session. This is in contrast to the current practice of only gaining these figures once a month through the use of the herd recording services of Dairy Express.

Trevarthen at 98.

104. This would indicate to a POSA that the Cochranes were pleased with their current “RFID” system and not seeking to change that. However, they were interested in potentially adding milk meters specifically to avoid or improve upon their “current practice of only gaining these [milk production] figures once a month through the use of the herd recording services of Dairy Express.” *Id.* There is no disclosure or suggestion, for example, of using information from milk meters in any logical expression. Moreover, as stated above, the Cochranes used basic ear tags to identify cows, which are not “implanted in an animal” as claimed. *See* Trevarthen, 69–70; *see also* Sections VII.A, IX.B.1.

105. Also of note is that the Cochranes employ a specific herd management software called “Dairy 2000.” *See* Trevarthen at 92–93. Trevarthen states that Dairy 2000 “provides the ability to store information pertaining to each individual cow.” *Id.* Trevarthen does not states that this software can perform any of the steps of claim 1, including “linking” milk information to information retrieved from an RFID device implanted in an animal, “converting” milk information into a logical variable, “inserting” a logical variables into a logical expression, or “obtaining a logical value relating to said animal.” *See* element 1[D] through 1[G].

106. The other discussions in Trevarthen that Petitioners’ and Dr. Brown-Brandl rely on also refer to milk meters and not to an RFID-based animal management system like those claimed. For example, Trevarthen does not explain how or why milk production information would be entered into a method that retrieves information from an “RFID device implanted in an animal” or that solves logical expressions.

3. Trevarthen Does Not Render Obvious Elements 1[E] and 1[F]

107. As I have explained above (*see* Section IX.A), I do not see any place that Dr. Brown-Brandl or Petitioners have identified any specific differences that they believe exist between Trevarthen and the challenged claims. I also do not see any reasons they have provided to combine or modify Trevarthen with a reasonable expectation of success.

108. In fact, a POSA could not modify a “logical expression” that Dr. Brown-Brandl or Trevarthen identified because what they have identified are not logical expressions. For example, Petitioners and Dr. Brown-Brandl identify as a “logical expression” Trevarthen the following: “Further, this frequent recording of information may also serve as a means to detect problems with cows. For example, a cow producing significantly less milk than her calculated average may be suffering from an illness, or other stress factor that is reducing her milk production abilities.” Pet. at 18; Ex. 1003 ¶ 112. A POSA would view this passage regarding the

Cochrane’s potential desire to implement milking meters as aspirational and does not identify an actual logical expression in Trevarthen. Similarly, as discussed above, Trevarthen’s mention of “[r]ecognising patterns in milk production” relates to a potential future use of “milking meters” with “automated feed bins” and not any logical expression. See Trevarthen, 109; Pet. at 18; Ex. 1003 ¶¶ 111–113; Sections VII.A, IX.B.1 above. Likewise, Trevarthen’s brief two-sentence statement on page 115 would not teach the use of any “logical expression” to a POSA. Trevarthen at 115 (“Utilising milk meters will also aid to identify any problems that may arise in the herd (such as illness). For example, if a cow provides a significantly lower amount of milk than their usual output, the system will be able to identify this disparity and alert the operators to check this cow when milking has completed.”); Pet. at 18; Ex. 1003 ¶ 112.

109. Moreover, if any of the above examples from Trevarthen included or suggested a “logical expression,” a POSA would not have had any reason to further incorporate a step of retrieving information from an “RFID device implanted in an animal.” Dr. Brown-Brandl and Petitioners’ explanations of what they call “logical expressions” relate solely to milking meters that may obtain milk production information. They do not explain why an RFID device implanted in an animal could or would be used in conjunction with that.

110. The additional references cited by Petitioners and Dr. Brown-Brandl cannot supply a reason to modify Trevarthen to include a logical expression as claimed. *See* Ex. 1003 ¶¶ 114–117. Specifically, Petitioners and Dr. Brown-Brandl rely on a de Mol reference (Ex. 1033) to suggest that implementing the claimed logical expression was achievable. In my opinion, de Mol also does not provide a reason to use a logical expression or to integrate milk information into any method as claimed. In fact, in my view, de Mol would discourage or “teach away” from using his equations for purposes of identifying illness, particularly in a “practical application,” like an animal tracking method. In its “Conclusions,” de Mol states the following:

The results of the detection model are based on a comparison with reference data. The sensitivity is high (but depending on the chosen criterion). The specificity also seems high but may be too low for practical application, therefore additional research is directed to a reduction of the number of false positive alerts.

Ex. 1033 at 184. A POSA would understand that de Mol is explaining that the “specificity” of its detection model is “too low for practical application, therefore additional research is directed to a reduction of the number of false positive alerts.” *Id.* With this understanding, a POSA reviewing de Mol would be discouraged from using de Mol’s models in any herd management system due to their excessive number of false positives. This same evidence shows that a POSA would not have

had a reasonable expectation of success in incorporating equations like de Mol's into an animal management system such as Trevarthen's. Moreover, in my opinion, de Mol would not have provided a reason to modify Trevarthen to achieve the '515 Patent claim elements because de Mol uses *milk* temperature, measured in vitro, not in vivo in its equations. *See, e.g.*, Ex. 1033 at Abstract, 173; Ex. 1023 at 4:13–18 (referring to “the temperature of a milk flow”).

C. Element 1[A]: “Connecting a Computer to an RFID Device Reader”

111. Dr. Brown-Brandl and Petitioners have not identified a step of “connecting a computer to an RFID device reader” in Trevarthen as part of a method arranged as claimed. They also have not explained why such a step would have been obvious.

112. First, Dr. Brown-Brandl relies on Trevarthen's statement that “[a]s each cow passes through the RFID reader, their individual information is displayed on the two computer screens located in the dairy.” Ex. 1003 ¶ 97 (citing Trevarthen, 78-79). According to Dr. Brown-Brandl, this “indicat[es] a connection between the RFID reader and the computer, which indicates that the RFID reader is connected to a computer.” *Id.*; *see also* Pet. at 12–13. However, these statements from Trevarthen were discussing the *Cochrane Dairy* system. POSAs would have understood that using the *Cochrane Dairy* system does not include every claim element. It also would

not have been obvious to a POSA to re-arrange the Cochrane Dairy system, or to incorporate it into another system, in the manner claimed.

113. For example, element 1[B] of the claims requires “reading an RFID device implanted in an animal with said RFID device reader.” This means that the RFID device reader connected to a computer in element 1[A] must “read” a device “implanted in an animal.” The Cochrane Dairy system does not have an RFID device reader connected to a computer that reads a device “implanted in an animal.” Instead, at Cochrane Dairy, the RFID reader “reads” a basic RFID tag that is “attached to [a cow’s] right ear.” *See, e.g.,* Trevarthen, 69. Therefore, the Cochrane’s RFID device is external to the cow (on its ear) and not implanted within the cow as required by the claims. In short, The Cochrane Dairy system does not include “a computer connected to an RFID device reader” that reads an “RFID device implanted in an animal.”

114. Petitioners and Dr. Brown-Brandl also rely on Trevarthen’s discussion of “mainstream computer network devices” that may be linked to “RFID readers.” Ex. 1003 ¶ 97; Pet., 12. Those discussions refer to future potential devices that a POSA would understand were not part of any method, let alone one arranged as claimed. Below is the context of that discussion:

Ideally, farmers will be utilising wireless networks in future arrangements. This will enable an array of devices, whether fixed or portable, to be linked directly to real-time data in the herd management

database. Such devices include the mainstream computer network devices, such as PDAs (Personal Digital Assistants), laptops, desktop personal computers and printers, however will also provide the vital links to dairy farm devices, such as RFID readers, milking controller units, feed management units, drafting gates, and a vast array of other devices that could be configured to operate under computer control, or require access to herd information for operation.

Trevarthen, 104. A POSA would have understood that Trevarthen was describing potential “future arrangements” and devices that potentially “could be configured to operate under computer control.” They would not have understood Trevarthen to be describing a particular system or method, including those described elsewhere in Trevarthen. Dr. Brown-Brandl and Petitioners also do not explain what methods disclosed in Trevarthen could or would be modified to incorporate the “future arrangements” discussed above. And they do not explain why or how a POSA would pursue or make such a modification to achieve the entirety of the claimed method.

115. Moreover, elements 1[D] and 1[E] refer to “said computer,” which a POSA would understand indicates that the “computer” in those elements must be the same computer identified in element 1[A]. Specifically, element 1[D] requires “linking an amount of animal information of said animal stored in a data base of *said computer* to said amount of information retrieved from said RFID device implanted in said animal, said amount of animal information stored in said data base of *said computer* comprising an amount of milk production information or an amount of

days milked.” Element 1[E] requires “converting said amount of animal information of said animal stored in said database of *said computer* linked to said amount of information retrieved from said RFID device implanted in said animal into one or more logical variables.” Neither Dr. Brown-Brandl nor Petitioners identify a “computer” in elements 1[D] and 1[E]. They also do not explain that the alleged “amount of animal information of said animal stored in said database of said computer” that is “converted” or “linked” was in a database of the “computers” identified in element 1[A]. Nor could they have. Trevarthen does not indicate or suggest that the “computer screens” at Cochrane Dairy involve a computer that has a database with “an amount of milk production information or an amount of days milked.” Trevarthen also does not indicate or suggest that the future “mainstream computer network devices” include a database with “an amount of milk production information or an amount of days milked.” I do not see any arguments in Dr. Brown-Brandl’s declaration or the Petition that would explain how it would have been obvious to include the claimed information in a database in those specific components that they identified as the “computer” of element 1[A].

116. In summary, Dr. Brown-Brandl and Petitioners do not show Trevarthen discloses or renders obvious “connecting a computer to an RFID device reader” in the manner claimed.

D. Element 1[B]: “Reading an RFID Device Implanted in an Animal With Said RFID Device Reader”

117. Dr. Brown-Brandl and Petitioners also do not show that Trevarthen discloses or renders obvious “reading an RFID device implanted in an animal with said RFID device reader,” as required by element 1[B]. See Ex. 1003 at ¶¶ 98–100; Pet., 13. For that element, Dr. Brown-Brandl and Petitioners rely on Trevarthen’s references to the “Bio-thermo RFID” and “boluses.” However, the Bio-thermo RFID would not have been used in any of the disclosed systems in Trevarthen (or in any method that meets the claims) because, as Trevarthen explains, the “Bio-thermo RFID” is not yet applicable to livestock. Specifically, Trevarthen states “that it is possible to incorporate temperature sensing abilities into RFID microchips currently – the application of which may soon be extended the livestock industry.” Trevarthen, 121. Trevarthen further states that “RFID temperature sensing is a currently available technology, and its use in the livestock industry is currently being investigated.” *Id.*, 123. POSAs would understand this to mean that the disclosed temperature sensing device was not yet successfully incorporated into animal tracking methods at the time.

118. There are good reasons why POSAs had not successfully incorporated temperature-sensing RFID devices into animal tracking methods at the time of the invention. Some reasons include data storage, physical size, and battery life. Data storage for most tags being used at the time was 256 bits, or about the equivalent of

6 phone numbers, far less than what is needed to record physiological data from a cow. The physical size of the RFID tag and associated, battery, sensors, and connections grows with the complexity, and amount of data. Sensors (e.g., to measure temperature), data storage, data transmission, and system operation all require power. Batteries are required for ambulatory RFID systems. Batteries impose strict limitations on RFID systems due to accessibility (for charging or replacement) size, current, voltage, and lifespan. Data security was also very important to farmers concerned with regulatory overreach and privacy, which would have been an additional reason POSAs would not have incorporated sensed animal information obtained from RFID devices into an animal tracking method at the time of the invention.

119. Additionally, in the livestock context, POSAs would have believed that a microchip such as the one referenced in Trevarthen would have been likely to cause tissue damage, possible infection, discomfort, and animal welfare issues. Cattle and other livestock spend most of their lives outdoors exposed to the elements. They roll on the ground, bite and scratch their skin, rub against trees and barbed fences, walk through thorn bushes, and immerse themselves in water. Cattle and other livestock are also exposed to temperature extremes and, in my personal experience, I have seen cattle arrive at the abattoir encrusted with mud, scarred, bruised, and bloody, which POSAs believed could impact measurements with an internal device.

Additionally, POSAs considered the location of the device is critical for reading RFID data since readers are distance dependent. In a POSA's view, depending on the size and structure of the animal, a sensor located in the same part of the body may not register uniformly from cow to cow based on a fixed receiver location, and properties and the relative location of the animal. For these reasons, POSAs at the time of the invention would not have had reason to use the microchips in Trevarthen in the manner claimed with a reasonable expectation of success.

E. Element 1[C]: “Retrieving an Amount of Animal Identification Information From Said RFID Device Implanted in an Animal”

120. Dr. Brown-Brandl and Petitioners also do not show that Trevarthen discloses or renders obvious “retrieving an amount of animal identification information from said RFID device implanted in an animal” as stated in element 1[C]. See Ex. 1003 ¶¶ 101–102; Pet. at 14. As explained for element 1[B], Trevarthen does not teach any animal tracking method that utilizes an RFID device implanted in an animal as required to perform the claimed methods. showing a retrieval of any information from an implanted RFID device.

X. GROUND 2 – OBVIOUSNESS OF CLAIMS 3–4 BASED ON TREVARTHEN AND BRUNE

121. Ground 2 challenges dependent claims 3–4, which ultimately depend from claim 1, based on Trevarthen and Brune. Based on my review of Ground 2, I conclude that it does not show obviousness for the same reasons Ground 1 does not

show obviousness. First, as discussed Section VIII, Trevarthen was not shown to be prior art. Second, Dr. Brown-Brandl and Petitioners do not rely on Brune to address any of the missing elements or other deficiencies I have identified in Ground 1. Instead, they rely on Brune only regarding “retrieving an amount of date-time information from said plurality of RFID devices implanted in said plurality of animals,” which is a further requirement of claim 3. Therefore, Ground 2 does not show that claims 3–4 are obvious.

XI. GROUND 3 – OBVIOUSNESS OF CLAIMS 15–25 BASED ON TREVARTHEN AND ROLLINS

122. Ground 3 challenges dependent claims 15–25, which ultimately depend from claim 1, based on Trevarthen and Rollins. Based on my review of Ground 3, I conclude that it does not show obviousness for the same reasons Ground 1 does not show obviousness. First, as discussed in Section VIII, Trevarthen was not shown to be prior art. Second, Dr. Brown-Brandl and Petitioners do not rely on Rollins to address any of the missing elements or other deficiencies I have identified in Ground 1. Instead, they rely on Rollins regarding various components related to claims 15–24, such as a “server device,” “networks,” a “client device,” “computer-executable instructions,” “personal digital assistants,” “cellular phones,” an “RFID reader that is portable.” Therefore, Ground 3 does not show that claims 15–25 are obvious.

XII. GROUND 4 – OBVIOUSNESS OF CLAIMS 1–2 BASED ON LAITINEN, BUCHANAN, AND LIAO

123. Below I explain why I disagree with Petitioners and Dr. Brown-Brandl that Laitinen, Buchanan, and Liao do not render obvious claims 1 or 2 of the '515 Patent.

A. Elements 1[E] and 1[F]: POSAs Would Have Had No Reason to Include “An Amount of Milk Production Information or an Amount of Days Milked” in the Alleged “Logical Expressions”

124. Petitioners and Dr. Brown-Brandl identify two alleged “logical expressions” in Laitinen: (1) a “pico level” device for monitoring when an animal is in heat based on temperature and movement measurements and (2) a “global level” mathematical function that assesses the efficacy of animal medication across multiple local levels. *See* Ex. 1003 ¶¶ 160, 162. Notably, neither of these includes “an amount of milk production information or an amount of days milked,” as required by claim 1. As I explain below, there would have been no reason for a POSA to modify either of them to include such information.

125. With respect to the first alleged “logical expression,” Laitinen explains, “[t]o monitor the animal’s heat with a pico level device, body temperature and movement are usually measured.” Laitinen at 8:5–15. A POSA would understand that this means the “heat” status of animal (i.e., whether it is in estrus) is detected using temperature and movement data acquired directly from the animal using the “pico level” device. Milk production or days in milk is not one of the inputs.

126. I disagree with Petitioners and Dr. Brown-Brand's reasons for contending that Laitinen's heat application would be modified to add the claimed milk information, based on a combination with another reference, "Liao" (Ex. 1010). See Ex. 1003 ¶ 161. Specifically, Dr. Brown-Brandl states that "Liao teaches that milk production is also useful for determining whether a cow is in heat and ready for artificial insemination." Ex. 1003 ¶ 161 (citing Liao at 9:34–10:15, 12:3–15). A POSA would not understand Liao to be teaching that. In reality, Liao teaches that milk production and days-in-milk (DIM) information are independent of whether a cow is in heat. As the tables in Liao show, "heat" is a separate "input parameter" from milk production for recommending whether to inseminate a cow. See tables depicted on Liao at 10, 12. Liao also explains that "days in milk," "peak yield in milk," and "whether the animal is in heat presently" are "input parameters." Liao at 10:6–11:1; see also *id.*, 9:27–11:1. Additionally, Liao includes claims that describe "heat-detection status" as an "input parameter." *Id.* at 20:16–21:10 (claim 10). Thus, according to Liao, "milk production" or "days in milk" does not inform a POSA if the animal is in heat. The POSA would already have that information to provide as an "input." Accordingly, Liao would provide no reason to modify Laitinen's "heat control" application to include milk information. Therefore, a POSA would not understand Liao's milk information would be used "as an input variable, along with

the temperature, to improve its accuracy and reliability at determining whether a cow is in heat,” as Dr. Brown-Brandl states. Ex. 1003 ¶ 161.

127. A POSA also would not have expected to successfully incorporate milk information from a database into Laitinen’s heat control application. Laitinen explains that it monitors heat with a “pico level device.” Laitinen at 8:9–11. Laitinen further states that “[w]hen the local system notices that the alarm limit(s) have been reached, it signals a heat alarm.” *Id.* at 8:12–14. A POSA would thus understand that the “heat alarm” is calculated by the pico-level system based on the temperature and movement data that it measures, while the local system merely “notices” and relays the alarm. Laitinen further describes the pico level system as having “an additional alarm 224,” which can be “signaled electrically to the local, and possibly even to the global, level.” Laitinen at 5:60–64 (describing). Also, Figure 2 depicts an “ALARM DEVICE” at the pico-level). Such statements and figures confirm to a POSA that the pico-level device is acquiring the data and generating the alarm. However, neither Dr. Brown-Brandl nor Petitioners argues that the pico-level system has a database or any other feature that could incorporate milk information. And they do not argue that the pico-level device integrates such information into a “logical expression” as required by the claims.

128. Moreover, because Petitioners and Dr. Brown-Brandl identify the pico-level device as both the “RFID device” and also as the device that generates the

“logical expression,” it is unclear how information “retrieved from said RFID device” would be entered into a logical expression. In other words, even if there were a reason to include milk information in a heat detection system (which there was not), Dr. Brown-Brandl and Petitioners do not explain how that information would be acquired and incorporated into Laitinen’s system in the manner required by the claims.

129. As explained below, POSAs also would not have reconfigured Laitinen’s “inverse function” to include milk production. There was no reason to include that information in Laitinen’s function with a reasonable expectation of success.

130. As an initial matter, Petitioners and Dr. Brown-Brandl misquote the “inverse function” in Laitinen. They repeatedly reproduce it (every time they reference it) as “ $x=f^{-1}(y,z)$.” See Ex. 1003 ¶¶ 162, 167; Pet. at 47, 50. Laitinen provides the equation “ $x=f^1(y,z)$.” Laitinen at 7:35–37. In other words, Petitioners and Dr. Brown-Brandl amended Laitinen’s equation to add a “-” in front of the “1.” They never explain why they revised the equation, even though “ f^{-1} ” generally represents a specific “inverse function” that can be used to “undo” or reverse the effect of one operation on the other or used as an input of a logical expression. It is not clear from Laitinen’s notation that it was referring to this type of “inverse function” which would typically be notated as “ f^{-1} .” In practical terms, Laitinen’s

so-called inverse function (indicated as f^1) is a “possible embodiment” “based on a counter propagating network, as described, for instance, in the article Hecht-Nielsen.” Ex. 1006 at 7:38–40. Based on this, a POSA would have understood that what Laitinen calls an “inverse function” could only potentially be an output from a Counter Propagating neural Network (CPN) programmed to search terms (the physiological data of cattle, and the “regular interdependency $z=f(x,y,m)$ between the used medicaments and the effects they produced, using a large sample” (*id.* at 7:11-13) to predict the best medical treatment schemes. In other words, the POSA would *not* have necessarily understood the function described in Laitinen to be a traditional mathematical construct or logical expression (as incorrectly assumed by Petitioners and Dr. Brown-Brandl) referred to as an inverse function, which would have been noted as “ f^{-1} ” because it would not have been clear to a POSA that Laitinen’s function (indicated as f^1) can be used to “undo” or reverse the effect of one operation on the other or used as an input of a logical expression, which is generally what is meant by inverse functions marked as “ f^{-1} .” In fact, Petitioner’s incorrect notation could have a meaningful difference because, in the practical application of CPNs, it is recognized that for many cases, a true inverse function (“ f^{-1} ”) does not exist.

131. In any event, I disagree with Dr. Brown-Brandl and Petitioners that a POSA would have been motivated to add milk production information to Laitinen’s

inverse function or to create a new function that meets the claims. Dr. Brown-Brandl is of the opinion that “modify[ing] Laitinen’s logical expression relating to detecting heat to include milk production information as an input variable, along with the temperature, to improve its accuracy and reliability at determining whether a cow is in heat . . . would merely be applying known techniques, as Liao teaches using milk production as a variable in its decision engine for artificial insemination.” Ex. 1003 ¶ 161; *see also id.* ¶ 165. I disagree. Adding “milk production information” to Laitinen’s “inverse function” does not make physical sense since it would be the output of a CPN, and POSAs would not have been expected to be able to incorporate such information, in combination with a CPN, or “self-learning system” (*id.* at 6:56) or “Neural Calculator” (*id.* at Fig. 3) to meet the claims, as explained more below.

132. Laitinen explains that the disclosed “functions” are implemented at the “global level.” According to Laitinen:

The goal is to discover a regular interdependency $z=f(x,y,m)$ between the used medicaments and the effects they have produced, using a large sample. A self-organizing map, for instance, can be used for this purpose. In that case the medicine matrix is transformed into a vector by lines, and the environment, initial state and present state vectors are combined into one vector $x'=(x,y,m,z)$ which is then inserted into a self-learning map. A typical map size is about 1000 elements. Vectors can be compared by using suitable metrics, such as the square of the

remainder of the components. After a sufficient number of cases, groups of variables begin to accumulate at certain points on the map.

Laitinen at 7:11–23. A POSA would understand that these requirements apply to the “inverse function.” In other words, using equations such as the inverse function requires “a large sample” “inserted into a self-learning map” (Neural Network or CPN) and “sufficient number of cases,” which could be on the order of “about 1000 elements.” See Laitinen at 7:14–22. These requirements would make sense to a POSA because the inputs into the function that Petitioners and Dr. Brown-Brandl rely on, namely, “temperature,” is a series of data acquired from numerous animals that could respond to medication over time. Furthermore, the physiological information collected does not apply to the milk information that they rely on. That is, the milk information that Petitioners and Dr. Brown-Brandl rely on for obviousness from Liao (specifically, “days in milk” and “peak yield”) are single data points that would not respond to medication over time and thus cannot be implemented into Laitinen’s “inverse function,” if such an inverse function existed and if a CPN was used.

133. The following example illustrates this point. Laitinen states that its “inverse function” finds the “necessary medical treatment by analysing [sic] the animals’ “present condition.” See, e.g., Laitinen at 7:36–37. In the “inverse function,” the “initial state” is the time when administration of medication to the

animal began or commenced. With respect to Liao’s “peak yield,” it is impossible to acquire such information at an “initial state” or “present” time because peak yield is determined by looking backwards at the end of a lactation period. *See* Liao at 5:18 (describing “a peak milk yield in a latest lactation”). A POSA would have understood this and thus would not have incorporated Liao’s “peak yield” into Laitinen’s “inverse function.” Indeed, there would be no way to do so, since the “inverse function” described by Laitinen is the output of a CPN, and therefore even if the “inverse function” was a mathematical construct or logical expression, “peak yield” would provide no useful information, including information regarding medical treatment or whether an animal is ill.

134. With respect to the “days in milk” input in Liao, a POSA would understand that it refers to the current number of days an animal has been in lactation at a given time. Thus, “days in milk” increases by one day each day until lactation ends, regardless of whether medication is administered. For the same reasons described above for “peak yield,” using such values in Laitinen’s “inverse function” to assess the efficacy of medication would make no sense and would not provide useful information, including regarding whether an animal is ill. A POSA would have understood this and would not have had reason to include, or even consider, Liao’s “days in milk” into Laitinen’s “inverse function.”

135. In summary, because the “inverse function” in Laitinen is the output of a CPN, and not a mathematical construct or a logical expression, it is unclear how or why a POSA could or would incorporate milk production information or days in milk into Laitinen’s “inverse function” (if it existed) to achieve the claimed invention based on any disclosure in Liao. Even if Laitinen’s “inverse function” was a mathematical construct or logical expression, milk production information or days in milk would not provide any useful information regarding medical treatment or illness of an animal, and therefore there would be no reason for a POSA to incorporate such information into Laitinen’s “inverse function.”

136. Moreover, a POSA would understand that excluding information such as an amount of milk production or days in milk from Laitinen’s “heat” application and its inverse function is consistent with Laitinen’s “basic principle” that requires three hierarchical levels because such milk information is not acquired from a pico device. Laitinen at 3:21–27. Laitinen operates by acquiring data at the “pico level,” storing that data at the “local level,” and then analyzing such data from multiple local levels at the “global level.” *Id.* at 3:21–4:49, Figs. 1–6. For example, Laitinen explains that “algorithms and knowledge models upheld in the global level systems, fed by locally collected data, are essential to the effectiveness of the system’s services.” *Id.* at 6:29–32. Laitinen further states that:

For example, a relation database 31 comprising certain local measures and their corresponding results, as measured with the pico devices, is created on each local level. These results are taken to a higher global level system 190 on which the desired analysis is performed on the chosen measure/result pairs. Local levels (arrows A, B and C) are controlled on the basis of the results of the analysis.

Laitinen at 6:36–46. A POSA would understand that this means that locally collected data “compris[e] certain local measures and their corresponding results, as measured with the pico devices,” and the “results are taken to a higher global level system 190 on which the desired analysis is performed.” *Id.* at 6:36–42. The local levels, which a POSA would understand are individual farms, are in turn “controlled on the basis of the results of the analysis.” *Id.* at 6:42–46. Laitinen thus makes clear that the measurements that are ultimately sent to the global level to control the local levels are acquired directly from the animal by a pico-level device. There is no explanation in Laitinen to suggest milk information is acquired from a pico-level device. Reconfiguring Laitinen such that the local level system generates a database independent of the pico-level measurements would change Laitinen’s basic principle of operation. A POSA would not look to change Laitinen’s principle of operation and thus would not look to include milk information.

137. Moreover, for the reasons explained above (see §§ IX.A, IX.B.3), de Mol discourages POSAs from combining temperature and milk production

information in a logical expression and further explains why a POSA would not have a reason to do so. As noted above, de Mol explained that the “specificity” of its detection model was “too low for practical application, therefore additional research is directed to a reduction of the number of false positive alerts.” Ex. 1033 at 184. Specificity for de Mol is the ability of the test to correctly classify a cow as disease-free. $\text{Specificity} = d \text{ (true negative)} / b + d \text{ (true negative + false positive)}$. For de Mol’s study the specificity was regarded as “too low” due to “the number of false positive alerts.” *Id.* at 184. A false positive occurs when a healthy cow is incorrectly diagnosed with a disease. Because a POSA would understand, based on de Mol’s conclusions, that the models provide too many false positives, they would have been discouraged from incorporating such models like that proposed by de Mol into any logical expression. This also shows that POSAs would not expect success in achieving the claimed invention based on modifying Laitinen using de Mol’s teachings.

138. Additionally, de Mol would not have provided a reason to include both temperature and milk production information into any logical expression. *See* Ex. 1003 ¶¶ 164–165. When de Mol refers to “temperature,” it is referring to the in vitro temperature of the milk, not animal temperature. *See, e.g.,* Ex. 1033 at Abstract, 173. Such disclosures therefore would not have provided any reason to combine animal

temperature and milk production or days in milk into a logical expression as required by the claims.

139. Van den Berg (Ex. 1023) also would not have provided a reason for a POSA to modify Laitinen to achieve the claimed method. For example, van den Berg does not suggest let alone “expressly teach[]” that “‘one or more of the parameters [including temperature and milk yield] may be combined ... to achieve **higher accuracy**’ in determining whether an animal is ill or in heat,” as Dr. Brown-Brandl’s modified quotation suggests. Ex. 1003 ¶ 164 (citing Ex. 1023, 4:12-22).”

In the passage cited by Dr. Brown-Brandl, van den Berg states:

According to the invention, a more reliable indication signal of heat or illness is obtainable from parameters including one or more of the following: the milk rate of flow, the temperature of a milk flow, the milk yield, and/or the number of times per given time period that an animal pays a visit to the milking parlor or the food quantity consumed in the milking parlor. These parameters for ill or estrous animals are different from those for healthy and non-estrous animals. One or more of the parameters may be combined with the dead time and analyzed by a computer. In doing so, to achieve a higher accuracy, especially the temperatures of each of the flows of milk from the various teats can be determined. For the determination of the temperature, use is made of temperature-sensitive sensors to be arranged in the flow of milk. When the farmer has obtained an indication that the animal is ill or threatens to fall ill, it is important to know whether mastitis or any other disease is involved. According to the invention, an indication that an animal

suffers from mastitis [sic] can therefore be obtained in the computer by means of a sensor for electrical conductivity of the milk flow and, if necessary [sic], also by means of a temperature-sensitive sensor.

Ex. 1023 at 4:15–34. A POSA would have understood that van den Berg was explaining that one or more of the listed “parameters” could “be combined with the dead time,” specifically “the temperatures of each of the flows of milk from the various teats can be determined.” Ex. 1023 at 4:20–24. A temperature of an animal itself is never mentioned as a parameter. Van den Berg then explains that an indication of mastitis can “be obtained in the computer by means of a sensor for electrical conductivity of the milk flow and, if necessary [sic], also by means of a temperature-sensitive sensor.” Ex. 1023, 4:29–34. Accordingly, Van den Berg is possibly suggesting that *milk* temperature can be combined with electrical conductivity measurements to help identify mastitis. However, van den Berg is not suggesting that *animal* temperature could or should be combined with milk production to detect illness, let alone in a logical expression like the one claimed in the ’515 Patent.

B. Element 1[B]: “Reading an RFID Device Implanted in an Animal With Said RFID Device Reader”

140. Dr. Brown-Brandl provide a single paragraph in identifying where Laitinen allegedly discloses element 1[B]:

Laitinen states that its RFID device can be “an *implant* inside the animal, in which case the data it provides can be ... *read*/transcribed ...

using the so-called ***Radio Frequency Identification Technology.***” *Id.*, 3:53-57, 5:38-42. As explained for 1[A] (*supra* §XI.A.2), the POSA would have understood that it is implicit that Laitinen’s implanted RFID device is read with an RFID reader. Thus, Laitinen discloses this element.

Ex. 1003 ¶ 150. A POSA would not have understood the statement from Laitinen relied upon by Dr. Brown-Brandl as teaching the claimed “RFID device implanted in an animal.” The “implant” Dr. Brown-Brandl refers to is a “[s]ensor unit” described in Laitinen, which is not the “RFID device.”

141. Rather, a POSA would have understood the sensor unit to be completely separate from the RFID device, based on Laitinen’s own description of the sensor unit, as shown below:

The Pico level, i.e., the lowest level comprises the technology used directly with the animals. A pico level device is attached permanently to, e.g., the animal's ear after its birth, and it functions like conventional identification tool. In other words, it replaces the presently used earmark that in Finland is provided by Maatalouden laskentakeskus Oy. The Pico level device, indicated by the reference **100** in the illustration, generally include at least the following components:

RF transmitter/receiver used in the creation of a (programmable) radio network with the local level's terminal unit. This component can also be a mere RF transmitter.

Antenna system, which in a typical application can be incorporated into the device attached to the animal.

Energy supply instruments, which normally comprise, e.g., a lithium accumulator.

Micro controller that coordinates radio transmissions between the pico and the local level and gathers parameter values from the sensors attached to the animals. When necessary, the micro controller protects data saved in the device. As a part of the micro controller or as a separate component, the pico level also features an identifier.

Censor unit connected to the micro controller for the surveillance of the animal's body temperature, occlusion, muscular action, motion or metabolic level. The censor unit can also be an implant inside the animal, in which case the data it provides can be, for instance, read/transcribed by the pico level equipment using the so-called Radio Frequency Identification Technology. It is also possible the censor unit includes components suitable for the dispersing of medicaments which enable the individual treatment of animals via a communications network, or detectors which alarm if the pico level device is detached from the animal.

Laitinen at 3:28–62. A POSA would have understood Laitinen to be explaining that the “pico level device is attached permanently to, e.g., the animal’s ear after its birth” and that the *separate* “[s]ensor unit” can be “an implant inside the animal, in which case the data it provides can be, for instance, read/transcribed by the pico level equipment.” *Id.* Thus, even where Laitinen discusses an “implant[ed]” sensor unit,

he is not describing any pico level device that is an RFID device implanted in an animal.

142. Laitinen also makes clear that the alleged logical expressions identified by Dr. Brown-Brandl and Petitioners did not use an RFID device implanted in an animal. Thus, Dr. Brown-Brandl and Petitioners fail to identify an RFID device implanted in an animal as used in the claimed method. As I explained above, when identifying what they claim to be “logical expressions,” Petitioners and Dr. Brown-Brandl rely on the use of “temperature” as part of their proposed motivation to combine milk information into the alleged logical expressions. *See, e.g.*, Ex. 1003 ¶¶ 160–165; *see also* Section XII.A above. Importantly, Laitinen clearly states that temperature is obtained only from an “external” pico device. Temperature is not obtained from any RFID device implanted in an animal. Also as noted above, Petitioners and Dr. Brown-Brandl rely on two logical expressions that allegedly incorporate the animal “temperature.” First, they rely on Laitinen’s “heat control” application that Dr. Brown-Brandl states “monitors a cow’s temperature” and then uses the temperature data as “an input variable.” Ex. 1003 ¶ 160. Second, they rely on Laitinen’s “medical treatment” equation that uses “the animal’s temperature at different times” because, according to Dr. Brown-Brandl, “temperature correlated with animal illness.” Ex. 1003 ¶ 162.

143. The two disclosures Petitioners and Dr. Brown-Brandl rely on for “logical expressions” in Laitinen *do not* enter data from an RFID device “implanted in an animal” as claimed because Laitinen states that animal temperature is obtained from an “external” pico level device, not an RFID device “implanted in an animal.” As Laitinen explains, “[t]he external device can, for instance, measure the animal’s body temperature (with a temperature [s]ensor) or movements ... or determine the animal’s location.” Laitinen at 5:44–49. Laitinen never describes an implanted or internal device as capable of such measurements. Similarly, a POSA would understand that Figure 2 of Laitinen depicts an “EXTERNAL CONTROL DEVICE” with “TEMPERATURE” and “MOVEMENT/LOCATION” inputs:

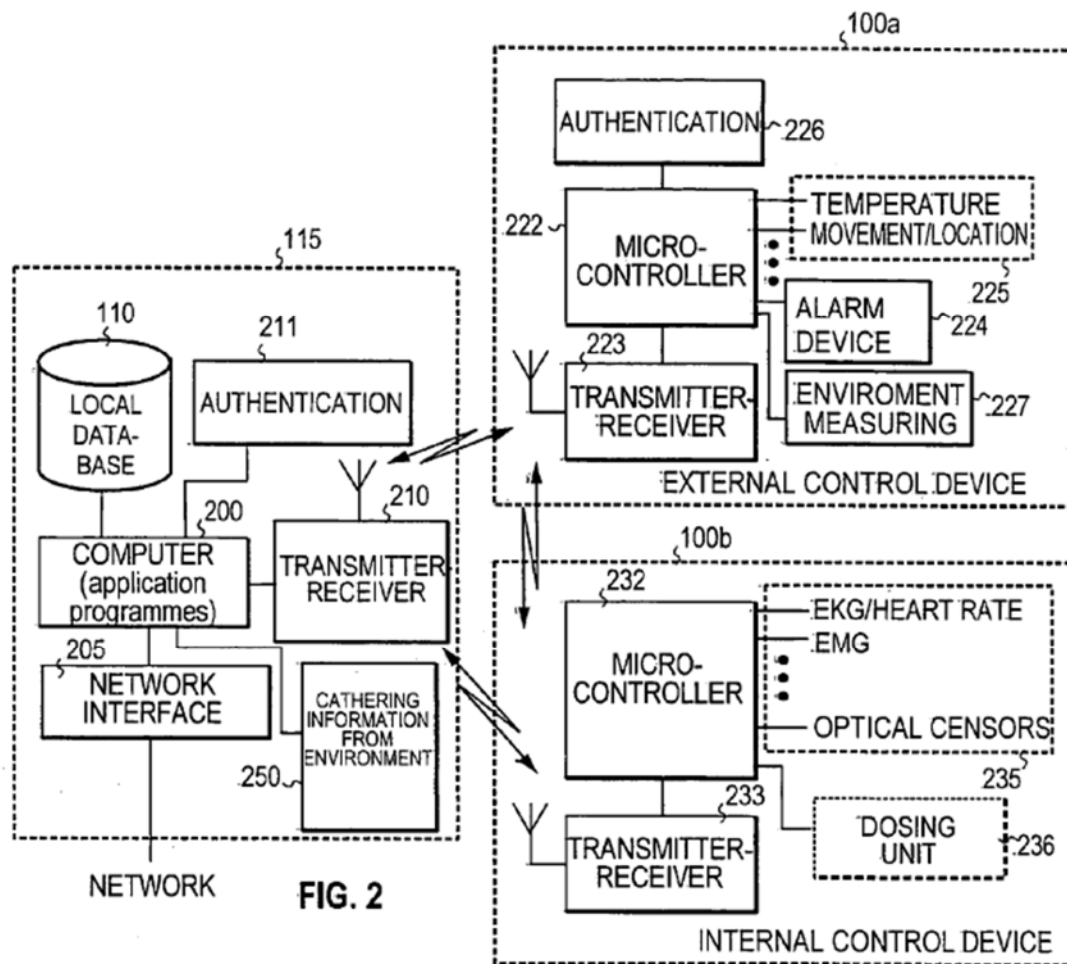


FIG. 2

144. As shown above, Figure 2 also depicts an “INTERNAL CONTROL DEVICE” that does not have temperature or movement/location inputs. This would have confirmed to a POSA that Laitinen’s “external” device is the only device that measures temperature and therefore is the only device that would be employed in Petitioners and Dr. Brown-Brandl’s two alleged “logical expressions.”

145. Dr. Brown-Brandl does not address Laitinen’s distinction between external and internal devices that perform different functions. She does, however, cite to where Laitinen describes a “[s]ensor unit” that may be an “implant.” Ex.

1003 ¶ 150 (citing Laitinen at 3:53–57); *see also id.* ¶ 177 (citing Laitinen at 3:51–57). As I discussed above, a POSA would have understood the sensor unit to be completely separate from the RFID device, based on Laitinen’s own description of the sensor unit.

146. Moreover, a POSA at the time of the invention would have reasons not to use Laitinen’s “internal device” to measure temperature. In fact, it is not clear how or where the “internal device” mentioned in Laitinen would be inserted or how it would measure data at all. At the time of the invention, POSAs would have most likely understood an “internal device” to imply an under-the-skin device. In the livestock context, an internal device would have been understood by a POSA to potentially cause tissue damage, possible infection, discomfort, and animal welfare issues. Cattle and other livestock spend most of their lives outdoors exposed to the elements. They roll on the ground, bite and scratch their skin, rub against trees and barbed fences, walk through thorn bushes, and immerse themselves in water. Cattle and other livestock are also exposed to temperature extremes and, in my personal experience, I have seen cattle arrive at the abattoir encrusted with mud, scarred, bruised, and bloody, which POSAs believed could impact measurements with an internal device. Additionally, POSAs considered the location of the device as critical for reading RFID data since readers are distance dependent. In a POSA’s view, depending on the size and structure of the animal, a sensor located in the same part

of the body may not register uniformly from cow-to-cow based on a fixed receiver location, and properties and the relative location of the animal. POSAs thus would not have had reason to use such devices with a reasonable expectation of success. *See, e.g.*, Ex. 1006 at 5:38–55.

147. In summary, Laitinen does not disclose an RFID device implanted in an animal that uses temperature data. Petitioners and Dr. Brown-Brandl rely on temperature as alleged variables in “logical expressions.” But Laitinen makes clear that such measurements can only be obtained with external devices. Petitioners and Dr. Brown-Brand thus do not show that Laitinen discloses or renders obvious the use of an RFID device “implanted in an animal” or “implanted in a plurality of animals” as required by the claims.

C. Element 1[C]: “Retrieving an Amount of Animal Identification Information from Said RFID Device Implanted in an Animal”

148. Petitioners and Dr. Brown-Brandl do not identify the step of “retrieving an amount of animal identification information from said RFID device implanted in an animal,” as required by element 1[C]. With respect to Laitinen, the entirety of Dr. Brown’s argument for element 1[C] is as follows:

149. Laitinen describes its system as “a system of individual animal identification.” Laitinen, 2:47-48; see also *id.* 6:2-4 (“Each surveillance device includes a personalized identifier for the correct identification of the animal in question.”). Laitinen explain that such a “pico level device is attached permanently to [an animal], and it functions like

conventional identification tool.” Laitinen, 3:28-35; see also id., 6:2-4 (“Each surveillance device includes a personalized identifier for the correct identification of the animal in question.”).

Ex. 1003 ¶ 151. As shown, Dr. Brown-Brandl is stating that Laitinen’s pico level device “functions like [a] conventional identification too,” but she never argues that Laitinen’s “functions” include a step of “retrieving an amount of animal identification information from said RFID device implanted in an animal” as claimed.

150. Dr. Brown-Brandl also does not contend that the step would have necessary or obvious. She simply cites to another reference (Ex. 1009, Pohlkamp) in support that “[t]he use of implanted RFID devices for animal identification was well-established.” Ex. 1003 ¶ 152. This does not explain how it would have be obvious to perform the step of “retrieving an amount of animal identification information from said RFID device implanted in an animal” using any of Laitinen’s systems.

XIII. GROUND 5 – OBVIOUSNESS OF CLAIMS 3–4 BASED ON LAITINEN, BUCHANAN, LIAO, AND BRUNE

151. Ground 5 challenges dependent claims 3–4, which ultimately depend from claim 1, based on Laitinen, Buchanan, Liao, and Brune. Based on my review of Ground 5, I conclude that it does not show obviousness for the same reasons Ground 4 does not show obviousness. Dr. Brown-Brandl and Petitioners do not rely

on Brune to address any of the missing elements or other deficiencies I have identified in Ground 4. Instead, they rely on Brune only regarding “retrieving an amount of date-time information from said plurality of RFID devices implanted in said plurality of animals,” which is a further requirement of claim 3. Therefore, Ground 2 does not show that claims 3–4 are obvious.

XIV. GROUND 6 – OBVIOUSNESS OF CLAIMS 3–4 BASED ON LAITINEN, BUCHANAN, LIAO, AND ROLLINS

152. Ground 6 challenges dependent claims 15–25, which ultimately depend from claim 1, based on Trevarthen and Rollins. Based on my review of Ground 6, I conclude that it does not show obviousness for the same reasons Ground 4 does not show obviousness. Dr. Brown-Brandl and Petitioners do not rely on Rollins to address any of the missing elements or other deficiencies I have identified in Ground 4. Instead, they rely on Rollins regarding various components related to claims 15–24, such as a “server device,” “networks,” a “client device,” “computer-executable instructions,” “personal digital assistants,” “cellular phones,” an “RFID reader that is portable.” Therefore, Ground 6 does not show that claims 15–25 are obvious.

XV. CONCLUSION

153. 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.

Date: 8/30/2024

By: Timothy J. Bowser
Timothy J. Bowser, Ph.D.

APPENDIX—LIST OF MATERIALS

Exhibit No.	Description
1001	U.S. Patent No. 9,844,206
1002	Prosecution History of U.S. Patent No. 9,844,206
1003	Declaration of Tami M. Brown-Brandl, Ph.D.
1004	CV of Tami M. Brown-Brandl, Ph.D.
1005	Trevarthen, <i>The Importance of Utilising Electronic Identification for Total Farm Management: A Case Study of Dairy Farms on the South Coast of NSW</i> (Oct. 24, 2005) (Bachelor Thesis, University of Wollongong) (“Trevarthen”)
1006	U.S. Patent No. 7,059,275 to Laitinen et al. (“Laitinen”)
1008	U.S. Patent No. 6,059,733 to Brune et al. (“Brune”)
1009	U.S. Patent App. Pub. No. 2006/0267767 to Pohlkamp et al. (“Pohlkamp”)
1010	International Patent Pub. No. WO 2007/089184A1 to Liao (“Liao”)
1011	International Patent Pub. No. WO 2006/059916A2 to Buchanan et al. (“Buchanan”)
1013	International Patent Pub. No. WO 2004/066720 to Cross et al. (“Cross”)
1014	U.S. Patent App. Pub. No. US 2004/0233971 to Meads et al. (“Meads”)
1015	J.M. Bewley et al., <i>Comparison of Reticular and Rectal Core Body Temperature in Lactating Dairy Cows</i> , 91 J. Dairy Sci. 4661 (2008)
1016	L.C. Hicks et al., <i>Comparison of Methods of Measuring Deep Body Temperatures of Dairy Cows</i> , Livestock

	Environment VI: Proceedings of the 6th International Symposium 432 (May 2001)
1017	K.T. Higgins, <i>Temperature Readings by Remote Control</i> , Food Engineering 63 (May 2003)
1018	T. Mottram et al., <i>Technical Note: A Wireless Telemetric Method of Monitoring Clinical Acidosis in Dairy Cows</i> , 64 Computers and Electronics in Agriculture 45 (November 2008)
1020	T.M. Brown-Brandl et al., <i>Telemetry System for Measuring Core Body Temperature in Livestock and Poultry</i> , 2001 ASAE International Meeting Sacramento, California, USA, Paper No. 01-4032 (July 30-Aug 1, 2001)
1021	D.J. Prendiville et al., <i>Radiotelemetry Systems for Measuring Body Temperature</i> , Beef Production Series No. 57 (June 2002)
1022	Amended Complaint, D.I. 25, <i>ST Reproductive Technologies, LLC d/b/a STinsight v. Smaxtec Inc. et al.</i> , No. 3:24-cv-00037 (W.D. Wis. Apr. 23, 2024)
1023	U.S. Patent No. 5,568,788 to van den Berg et al (“van den Berg”)
1024	U.S. Patent App. Pub. No. 2006/0185605 to Renz et al. (“Renz”)
1025	U.S. Patent App. Pub. No. 2007/0271320 to Tsuyuzaki (“Tsuyuzaki”).
1026	U.S. Patent App. Pub. No. 2005/0145187 to Gray (“Gray”)
1027	R. Daly & M. Organ, <i>Research Online: Digital Commons as a Publishing Platform at the University of Wollongong</i> , Australia, 35 Serials Review 149-53 (2009).
1028	International Application No. PCT/NZ2007/000286, International Search Report (March 18, 2008)

1029	International Application No. PCT/NZ2007/000286, Written Opinion of the International Search Authority (March 18, 2008)
1030	Affidavit of Nathaniel E Frank-White
1031	Declaration of June Munford in Support of <i>Inter Partes</i> Review of U.S. Patent No. 8,823, 515
1032	R.M. de Mol et al., <i>Results of a Multivariate Approach to Automated Oestrus and Mastitis Detection</i> , 48 <i>Livestock Production Science</i> 219-227 (1997)
1033	R.M. de Mol et al., <i>Description of a Detection Model for Oestrus and Diseases in Dairy Cattle Based on Time Series Analysis Combined with a Kalman Filter</i> , 22 <i>Computers and Electronics in Agriculture</i> 171–185 (1999) (“de Mol”)
1034	J.E. Hillerton, <i>Detecting Mastitis Cow-Side</i> , National Mastitis Council Annual Meeting Proceedings 48-53 (2000)
1035	G.M. Hyde, <i>Milk Yield as a Factor in Dairy Herd Management</i> (1979) (Ph.D. dissertation, University of Illinois at Urbana-Champaign)
1036	U.S. Patent No. 5,724,316 to Brunts (“Bruns”)
1037	U.S. Patent Pub. No. 2006/0161443 to Rollins (“Rollins”)
1038	U.S. Patent Pub. No. 2005/0177390 to Young et al. (“Young”)
1039	File History of U.S. Patent No. 9,844,206