

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

SMAXTEC INC. and
SMAXTEC ANIMAL CARE GMBH,
Petitioner

v.

ST REPRODUCTIVE TECHNOLOGIES, LLC
Patent Owner.

Case: IPR2024-00875
Patent No. 9,844,206

DECLARATION OF TAMI M. BROWN-BRANDL, Ph.D.

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I. INTRODUCTION

1. I submit this declaration in connection with the Petition in the *Inter Partes* Review (“IPR”) challenge of claims 1-4, 6, and 17-20 (“challenged claims”) of U.S. Patent No. 9,844,206 (the “’206 patent”; Ex. 1001). I have been retained by Dechert LLP, counsel for smaXtec Inc. and smaXtec Animal Care GmbH in this matter. I am being compensated for my time at my standard rate of \$325 per hour plus actual expenses. The opinions in this declaration are my own, and my compensation is not dependent in any way upon the outcome of the IPR of the ’206 patent.

II. PROFESSIONAL QUALIFICATIONS

2. I received an A.S. degree in Math, Chemistry, and Biology in 1990 from McCook Community College; a B.S. degree in Biological Systems Engineering in 1993; an M.S. in Agricultural and Biological Systems Engineering and Animal Science in 1995 from the University of Nebraska-Lincoln; and a Ph.D. in Agricultural and Biosystems Engineering in 1998 from the University of Kentucky, with my dissertation titled: “Bioenergetics and growth in high-lean growth swine under thermal stress.”

3. After completing my Ph.D. in 1998, I joined the United States Department of Agriculture’s Agricultural Research Service in the Meat Agricultural Research Center (“USDA-ARS-MARC”), where I was an

Agricultural Engineer until 2018. In 2008, while at USDA-ARS-MARC, I was promoted to adjunct associate professor: Biological Systems Engineering at the University of Nebraska-Lincoln. In 2019, I joined the University of Nebraska-Lincoln full-time as Professor, Dr. William E and Eleanor L. Splinter Chair, in the Biological Systems Engineering Department.

4. My research has yielded more than 100 peer-reviewed publications and in addition more than 100 articles related to research symposia. Several of these publications have referenced applying RFID systems, and such systems have been an important component of my research for decades.

5. I have worked in RFID systems since 2003. Dr. Roger Eigenberg and I worked to create an RFID system to track feedlot cattle feeding behavior. A conference proceedings paper was published in 2005. Since that time, I have developed three different systems to monitor feeding and drinking behavior in swine using low-frequency RFID. In addition, we tested active RFID tags to track pigs in a finishing pen. In addition, I lead a team of international researchers in a review of different frequency ranges of RFID and their use in livestock.

6. I worked with Paul Kononoff on Dairy Calorimetry for 15 years. In addition, as an Agricultural Engineer, I have expertise in monitoring animal responses, animal housing systems, and systems to collect physiological and behavioral data. For the last 15 years, Dr. Kononoff and I have collaborated on

indirect calorimetry methods (measuring the oxygen consumption, carbon dioxide, and methane production) to monitor changes in heat production and methane production to understand the impacts of different feed ingredients.

Over the last 3 years, I have been developing a large USDA grant to evaluate small dairies with integrated milk processing. Through that process, we have worked with people who own dairies, Midwest Dairy and Nebraska Dairy association, along with many industry partners to further develop sustainable methods of dairy production. In addition, we have been engaging students across campus in different aspects of dairy—from building design animal well-being, milk processing, and public perception of dairy production and consumption.

7. I have served on the editorial board for renowned agriculture science journals, including *Frontiers in Animal Science -Precision Livestock Farming*, the *American Society of Agricultural and Biological Engineers (ASABE)*, and as a Guest Editor for the *Animals* Special Issue, “Information Technology Applied to Animal Management.” In these roles, I reviewed over 50 manuscripts.

8. My work as both a researcher and a journal editor has given me a unique perspective on the state of the art and advancements in the field of RFID applied to agriculture.

9. I have been invited to give numerous national and international talks related to applying RFID technology to monitoring animals, including at the

American Dairy Science Association-American Society of Animal Science (ADSA ASAS) Midwest Meeting in Omaha, Nebraska in March 2019, the IV International Workshop on Precision Environmental Control in Campinas Brazil in November 2018, and the RFID Conference in Orlando, Florida in April 2014.

In addition, I have presented this work at several international meetings, including International Livestock Environment Symposium (2005, 2018), European Conference on Precision Livestock in 2011, 2013, 2016, 2017, and at several workshops in Brazil between 2015-2023.

10. My research and teaching have been recognized by several organizations, including being named an ASABE Fellow in 2019, receiving the Henry Geise Award through ASABE in 2023, an outstanding Mentor Award through Nebraska FIRST Lego League in 2022, a Merck Outstanding Innovation Swine Production award in 2020, and being named Outstanding Professional (Alumni award) from the University of Kentucky in 2020.

11. In 2021, I led a team of researchers to claim an innovation prize and start a swine innovation project with MERCK animal health.

12. Attached as Exhibit 1004 is my curriculum vitae, which summarizes my background, credentials, and includes a list of my publications, presentations, and honors.

III. MATERIALS CONSIDERED

13. My analysis is based on my years of education, research, experience, and background, as well as my investigation and study of relevant materials for this declaration. When developing the opinions set forth in this declaration, I was asked by counsel to assume the perspective of a person having ordinary skill in the art (“POSA”) (*infra* §IV.C). I reviewed and considered the materials identified in the list below.

Exhibit	Description
1001	U.S. Patent No. 9,844,206
1002	Prosecution History of U.S. Patent No. 9,844,206
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 ”)

Exhibit	Description
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.
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, Australia</i> , 35

Exhibit	Description
	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)
1032	R.M. de Mol et al., <i>Results of a Multivariate Approach to Automated Oestrus and Mastitis Detection</i> , 48 Livestock Production Science 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 Computers and Electronics in Agriculture 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

IV. RELEVANT LEGAL STANDARDS

14. I understand that the Petitioner has the burden of proving the challenged claims are obvious by a preponderance of evidence, which means proving that the challenged claims are more likely than not obvious under the applicable legal standard.

A. Claim Construction

15. I have been informed by counsel that claims are given their ordinary meaning as understood by one skilled in the art at the time of the invention. I also have been informed that a term's ordinary meaning does not stand alone and is considered in the context of the "intrinsic evidence," which includes the claim language itself, the specification, and the prosecution history. I understand that the specification is highly relevant to claim construction and is often the single best guide to understanding the meaning of a claim term.

16. I have been informed that while the claims are read in light of the specification, a particular embodiment appearing in the specification may not be read to limit the scope of a claim term when the claim language is broader than that embodiment unless there is a clear and unmistakable disclaimer of claim scope beyond the specific embodiment in the intrinsic evidence.

17. I have also been informed that evidence other than the patent and prosecution history, referred to as "extrinsic evidence," can be relevant in determining how a skilled artisan would have understood terms of art used in the claims. I have been informed, however, that extrinsic evidence may not be used to contradict the meaning of the claims as described in the intrinsic evidence—i.e., evidence in the claim language itself, the specification, and the prosecution history.

B. Obviousness

18. I have been informed by counsel that a patent claim may be unpatentable if it had been obvious in view of a combination of prior-art references. I have further been informed that a patent claim is obvious if the differences between the subject matter of the claim and the prior art are such that the subject matter as a whole was obvious to the person of ordinary skill in the art (“POSA”) in the relevant field at the time the invention was made. Specifically, I understand that the obviousness question involves a consideration of the following factors:

- the scope and content of the prior art;
- the differences between the prior art and the claims at issue;
- the knowledge of a person of ordinary skill in the pertinent art; and
- if present, objective factors indicative of non-obviousness, sometimes referred to as “secondary considerations.”

19. I have been informed that for a claimed invention to be considered obvious over a combination of references, the POSA must have had a motivation and/or reason for combining teachings from multiple prior-art references in the manner proposed to arrive at the claim. I further understand that in determining whether a prior-art reference would have been combined with other prior art or

with other information within the knowledge of the POSA, the following are examples of approaches and rationales that may be considered:

- combining prior-art elements according to known methods to yield predictable results;
- simple substitution of one known element for another to obtain predictable results;
- use of a known technique to improve similar devices in the same way;
- applying a known technique to a known device ready for improvement to yield predictable results;
- applying a technique or approach that would have been “obvious to try,” i.e., choosing from a finite number of identified, predictable solutions, with a reasonable expectation of success;
- known work in one field of endeavor may prompt variations of it for use in either the same field or a different one based on design incentives or other market forces if the variations would have been predictable to one of ordinary skill in the art;
- some teaching, suggestion, or motivation in the prior art that would have led one of ordinary skill to modify the prior-art reference or to combine prior-art reference teachings to arrive at the claimed invention.

20. I understand that this motivation or reason to combine may come from a prior-art reference or based on the POSA's knowledge or common sense.

21. I have been informed that for a combination of references to render the claimed invention obvious, the POSA must have been able to arrive at the claimed invention by altering or combining the applied references and must have had a reasonable expectation of success in doing so. I understand that the claim is considered as a whole, so the obviousness analysis requires consideration of whether the claimed combination of elements was rendered obvious by the cited prior art.

22. I also have been informed that a claim can be obvious if it is the product of routine experimentation or optimization.

23. Finally, I understand that it is important to guard against slipping into the use of hindsight and to resist the temptation to read into the prior art the teachings of the invention in issue. I have been informed it is improper to rely on the inventor's own path to support a conclusion of obviousness; what matters is the path that the POSA would have followed, as evidenced by the pertinent prior art.

C. Level of Ordinary Skill in the Art

24. In my opinion, the POSA as of the claimed priority date, which I have been informed was September 15, 2009, would have had 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. I had more than that level of skill before September 2008, and consider myself an expert in this area.

25. The POSA prior to September 2008¹ 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, PubMed, 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.

¹ 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 '206 patent was not significantly different in September 2008 versus September 2009.

V. RELEVANT BACKGROUND TECHNOLOGY

26. Before September 2009, and even before September 2008, there were numerous examples in the art of electronic monitoring systems for monitoring dairy cows using Radio Frequency Identification (RFID). RFID is a form of wireless communication that can be used to identify objects, including livestock.

27. Exemplary references discussed below describe systems having several core features. These references describe systems in which individual cows in the herd have implanted radio frequency (“RF”) devices. *E.g.*, Trevarthen (Ex. 1005), 100; Laitinen (Ex. 1006), 3:51-62, Figure 1. Data from those devices could be read by an interrogator that retrieves data collected at the device level. *E.g.*, Trevarthen, 102; Laitinen, 3:51-62. This data could be further transferred to a central system, which may include a database that permitted the storage and the further analysis of this data. *E.g.*, Trevarthen, 101-102; Laitinen, 3:21-26, Figure 1. Analyzing this data could result in alerts relating to, for example, illness or reproductive cycle. Trevarthen, 121-122; Laitinen, 8:5-16, Figure 5.

A. Terms Relevant to Dairy Farm Management

28. Below I provide definitions of several terms or art related to dairy farm management systems described in my declaration to assist the reader’s understanding. The POSA’s understanding of these terms now and prior to September 2008 remains the same.

29. The “**rumen**” is the largest stomach compartment of a ruminant, such as a cow, and consists of several sacs. Because of its size, the rumen acts as a storage or holding vat for grass and feed. Aside from storage, the rumen is also a fermentation vat containing microorganisms that helps the cow’s digestion.

30. A “**bolus**” is a sensor that is typically orally administered to a cow, and often settles in the rumen. Each bolus typically has a unique identification that can further be associated with an individual cow.

31. The term “**days in milk,**” which can be abbreviated “**DIM**” refers to the number of days since a cow’s last calving day (i.e., the day a cow gave birth). Days in milk is a measure of the stage of lactation that a cow is in.

32. “**Drafting**” refers to separating cattle into smaller lots for farm management. Dairy farms often separated cows by lactation stage, reproductive readiness, or by health status, for example, if a cow was ill and in need of medical treatment. Drafting is typically achieved by using gates that direct cows into designated pens or paddocks.

B. Implantable RF Devices with Electronic Sensors

33. By September 2008, it was understood that RF devices, including RFID devices, could have additional capabilities beyond just providing animal identity. These capabilities included sensing animal temperature, pH, motion, and

other physiological parameters. Several examples of such devices are provided in the subsections below.

1. Implantable Temperature Sensing Devices

34. The field of agricultural engineering invested in the development of an “[a]utomatic monitoring of core body temperature in dairy cattle” because such systems “could be useful for the identification of illness, heat stress, general physiological stress, and estrus.” Ex. 1015, 4661. Indeed, the POSA would have considered temperature monitoring as important, because heat stress and illness were understood to pose serious risks to animal health, reproduction, and dairy farm productivity:

Physiological parameters, such as body temperature, are key indicators of heat stress and disease in dairy cows. Heat stress is a major complication in dairy production and is known to predispose cows to significant health problems such as mastitis, poor reproductive performance, and lameness. It is therefore important to develop improved means of monitoring deep body temperature.

Ex. 1016, 432; *see also* Brune (Ex. 1008), 6:48-51 (“Heat stress is particularly important in the dairy industry, since heat stress may cause the milk production of a dairy cow to decrease for several days.”). Rapid illness detection is instrumental in preventing disease outbreaks, and “the quicker an illness can be detected and treated, the less time a cow will spend affected by this illness and hence minimise

probable reduction in milk production. As such, rapid treatment of cow illness is in the best interests of a farm financially, as well as to aid to keep the cows in good health.” Trevarthen (Ex. 1005), 121.

35. By September 2008, RF devices with temperature sensing had been demonstrated to have been effective for temperature measurement.

36. A 2001 study by Hicks et al. compared “[c]ow body temperatures measured by ... implanted CorTempTM sensors and rectal thermometers ... in an effort to develop an accurate and relatively non-invasive means of monitoring body temperature.” Ex. 1016, 432. Hicks described how an implanted sensor may be ingested or surgically implanted. *Id.*, 434. In the Hicks study, “a sensor was surgically implanted into the abdomen between the greater omentum and right abdominal wall ... temperatures were recorded by the receiver, as well as rectally by a mercury thermometer.” *Id.*, 432. Hicks explained that an “[a]nalysis of results showed no statistically significant differences between [an implanted] sensor and rectal temperatures in the same cows, showing the validity of using the sensors as a means of measuring deep body temperature.” *Id.*, 436.

37. In 2001, while I was at USDA-ARS USMARC, I co-authored a manuscript for a presentation at a 2001 American Society of Agricultural Engineers (ASAE) that described a study of surgically implanted pre-calibrated temperature sensors in cattle. Ex. 1020, 4-6. The study concluded that in bovine

“[t]here was no significant difference between rectal, measured using a mercury thermometer, and core body temperature, measured using the CorTemp™ system.” *Id.*, 11.

38. A 2002 study by Prendiville et al. compared methods of remotely measuring bovine body temperature with radio signaling devices, including the Cow Temp™ rumen bolus. Ex. 1021, 4-5. Prendiville noted that while temperatures recorded by the rumen bolus were routinely higher than the standard rectal temperature, the “data demonstrate that the rumen bolus is an effective means of continuously measuring body temperature.” Ex. 1021, 11.

39. In a 2003 interview for Food Engineering, Randolph K. Geisler, CEO of Digital Angel Corp described how his company “developed a temperature-sensing, implantable microchip” that uses RFID technology “[d]ubbed Bio-Thermo,” which “received clearance from federal regulators for use in livestock and other animals.” Ex. 1017, 63. External temperature monitoring carries a risk of inaccuracy, for example, “[i]f you put this tag on the ear of the animal, wind and ambient temperatures would affect readings and other factors would compromise the data.” *Id.*, 63-64. “To capture the correct temperature,” the Bio-Therm “tag is injected into the cuneiform cartilage, where the ear attaches to the head, at birth.” *Id.*, 64.

40. Meads is a 2004 patent publication that relates to “temperature recording systems for[] monitoring the health status of a large group of animals” and “provid[ing] systems for monitoring the health, estrus status, and examination schedule for a herd of dairy cows.” Ex. 1014, [0010]. Meads describes an “utiliz[ing] RFID technology in the monitoring of dairy cow internal body core temperatures within a herd.” Ex. 1014, [0056]. For example, Meads’s “implantable temperature device 100 communicates core body temperature data and an identification number to a signal receiver 105 (e.g., an RFID antenna). In further preferred embodiments, the signal receiver 105 communicates this message to a processor 110.” *Id.*, [0058], Figure 1.

41. Bewley’s 2008 publication (Ex. 1015) describes a study with a specific temperature sensing RFID device, “[t]he Phase IV Cattle Temperature Monitoring System (CTMS; Phase IV Engineering Inc., Boulder, CO) marketed by MaGiiX (MaGiiX Inc., Post Falls, ID).” Ex. 1015, 4661. The CTMS “uses a passive bolus” that is ingested by the cow “equipped with a temperature sensor, a panel reader placed at a parlor entrance or exit to query the bolus, and a software package to collect, analyze, and view data.” *Id.* Thus, as the cow passes the reader, the panel reader retrieves the sensed data from the bolus.

2. Other Sensed Data

42. Implantable RFID devices for electronic monitoring were not limited to temperature. The Laitinen et al. patent publication (Ex. 1006, “Laitinen”), for example, describes RFID devices that may include “[s]ensor unit connected to the micro controller for the surveillance of the animal’s body temperature, occlusion, muscular action, motion or metabolic level.” Laitinen, *Id.*, 3:51-62.

43. The Pohlkamp et al. patent publication describes RF “transponders ... carried as bolus, ear tags, injectates or as conventional transponders attached to the foot or neck, in the rumen, at the udder or at the teat, or subcutaneously or in other suitable locations” that “[i]n addition to the data on individual animals ... can also transmit other sensory functions, which can be for example activity values, pH values or temperature values.” Ex. 1009, [0039]; *see also id.*, [0053]. Pohlkamp is an RFID device. *Id.*, [0041].

44. By 2008 the POSA would have been aware of numerous RFID-based implantable sensors for measuring and monitoring cow temperature, pH, and other sensed parameters.

C. Identifying Illness from Sensed Animal Information

45. For decades, animal scientists and agricultural engineers have been studying and developing ways to more readily detect illness and reproductive status of dairy cows. The 1979 thesis of Gary Hyde, for example, proposes using a

combination of variables to diagnose whether a cow is ill, which Hyde refers to as the “management-by-exception concept.” Ex. 1035, 1-3. Hyde focused on one factor, milk production. Hyde explains that milk is “the main product of a dairy enterprise,” and it “is dependent upon the cow’s inherent milk-producing ability, her feed intake (quantity and quality), her environment, **health, stage of lactation**, whether pregnant, water intake, milking equipment, and handling by the milker.” *Id.*, 2.

46. Likewise, “[b]ody temperature has long been used to diagnose illness, and would be relatively simple to monitor in the milking parlor” using milk temperature as an indicator of a cow’s body temperature. *Id.*, 3. Hyde also explained that milk conductivity, which “would be relatively easy to monitor automatically in the milking parlor” is another good indicator of mastitis, because “mastitis causes a rise in milk sodium and chloride and a fall in potassium and lactose, the net result being an increase in electrical conductivity.” *Id.* Hyde therefore concluded that “three variables—milk yield, milk temperature, and milk conductivity ... appear to have the attributes of being both practical to monitor in the milking parlor and of value in a management-by-exception system.” *Id.*, 4.

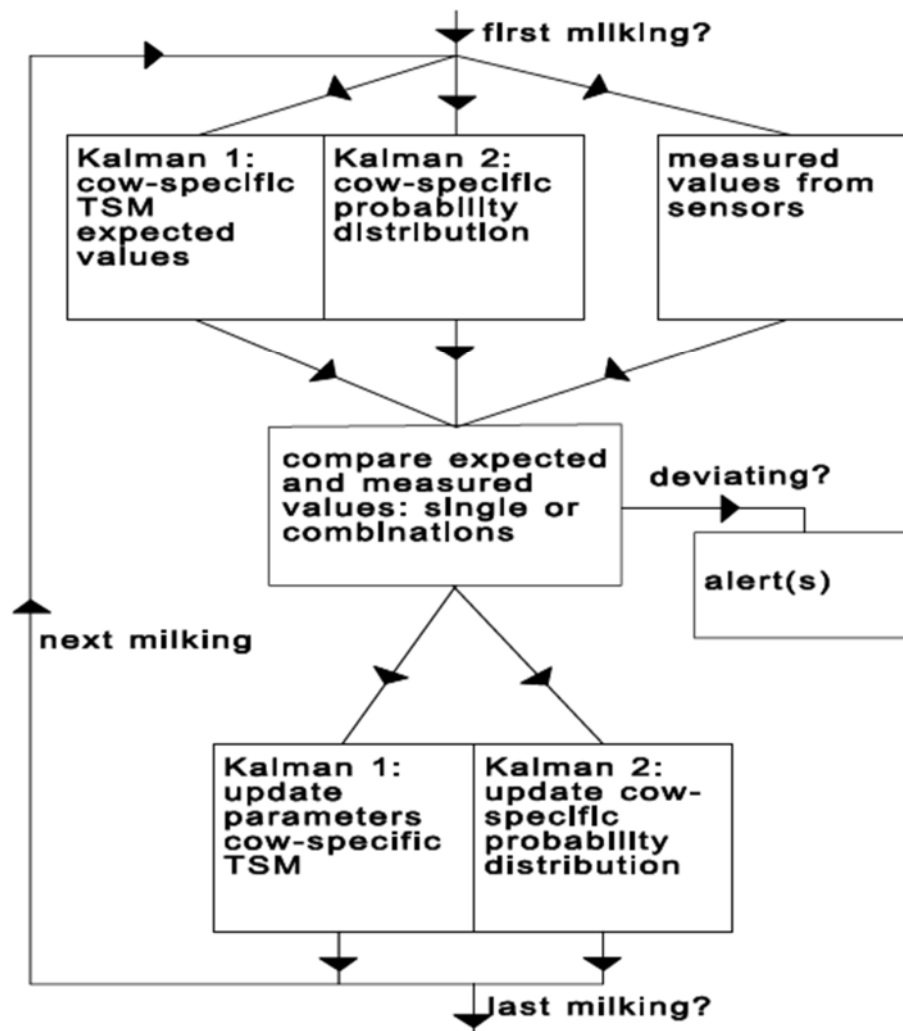
47. Hyde endeavored to monitor “milk yield alone” with the “results show[ing] that over 50 percent of the problem cows each day can be detected by monitoring milk yield alone.” *Id.*, 49. Hyde used a running average based on a

specific number of days to predict the expected milk yield, and flagged cows as potentially ill if their milk yield was 1.0 or 2.0 standard deviation limits outside the values predicted by 3-day or 7-day running averages. *Id.*, 50-53. Hyde proposed improving its management-by-exception method of identifying illness by further considering milk conductivity and “monitor[ing] cow body temperature (or milk temperature as an indication of body temperature) to detect problem cows (exceptions).” *Id.*, 57-58. Hyde concluded:

The potential value of a system that automatically monitors milk yield, milk conductivity, and milk temperature in the milking parlor, analyzes these data during the milking operation, and gives the dairy manager immediate results is very great indeed. With present technology, such a system is well within reach.

Id., 58. Indeed, long before 2008 such automatic monitoring technologies were firmly implemented in dairy farms worldwide.

48. In the late 1990s, de Mol et al. provided examples of logical expressions combining temperature and milk yield, where an “alert is given when a single variable or a combination of variables is deviant.” Ex. 1032, 44. A combined logical expression having inputs of “milk yield, milk temperature,” which is a surrogate for body temperature, “cow activity and milk conductivity” (*id.*, 42) is excerpted below:



Id., Figure 3.1. The above flow chart illustrates how a system generates a time series model for each cow that generates expected values for measured parameters (Kalman 1) and the probability distribution around these expected values (Kalman 2). *Id.*, 42-43. As additional data is entered to the system, the models are updated. *Id.*, 42-43, 53. Measured values are compared to expected values, and if the measured values fall outside the probability distribution an alert is generated. *Id.* Mastitis is indicated by a deviant combination of “increased conductivity of quarter milk, increased milk temperature and decreased milk yield,” while “for other

diseases” indicators are “increased milk temperature, decreased milk yield, decreased activity and increased concentrates leftovers.” *Id.*, 44.

49. In 1999, de Mol et al. published a paper that provides detailed multivariate expressions that considered several parameters to determine whether an animal was ill or in oestrus. Ex. 1033, 174-80 (“de Mol”). de Mol, for instance, teaches such an analytic model that uses equations (1)-(21) as an integrated logical expression. de Mol, 174-80. de Mol’s analytic model detects disease or oestrus using a combination of equations with inputs based on changes in milk yield ($Y_{M,n}$), milk temperature (a surrogate for animal temperature) (T_n), and activity ($A_{H,n}$), and also measured milk conductivity ($E_{q,n}$), as determined by time series equations (2), (3), (5), and (6).

$$\nabla Y_{D,n} = Y_{D,n} - Y_{D,n-1} = Z_{Y,n} - \alpha_Y \cdot Z_{Y,n-2} \quad (2)$$

$$\nabla T_n = T_n - T_{n-2} = Z_{T,n} - \alpha_T \cdot Z_{T,n-2} \quad (3)$$

$$\nabla A_{H,n} = A_{H,n} - A_{H,n-2} = Z_{A,n} - \alpha_A \cdot Z_{A,n-2} \quad (5)$$

$$E_{q,n} - \mu_C = \alpha_C \cdot (E_{q,n-1} - \mu_C) + \beta_C \cdot (E_{q,n-2} - \mu_C) + Z_{Cq,n} \quad (6)$$

de Mol, 174-75. “A characteristic of time series is the fact that in general the successive observations are not independent. This relationship is made explicit in a time series model, which is used to forecast the measurement values for a next milking. The new measurements can then be compared with these forecasts.

It is assumed that the model is valid for healthy cows that are not in oestrus. Too great deviations indicate that this assumption is no longer valid.” *Id.*, 174.

50. Restated, collecting data in a healthy cow over time allows system to derive a prediction for the state of the cow at the next milking. This state is then compared with the actual data, and if the deviations are too great, then this indicates there is an issue with the cow.

51. The values obtained by solving equations (2), (3), (5), and (6) are used to solve for example, equations (17a)–(17b) to determine variables x_n , y_n , v_n , and C_n .

$$x_n = \begin{bmatrix} -\alpha_Y \\ -\alpha_T \\ -\alpha_A \\ \mu_C(1 - \alpha_C - \beta_C) \\ \alpha_C \\ \beta_C \end{bmatrix}, \quad y_n = \begin{bmatrix} \nabla Y_{D,n} \\ \nabla T_n \\ \nabla A_{H,n} \\ E_{rh,n} \\ E_{rf,n} \\ E_{lf,n} \\ E_{lh,n} \end{bmatrix}, \quad z_n = \begin{bmatrix} Z_{Y,n} \\ Z_{T,n} \\ Z_{A,n} \\ Z_{Crh,n} \\ Z_{Crf,n} \\ Z_{Clf,n} \\ Z_{Clh,n} \end{bmatrix},$$

$$C_n = \begin{bmatrix} Z_{Y,n-2} & 0 & 0 & 0 & 0 & 0 \\ 0 & Z_{T,n-2} & 0 & 0 & 0 & 0 \\ 0 & 0 & Z_{A,n-2} & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & E_{rh,n-1} & E_{rh,n-2} \\ 0 & 0 & 0 & 1 & E_{rf,n-1} & E_{rf,n-2} \\ 0 & 0 & 0 & 1 & E_{lf,n-1} & E_{lf,n-2} \\ 0 & 0 & 0 & 1 & E_{lh,n-1} & E_{lh,n-2} \end{bmatrix} \quad (17a)$$

$$A_n = I, \quad v_n = z_n, \quad w_n = 0 \quad (17b)$$

Id., 178-79.

52. The values from these expressions, are in turn used in equations, including, for example, (7), (11), (15), and (19). *Id.*, 177-179. The expression of de Mol is solved to detect oestrus or illness so alerts to be generated based on the “combinations” of the temperature and milk yield input variables. *Id.*, 173, 180-181.

53. The model issues alerts when “combinations” of observations “fall[] outside a 95%, a 99% and a 99.9% confidence region.” *Id.*, 180-81. “An oestrus alert is given when the activity is rather high and the sum of standardized errors of activity, yield and temperature falls outside a certain confidence interval. A mastitis alert is given when the conductivity error is rather high and the sum of standardized errors of conductivity, yield and temperature falls outside a certain confidence interval. An illness alert is based on the sum of standardized errors of yield, temperature, activity and concentrates intake. *Id.*

54. de Mol was not the only example of models to identify illness in cows based on temperature and milk data. For example, a 2000 publication by Hillerton explains that a “minimum of 80% predictivity for clinical mastitis has been achieved experimentally using an ***algorithm combining temperature and time of day [milk] production*** directly with a running average conductivity for the target

quarter and a relative conductivity between quarters.” Ex. 1034, 52. Thus, as of September 2008 the POSA would have been aware of such models and algorithms.

D. Prior Art References

1. Trevarthen (Ex. 1005)

55. Trevarthen is a 2005 university thesis that is directed to the study of existing use of RFID technology in cattle herd management (Case Studies A and B) and a proposed framework system “in which farmers can derive additional advantages from their utilising [RFID] technology.” Trevarthen, 10. Trevarthen explains that as of 2005 RFID was “becoming globally recognised as the technology to implement animal identification and has become a mandatory form of livestock management in many countries.” *Id.*, 1; *see also id.*, ix (“There is a growing worldwide trend for countries to implement whole-of-life traceability systems for livestock, and RFID is clearly the dominant technology being chosen to achieve this.”), 17-18 (describing the benefits of traceability programs and negative consequences in their absence).

56. Trevarthen highlights a few examples for why RFID tracing was considered so important, one of which is to rapidly identify and control disease outbreaks:

There is currently a worldwide trend towards improving traceability systems within livestock industries, and RFID is the primary technology of choice. Spurred by disease incidents from around the

world, such as the Bovine Spongiform Encephalopathy (BSE, more commonly known as ‘mad cow disease’) outbreaks in the late 1990’s, countries such as those within the European Union (EU) have enacted policies to ensure livestock can be traced through their entire lifecycle (Animal Health Australia n.d.). Programs such as these are designed to minimise or eliminate the spread of disease as authorities are able to trace origins of diseases, identifying farms and animals that may have been affected and subsequently they are able to take direct appropriate action to minimise further spread (Food Production Daily 2004).

Id., 3.

57. Trevarthen describes case studies relating to the use of RFID cow tracing in two existing dairy farms in Australia, the Strong Farm (*id.*, 46-68 (Chapter 4)) and the Cochrane Farm (*id.*, 69-98 (Chapter 5)). The Strong Farm did not “utilise any RFID devices in their farm management operations.” *id.*, 46.

Whereas, the Cochrane farm was “selected as the advanced case study, as it has a strong use of RFID technology.” *Id.*, 69; 8 (“These case studies will differ in their use of electronic identification in their farming operations, from utilising little to no electronic identification (Case study A – ‘Traditional’), to a dairy farm with strong integration of electronic identification in their daily operations (Case Study B – ‘Advanced RFID’).”).

58. This analysis will focus on Case Study B (the Cochrane Farm) and Trevarthen’s proposed “framework for the use of RFID on dairy farms, while also

proposing enhancements and ideas which could be considered as future additions to further add value to the utilisation of RFID in farm management.” Trevarthen, 99.

59. Trevarthen explains that each cow in the Cochrane Farm is tagged with an RFID tag (*id.*, 70 (Exhibit 5.1)) that facilitates its automatic identification, and the farm “utilise[s] a software package to aid in their herd management” and “to also provide the basis for their RFID operations.” *Id.*, 69-71. “Cows enter the milking parlour ... passing through a permanent RFID reader installed on the entry gates” that “retrieves the identification number from the RFID tags attached to the ear of each cow.” *Id.*, 77-78 (Exhibit 5.3). For each cow “individual information is displayed” on a computer “provid[ing] a selection of information ... drawn from the central herd management database” with the cows “listed in rows, with their characteristics displayed in the corresponding columns.” *Id.*, 78-79 (Exhibit 5.4).

60. The Cochrane software may alert operators to issues, such as “freshly calved cows, and cows who have had a penicillin injection.” *Id.*, 78-79. Because milk from a penicillin treated cow could taint the batch if permitted to mix with other milk, this alert allows milk from treated cows to be segregated from other milk and disposed.

61. When the cows exit the dairy, they pass through an RFID reader in front of automatic drafting gates, so that the system can “determine the identity of

each cow before they enter the gates.” *Id.*, 86. By matching a cow’s identity with information in the system, the system could automatically adjust the gates to direct cows to designated locations. *Id.*, 86-87 (“When a cow that has been selected for drafting is recognised by the RFID reader, two flipper gates will rotate to block entry to the drafting gate for this cow. This gate prevents the selected cow from entering the drafting gate section until [the gate] has completely changed direction, and is ready to lead the selected cow directly to their designated paddock.”) For example, when the system identified “[c]ows requiring additional treatment, such as veterinary treatment, artificial insemination etc., are drafted to the holding paddock to the right of the drafting gates ... High producing cows, or ... show cows, are directed to a holding paddock to the left of the drafting gates.” *Id.*, 88.

62. Chapter 6 of Trevarthen provides the framework that builds on the Cochrane RFID-based system to add additional features based on already existing technology. *Id.*, 99-126. One way that Trevarthen’s framework builds on the Cochrane farm system is by implementing RFID readers “to record a cow[’]s milk production.” *Id.*, 100-102. Trevarthen’s framework connects milk meters that detect a cow’s milk production that can be recorded in the database, so that milk production for each cow becomes one of the types of information stored in the database. *Id.*, 111-12. Trevarthen explains that automatically tracking milk production will “aid to identify any problems that may arise in the herd (such as

illness) ... if a cow provides a significantly lower amount of milk than their usual output.” *Id.*, 115. Low milk production was well known as a signifier of illness.

63. Another way that Trevarthen’s framework builds also upon the Cochrane farm study is by “incorporat[ing] temperature sensing abilities into RFID microchips” to detect “anomalies in temperatures.” *Id.*, 121-22 (citing Ex. 1017). As explained above, implantable RFID devices with temperature sensing abilities were described in the art and even commercially available before September 2008. *Supra* §V.B. Trevarthen explains how temperature detection and monitoring can be an important feature of RFID-based herd management for dairy farms:

The temperature of a cow is certainly a valuable attribute for a farmer to utilise in managing their herd. Importantly, fluctuations in the body ***temperature of a cow can indicate that the cow may be falling ill.*** Thus, reading this temperature will allow a more rapid response to aid in detection and subsequent treatment of any illnesses that a cow may have attracted. It will also enable the farmer to take action to minimise the spread of the illness by being able to rapidly isolate the cow for observation and treatment.

Trevarthen, 121.

64. In addition to illness, Trevarthen explains that a “rise in temperature may also indicate that a certain cow is entering heat. It is important to know when this occurs, as this presents the farmer with a window of opportunity to artificially inseminate the cow.” *Id.*, 121-22. Therefore, the Trevarthen system further tracks

the reproductive cycles of cows based on sensed temperature information. Thus, Trevarthen's system that includes temperature sensing provides information relating to both illness and reproductive status.

65. Other features of Trevarthen's proposed system include a "GPS-RFID setup [that] could provide software that enables farm boundaries to be plotted and associated with the GPS devices. Using this arrangement, the software could detect if a cow (or cows) move beyond these plotted boundaries (i.e. escaping from a paddock)." Trevarthen, 124. Trevarthen "proposed that GPS technology be included in RFID tags in the future, thus providing the ability to track cattle movements, and locate individual cows with a single program." *Id.* In addition to locating cows, "software could be designed to detect individual cow movement that may be considered out of the ordinary. This may include if a cow does not move as much as it is expected ... or likewise, if it is moving significantly more than expected or usual." *Id.*, 125. Reduced movement can indicate illness, whereas increased movement can indicate a cow is in heat. *Id.*

66. In my opinion, the POSA exercising reasonable diligence would have located Trevarthen prior to September 2008. The POSA would have used internet search engines, such as Google, Google Scholar, or Yahoo, to locate relevant literature, including theses relating to livestock management sensor systems. I

personally used such public internet search engines such as Google and Google Scholar to identify literature relating to RFID systems prior to September 2008.

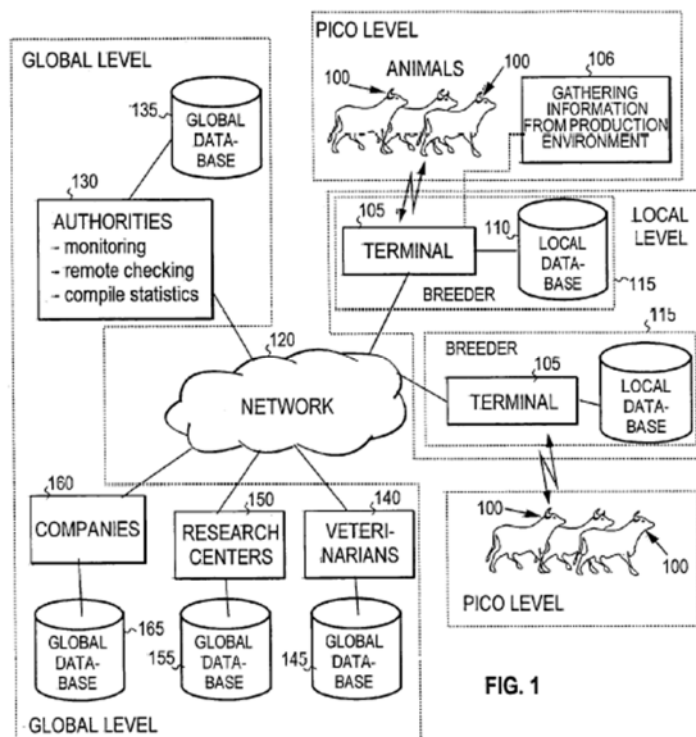
67. For example, the POSA prior to September 2008 searching for literature regarding livestock management sensor systems on internet search engines would have used terms such as “rfid,” “cattle,” “gate,” “temperature,” “livestock,” “dairy,” “bolus.” These terms appear in many places throughout Trevarthen, so based on my experience it likely the POSA would have located Trevarthen using such terms, or similar search terms.

68. I understand that the International Search Report and Written Opinion prepared by the Australian Patent Office, dated March 12, 2008, located Trevarthen before September 2008. Exs., 1028, 1029. The search report also indicates that various electronic databases were consulted, including the “internet,” and that search terms such as “cattle, rfid, gate etc.” were used to locate Trevarthen. Ex. 1028. Thus, the International Search Report and Written Opinion prepared by the Australian Patent Office confirms that the POSA exercising reasonable diligence would have located Trevarthen prior to September 2008.

2. Laitinen (Ex. 1006)

69. Laitinen is an issued patent that describes a cattle “surveillance system [that] comprises at least three hierarchical levels of technology....” Laitinen, 2:53-

56. Laitinen refers to the three levels as the Pico Level, Local Level, and Global Level.



Id., 3:5-6, Figure 1.

70. “The Pico level ... comprises the technology used directly with the animals.” *Id.*, 3:33-4:4. Laitinen explains that the pico level device may include “[s]ensor unit connected to the micro controller for the surveillance of the animal’s body temperature, occlusion, muscular action, motion or metabolic level. The [s]ensor 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.” *Id.*, 3:51-62. Thus, the POSA would have understood Laitinen’s pico level technology to include RFID

devices with sensor capabilities for detecting physiological parameters including temperature as well as animal motion.

71. Laitinen's local level may include a computer terminal that receives information from the pico level devices for cows at, for example, a single farm. *Id.*, 6:5-15. Laitinen explains that the local level "consists in practice of one or more local **115** information systems At the very minimum, a local information system comprises a **105** terminal unit, typically featuring the **110** data base into which the terminal gathers local measuring and surveillance and other important information." *Id.*, 4:5-41. Thus, the POSA would have understood Laitinen's local level to include a database for storing information relating to each animal on a farm, including physiological information and other information associated with each cow, for example, reproductive and medical treatment records.

72. Laitinen's global level may include inputs from local level terminals. Laitinen explains that the global level "includes a computer or computers linked to the communications network **120** and of software in the databases of which information sent by the local level is gathered, organized and refined." *Id.*, 4:42-5:3. Laitinen explains that:

First of all, data concerning an animal can be obtained from the pico and local levels throughout the animal's entire life span. Secondly, global level servers and databases feature algorithm and models, which are applied in the analysis of these and other possible data. Thirdly, the

system allows the use of large samples, which, together with the local level knowledge enable the discovery of weak connections that may not necessarily be observed from smaller samples (local levels). The resulting knowledge permits each party to perform the measures they deem necessary; either directly on the animals or more generally for the development of the field of animal husbandry.

Id., 5:26-37.

73. For example, Laitinen describes applying its system to assist in reproduction. Laitinen's system detects when a cow is in heat to assist farmers in determining the optimal time to succeed in performing artificial insemination. *Id.*, 8:5-26, Figure 5. Laitinen also describes entering animal information into algorithms, including entering information regarding an animal's present condition, to identify "necessary medical treatment." *Id.*, 7:35-56; *see also* 1:33-35 (noting that the state of the art was such that the POSA understood that "infectious diseases" were a "serious problem.") Laitinen also emphasized the importance of obtaining information relating to a cow's milking to monitor production as well as detect disease. *Id.*, 1:36-39 ("If problems due to overproduction are to be controlled, it is vital that real-time information about the production of agricultural goods, e.g. milk, is available."); *id.*, 4:60-64 ("For example, a local system can check the information about milk samples from the laboratory server before the

commencing of the milking process, which would immediately reveal, say, a latent bovine mastitis.”)

3. Brune (Ex. 1008)

74. Brune discloses “a method of determining a physiological state of a ruminant animal by mathematically analyzing at least one portion of a history of data representing sensed temperatures within a stomach of the ruminant animal.” Brune, 1:63-67. Specifically, “[a] bolus including a temperature sensor and a transmitter is placed within a stomach of the ruminant animal” wherein sensed temperature readings, at discreet time points, are then analyzed to determine the health of the cow. *Id.*, 2:4-16. Brune’s device sends a “data packet include[ing] temperature data representing the *sensed temperature* ... identification data such as an *identification number which is unique to the specific cow*, and *date and/or time stamp data* corresponding to the *discrete point in time at which the temperature was sensed* by the bolus.” *Id.*, 4:4-11.

75. Brune then analyzes this data from the implanted bolus. For example, if the system determines that a cow’s core body temperature exceeds a specific threshold, it may indicate sickness. *Id.*, 5:65-6:12. Brune’s system can also use the temperature data to determine whether a cow that “has been exposed to high temperatures [] is experiencing heat stress,” which can result in reduced milk output. *Id.*, 6:38-51.

4. Buchanan (Ex. 1011)

76. Buchanan describes a “farm management system” that includes a “database collectively receiving and storing data collected by data collection means in association with animal identifiers of individual animals.” Buchanan, 3:6-24. Buchanan states that the animals are identified and tracked using “RFID” tagging. *Id.*, 11:1-2 (“an RFID scanner read[s] animal identifying data from animal ID tags moving into the vicinity of the scanner.”).

77. The Buchanan system monitors each cow’s “milk volume” using “cup sensors or milk meters,” which enables the operator to record milk volume information “associated with the particular animal being milked.” *Id.*, 19:17-31. For example, the Buchanan system can determine if a cow’s measured milk volume is outside a preset range and, if so, automatically draft that cow to a separate holding pen for additional attention. *Id.*, 19:31-20:2 (“If the animal is to be automatically drafted the program generates a drafting event at step 406. If drafting is not to be automatically conducted the program instead creates and records an exception, and generates display data for the farm worker at step 408.”).

78. Like Laitinen, Buchanan is concerned with animal reproduction and discloses automatic drafting of animals for artificial insemination in response to the detection of oestrus (note that estrus and “oestrus” are synonyms). *Id.*, 17:22-27. Buchanan teaches that detecting when a cow is in heat may involve “sensors ...

taking a temperature reading from the cow[']s stomach” and sending this information over a network for storage and “retrieval into the farm management system.” *Id.*, 21:3-8.

79. Like Laitinen, Buchanan is concerned with monitoring for potential disease. Buchanan teaches the use of somatic cell count sensors at the milk meters to detect elevated somatic cell counts which may indicate onset of mastitis. *Id.*, 19:17-26. If it is determined that the cell count “is greater than a predetermined level” an alert is generated as well as a drafting instruction. *Id.*, 19:23-26.

5. Liao (Ex. 1010)

80. Liao describes a system for dairy farm management comprising a computer with a software based “rules engine” and “decision engine” for making dairy farm decisions based on “animal parameters.” Liao, 2:27-3:14. The system includes a data collection unit connected to “a number of animal-related sensor means ... i.e. sensors located on/in animals, or at implements interrelating with the animals, such as milking apparatuses.” *Id.*, 13:9-17.

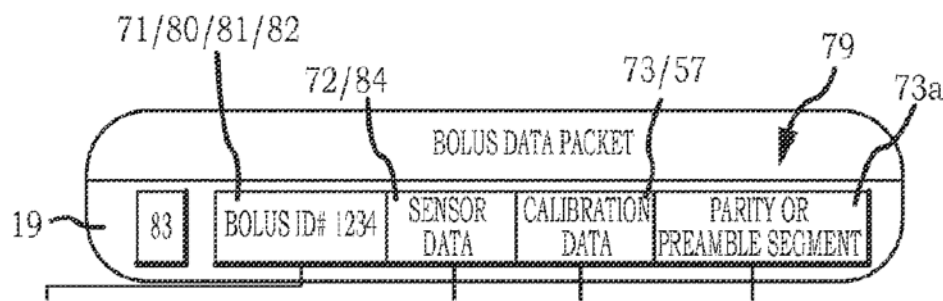
81. Like the systems described for Laitinen and Buchanan, Liao’s system is designed to assist the operator with decisions related to animal reproduction and artificial insemination. *Id.*, 5:10-13. For example, Liao’s decision engine determines when a cow is in heat and optimally ready for artificial insemination by evaluating several parameters for a particular animal. Key parameters that are

input into Liao's system for an individual cow include the "number of days in milk" and "peak milk yield." *Id.*, 5:14-27, 9:34-10:15, 12:3-15. The cow's data is stored by Liao's system along with a "first input parameter reflecting an animal identity." *Id.*, 5:14-15, 12:6-8.

82. Like Laitinen and Buchanan, Liao is also concerned with disease, and teaches evaluating animal parameters such a "milk yield," "number of days in milk," activity level, and somatic cell counts, to determine if an animal should be tested for mastitis. *Id.*, 6:31-7:6, 15:16-29, 29:15-35. This data is also stored in association with a "first input parameter reflecting an animal identity." *Id.*, 6:32-34.

VI. THE '206 PATENT

83. The '206 patent (Ex. 1001), is titled "Computer Implemented Animal Management System." The disclosed system comprises an RFID device encased within an implantable bolus that has sensors to sense animal information such as temperature and pH. Ex. 1001, 10:30-53. The block diagram in Figure 3 of the '206 patent depicts the implantable RFID device (**19**), as shown below.



Id., Figure 3, 3:16-21.

84. The specification states that the RFID device of the '206 patent is a “conventional radiofrequency identification device (‘RFID’ or ‘RFID device’). *Id.*, 1:25-59. Additionally, the sensors that were part of the device could be obtained from commercial sources. *Id.*, 10:53-61 (“The sensor (**83**) can as non-limiting examples be an omnidirectional tilt and vibration Sensor (PN SQ-SEN-200) distributed by Signal Quest Precision Microsensors; a Betachip Thermistor (PN 1K2OG3) distributed by BetaTHERM Sensors; a humidity sensor (PN HCZ-D5) distributed by Ghitron Technology CO., Ltd; an ultra miniature pressure transducer (PN COQ-062) distributed by Kulite, a proximity sensor (PN PY3-AN-3) distributed by Automation Direct.com”).

85. The animal information is retrieved from the conventional RFID device by a conventional RFID reader and then input into a database. *Id.*, 2:30-41, 10:17-29, 11:25-30. Like the components of the RFID device, the '206 patent describes using commercially available RFID readers. *Id.*, 8:38-9:20. The animal information that is input into the database can be analyzed to assess an animal's health status. The '206 patent provides an example of determining whether the animal's temperature has exceeded a pre-determined threshold so that an alert can be issued. *Id.*, 2:51-58, 14:24-32. Comparing sensed values with threshold values (e.g., temperature), like the '206 patent contemplates, was well known in the art

before September 2008. *E.g.*, Trevarthen, 122; Brune, 7:43-49 (“A one day average temperature and five day average temperature are calculated A DELTA value representing the difference between the one day average and five day average as well as the value of the sensed temperature, are compared with respective threshold values associated therewith.”).

86. The '206 patent discloses that other analyses of the animal information entered into the database can include determining whether the animal is at an incorrect location (Ex. 1001, 2:51-58), the entry and monitoring of diagnosis and treatment plans for an animal (*id.*, 2:59-64), and automatically categorizing animals into groups that can be located together(*id.*, 2:66-3:3). For example, the specification discloses creating a “pen definition” for animals having a similar status, for example, days in milk, milk production, reproductive status, or the like, so that animals having shared issues can be grouped together in the same pen number. *Id.*, 13:37-44.

87. The '206 patent explained that its system is implemented using conventional computer technology and software instructions stored on available computer readable media. *Id.*, 4:22-24, 5:3-6, 5:17-23, 5:59-64, 7:59-8:3. The POSA would have been familiar with the hardware of the '206 patent's system. Moreover, similarly configured system having, for example, an RFID device,

RFID reader, and a central herd management database were common in the prior art by September 2008. *Supra* §V.D.

VII. CLAIM INTERPRETATION

88. Applying the standards for interpreting patent claim terms discussed in Section IV.A above, I have interpreted the terms in the claims in accordance with their ordinary and customary meaning as understood by a POSA in the context of the '206 patent (including the descriptions in the specification) and its prosecution history.

VIII. GROUND 1: TREVARTHEN RENDERS CLAIMS 1-4, 6, AND 11 OBVIOUS

A. Claim 1

1. 1[Pre]: A computer implemented animal management system, comprising

89. Trevarthen describes systems using herd management software, including existing Cochrane farm system as well as the Trevarthen's framework system, which the POSA would have understood to mean that Trevarthen's system is computer implemented. For example, Trevarthen states the "ability to digitally store herd information is certainly a valuable tool for all farms, and a necessity for those desiring to utilise RFID ... Herd management software provides farmers with this ability, providing mechanisms for them to store individual cow data into a database." Trevarthen, 100. Trevarthen describes several ways of implementing its herd management software, including on wired or wireless networks of

computers, or hybrid implementations of both types of networks. *Id.*, 103-104.

Thus, Trevarthen teaches element 1[Pre].

2. 1[A]: a processor communicatively coupled to a non-transitory computer readable media containing program instructions executable to:

90. The POSA would have understood that Trevarthen's herd management "software" (*id.*, 100) means executable program instructions that are necessarily stored on computer-readable media and that necessarily runs on a processor. Trevarthen explains that the operator may interface with the software on a computer (*id.*, 101, 104), which the POSA would have understood to meet the element of "a processor communicatively coupled to a non-transitory computer readable media containing program instructions."

91. The prior art corroborates that the POSA would have understood Trevarthen's teaching of software to indicate to mean that the system must include a processor. For example, Meads describes a "processor" as "a device capable of executing a computer algorithm and/or storing information to a computer memory," where an "'algorithm' refers to computer programs." Ex. 1014, [0044]-[0045]. The POSA would further understand, as corroborated by, for example Meads and Cross (Ex. 1013) that the herd management software and animal information stored on the database would further require the processor to be coupled to a non-transitory computer readable media, such as a hard drive. Ex.

1014, [0081] (“The processor **110** stores information interpreted with various algorithms **125** in a database **130** contained on a computer readable medium (e.g., hard drive).”); Ex. 1013, 13:6-9 (“on-board data may be stored within a memory assembly, such as a computer hard drive, disc array, read only memory (ROM), or any other storage device that is capable of being interrogated in a reasonably short access time.”). Thus, Trevarthen teaches element 1[A].

3. 1[B]: retrieve animal identification information from an RFID device

92. As the POSA would have understood, and Trevarthen explains, “RFID tags, boluses or microchips” that are associated with individual cows “form the basis of any dairy farm RFID system.” Trevarthen, 99. These types of devices were widely used on farms well before September 2008, as evidenced, for example, by Trevarthen’s study of the Cochrane Farm, which used RFID as a way to identify each cow and the information associated with that cow. As a result of the widespread usage of these devices, “[t]here are a number of tags, boluses and microchips available from various vendors” (*id.*, 99-100), some of which have sensor capabilities and are described above. *Supra* §V.B.1.

93. The POSA would have considered the point of using RFID devices is for farms to be able to identify individual cows rapidly and easily. The POSA would have understood the importance of this feature, especially for large farms that may have hundreds if not thousands of dairy cows. Trevarthen, 69 (explaining

the Cochrane dairy had approximately 420 head of cattle in total, around 350 of which were lactating). Indeed, Trevarthen explains that identification is central to the POSA's reason for tagging or implanting RFID devices on each animal, stating that "to derive any use and subsequent benefit from the practice of **identifying every cow with RFID tags**, a farm requires an RFID reader device." *Id.*, 102.

94. Restated, the point of RFID devices is to be able to retrieve identification information from them by interrogation. In Trevarthen's system, an RFID reader is placed, for example, at the dairy entrance, which "provides the possibility for the reader to serve as the basis for a wide range of optional operations to be conducted within the dairy that require **individual identification of cows** (e.g. automatic feeding etc.)." *Id.*, 103. The POSA would have further understood that Trevarthen described a system that identified each cow by retrieving animal identification information from the RFID device when the cow passed the device when entering and/or exiting the dairy. *Id.*, 86-87, 106, 122.

4. 1[C]: retrieve sensed animal information from said RFID device, said sensed animal information generated by a sensor coupled to said RFID device

95. A central feature of Trevarthen's system is the ability to obtain sensed information about a cow that can improve monitoring of that cow, for example its reproduction state and health. Trevarthen, 121-23. Trevarthen states that "[i]t is evident from" the literature in this field "that it is possible to incorporate

temperature sensing abilities into RFID microchips currently Such a device will provide the temperature of the cow along with the cow[']s unique identification number every time the tag is read by an RFID reader.” *Id.*, 121.

Trevarthen cites the Bio-thermo RFID as an example of a RFID with temperature sensing capability (*Id.*, 24-25 citing (Ex. 1017). As Trevarthen recognized, and as described above in Section V.B.1, there were also other examples of implantable devices that demonstrated that it was “possible to incorporate temperature sensing abilities into RFID microchips.” Trevarthen, 121. The commercial availability of RFID-compatible temperature sensors is further corroborated by the ’206 patent itself. Ex. 1001, 10:56-57 (citing the “Betachip Thermistor ... distributed by BetaTHERM Sensors”).

96. Trevarthen further describes the implementation of its system, where the RFID readers retrieve the sensed temperature information from the RFID device, where temperature readings could be taken at the dairy, or at several locations around the farm.

At a basic level, **a temperature sensing RFID device** could be read by fixed RFID readers at the entry to the dairy. Such an arrangement would ensure that **each cow has their temperature read** at a regular interval at least twice a day, thus providing valuable information to the farmer. At a more advanced level, it is proposed that RFID readers also be placed at other high congregation areas throughout the farm Under this approach, more **temperature readings** can be gained between

milking, thus providing an *enhanced ability to detect temperature variations* ...

Trevarthen, 122. Thus, Trevarthen teaches “retriev[ing] sensed animal information from said RFID device, said sensed animal information generated by a sensor coupled to said RFID device.”

5. **1[D]: match said sensed animal information retrieved from said RFID device to animal information of said animal stored in a database including an amount of milk production or a number of days in milk**

97. Trevarthen’s system includes a feature that records milk production for each cow in the database by coupling its herd management system with cup sensors within the dairy that record milk volume. Trevarthen teaches “... *to record a cow[']s milk production* (in association with milk meters), to identify cows required for drafting gate operations etc.” Trevarthen, 102. “Milk meters provide this valuable ability, measuring the amount of milk each cow provides at every milking session.” *Id.*, 112.

98. Trevarthen explains that recorded milk production information for each cow is automatically stored in a database. *Id.* (“this *[milk meter] information* should be automatically recorded in the herd management *database*, and associated with the cow currently ... present.); *see also id.*, 100 (“data can be *automatically entered* through the use of other digital devices (such as *milk meters* ...) linked to this *database*.”), 101 (“the information *stored* regarding each cows last recorded

volume of **milk production**), *id.*, 109 (cow's milk "production history" may be analyzed to recognize "patterns," thus indicating storage of such information in the database). Because the database stores milk production information for each cow individually, the data for each animal is necessarily differentiated using the cow's unique animal identification information. *Id.*, 80 ("The data regarding how much milk each cow is producing is extracted from the central herd management database ... according to the cow's unique RFID identification number.").

99. As explained above in Section VIII.A.4 (element 1[C]), Trevarthen teaches retrieving sensed animal information, such as temperature from the RFID device. The cow's sensed temperature is retrieved "along with the cows unique identification number" so that the system recognizes the temperature as associated with a specific cow. *Id.*, 121. Trevarthen teaches that the herd management software enables farmers "to store individual cow data into a database," which would include a cow's temperature. *Id.*, 100. For example, Trevarthen teaches that its system identifies "fluctuations," "a rise," and "anomalies" in temperature so that a farmer may be alerted of a potential issue with a cow. *Id.*, 121-22. Trevarthen also teaches that farmers may "view patterns of temperature change[s]...." *Id.*, 122. In order to be able to identify temperature anomalies or fluctuations that may, it would have been necessary to store temperatures recorded

over multiple timepoints. Such temporal changes necessarily indicate that a history of temperature measurement for a cow are stored in the database.

100. Therefore, the POSA would have recognized from Trevarthen that both milk production information and temperature information are stored and associated with each cow's unique identification information in the database. Because Trevarthen discloses that the database stores milk production information for each cow as well as sensed temperature information for each cow, a POSA would have understood that the sensed temperature information for a particular cow, which is retrieved along with the animal's identification information, would be ***matched*** to the milk production information for that same cow by using the animal's identification information. Accordingly, Trevarthen's system meets element 1[D].

6. 1[E]: enter said sensed animal information retrieved from said RFID device and said animal information stored in said database as logical variables into at least one logical expression

101. Element 1[E] recites "entering sensed animal information" and "entering animal information stored in said database" into a logical expression. Element 1[D] recites that animal information "stored in a database include[es] an amount of milk production or a number of days in milk." Trevarthen describes entering sensed and stored temperature information as logical variables into a logical expression to determine whether a cow is ill or in heat (*infra* §VIII.A.6.a)

and entering stored milk production information as a logical variable into a logical expression to determine whether a cow is ill or may need feed adjustment (*infra* §VIII.A.6.b).

102. Element 1[E] could be understood to require entering both “sensed animal information” and “entering animal information stored in said database” that includes a cow’s “milk production or a number of days in milk” — as recited in 1[D] — into the *same* logical expression.

103. Trevarthen does not expressly describe entering **both** sensed temperature and stored milk production information as logical variables into the *same* logical expression. The POSA, however, would have been motivated to enter both temperature and milk production information into a single logical expression. The POSA further would have recognized that a logical expression applying both temperature **and** milk production information as logical variables could potentially enhance illness detection compared to relying on entering temperature **or** milk production alone. *Infra* §VIII.A.6.c. The POSA would have reasonably expected to successfully implement this logical expression. *Infra* §VIII.A.6.c.

104. To the extent that element 1[E] could be interpreted to allow for separate entry of sensed animal information (e.g., temperature) and stored animal information (e.g., milk production), into separate logical expressions, element 1[E]

would be satisfied by Trevarthen's explanations of separate logical expressions for temperature and milk production. *Infra* §§ VIII.A.6.a-VIII.A.6.b

a. Trevarthen Discloses Entering Sensed Temperature Information into a Logical Expression

105. Trevarthen describes entering the logical variables of sensed and stored temperatures into a logical expression designed to detect “fluctuations in the body temperature of a cow [that] can indicate that the cow may be falling ill.” Trevarthen, 121-22. The POSA would have understood that detecting illness through temperature “fluctuations,” would have necessarily required entering both presently sensed and previously stored temperature information as logical variables into a logical expression. Such a logical expression would have been understood by the POSA to compare recent temperature readings with a permissible temperature range, derived from past temperature measurements stores in the database, to determine, for example, whether the cow's temperature has crossed the upper or lower thresholds of the range, which the POSA would have understood as an indicator of possible illness. Trevarthen, 122 (explaining that “it is important that anomalies in temperatures be identified and investigated as soon as possible ... to allow the system to alert the farmer of such fluctuations”).

106. Indeed, it was known in the art prior to September 2008 to use logical expressions to analyze animal temperature measurements. Ex. 1014, [0096] (describing a “processor [that] compares the particular cow's temperature

information (e.g., temperature trend or average) with previous temperature fluctuations for that particular cow.”); Ex. 1008, 7:43-49 (“A one day average temperature and five day average temperature are calculated A DELTA value representing the difference between the one day average and five day average as well as the value of the sensed temperature, are compared with respective threshold values associated therewith.”).

107. I also reviewed the amended complaint (Ex. 1022) filed by the Patent Owner in patent infringement litigation. In the complaint, the Patent Owner explained that claim element 1[E] covers an “illness detection alert feature” where “the system converts the sensed temperature measurement into variables in a calculation that determines whether the current temperature deviates from the regular temperature.” Ex. 1022, ¶ 106. That is also what Trevarthen discloses to the POSA. Sensed temperature is compared with prior temperature ranges and/or temperature thresholds to identify anomalous temperatures that could signify, for example, that a cow has become ill and is in need of treatment or is entering heat. *Supra* §V.D.1. Therefore, Trevarthen’s disclosure of identifying temperature fluctuations and anomalies is consistent with the Patent Owner’s interpretation of this element.

**b. Trevarthen Discloses Entering Animal Milk
Production Information Stored in the Database into a
Logical Expression**

108. The application of logical expressions to determine whether an animal was ill based on milk production was done decades before Trevarthen, as described in the Hyde thesis from the 1970s. *Supra* §V.C (citing Ex. 1035). 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. "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." *Id.*, 98; *see also id.*, 115 ("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 ... [i]n this way, any illness or problems occurring with cows can be identified quickly and easily"). Trevarthen further explains that "milk meters will also allow ***an average milk production value to be derived***" and that a cow's milk production history can be analyzed by the herd management software "***to recognise certain patterns in the production*** of each cow." *Id.*, 109.

109. The POSA would have understood Trevarthen system calculates an average milk production based on several milk volume measurements. *Id.* ("This average may be taken from the production of the cow during their entire current

lactation cycle, or perhaps derived from a selected amount of previous milking sessions (e.g. the average milk provided over the past 10 milking sessions).”) Calculating this average, the comparison of recent milk production to usual or average milk output, and the recognition of patterns in milk production (*id.*) all require use of one or more logical expressions having stored milk production information as logical input variables. Thus, Trevarthen teaches logical expressions based on stored animal information that includes milk production information.

c. Trevarthen Rendered Obvious Entering Sensed Temperature Information and Animal Milk Production Into At Least One Logical Expression

110. Trevarthen does not expressly disclose a logical expression that has inputs of both sensed temperature ***and*** stored information that includes milk production information. But as explained in Section V.C above, the idea of a multi-factor approach to illness detection was proposed in the 1970s (Ex. 1035), and by the early-2000s there were multiple models and algorithms in the literature (Exs. 1032, 1033, 1034).

111. In contrast to the prior art discussed in Section V.C above, the '206 patent does not explain how data containing milk production and/or days in milk information are applied in a logical expression at all, let alone with sensed animal information, such as temperature information. A POSA, however, would have

been motivated to input both sensed temperature information and stored milk production information as logical variables into the same logical expression to enhance the ability to detect whether cows were ill as part of an enhanced disease detection capability. Applying the techniques described in the art, the POSA would have reasonably expected to have been able to successfully implement such models and algorithms in Trevarthen's system.

112. As Trevarthen emphasizes, detecting illness in a herd is important to preventing a disease outbreak. Indeed, the first paragraph of Trevarthen emphasizes that “animal borne disease” has “driven calls for reliable and effective systems for individual identification and tracking of livestock throughout the animals’ entire lifecycle ... empowering authorities with rapid and precise information (such as the animals’ farm of origin, cows it has been in contact with etc.), aiding them to take prompt and direct action to reduce the possibility of a disease outbreak.” Trevarthen, 1; *see also id.*, 18 (explaining that “[t]he need to control disease outbreaks is obvious....” and that outbreaks could “shut down the food supply.”).

113. Trevarthen expressly teaches how to use logical expressions with logical variables of sensed temperature and stored milk production in order to identify potential illnesses. *Id.* 121. For example, temperature fluctuations can indicate illness (*id.*, 98) and unexpectedly low milk production (*id.*, 115) can both

be signs of illness. Thus, the POSA would have been motivated to include within Trevarthen's system a logical expression into which both temperature **and** milk production information could be input as logical variables in order to serve as an enhanced illness detection alert system. This would have been merely combining familiar prior art elements that Trevarthen already teaches (temperature and milk production logical expressions) according to known methods to yield a predictable result of enhanced illness detection.

114. Furthering the POSA's motivation, would have been the POSA's understanding of how relying on the combination of two logical variables, rather than just a single variable, would potentially improve Trevarthen's illness detection capabilities. For example, the POSA understood that sensed temperature could be affected by environmental conditions, time of day, or the cow being in heat, rather than illness. Trevarthen, 121-22. Thus, a logical expression based on temperature alone may not always accurately indicate the specific issue a cow is experiencing.

115. Likewise, decreased milk production could be due different factors. For examples decreases milk production could be cause by illness, or could be due to other causes, including the quality or amount of feed that a cow has been provided. Trevarthen, 80-81, 114. Thus, with milk production data alone, a farmer may not be certain what corrective action needs to be taken to improve the cow's milk production. For example, van den Berg et al. (Ex 1023) expressly teaches

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. Ex. 1023, 4:12-22.

116. By considering **both** temperature and milk production in a logical expression, however, the farm would be able to detect sick animals more reliably. A temperature above an upper threshold combined with decreased milk production would be more likely to indicate illness compared to considering temperature alone, where elevated temperature could indicate a cow is in heat. Similarly, when considering milk production alone, reduced production could indicate a nutritional issue rather than an illness. For example, solving the combine temperature and milk production logical expression may indicate that an animal might have low milk production due to a feed issue, and otherwise be healthy with a normal temperature.

117. Modifying Trevarthen’s logical expression to include both sensed temperature and stored milk production information would have merely been applying the known techniques of using temperature and milk production information described by Trevarthen into a system ready for improvement, such as more reliable disease detection. Thus, it is my opinion that Trevarthen renders the logical expression of element 1[E] obvious.

118. Modification of Trevarthen's expressions, or introduction of an entirely new expression, to include both temperature and milk production as input variables would have been easily accomplished using computation. The POSA would have understood that such an expression could have been implemented by: computing averages; determining differences (deltas) between current values and past values or averages; and determining whether certain values, deltas, or averages exceeded or dropped below a threshold. An expression to perform such calculations would have involved the application of straightforward algebra that was well within the skill of the POSA.

119. The prior art also demonstrates that even more sophisticated multivariate expressions were known in the art that considered both temperature and milk yield to determine whether an animal was ill or in oestrus. *Supra* §V.C; Ex. 1033, 174-80 ("de Mol"); Ex. 1032, 42-44, 52; Ex. 1034, 52; Ex. 1035, 2-3, 50-53, 57-58. The POSA would have had classes that included algebra and more advanced mathematics (e.g., linear algebra and calculus), such that the expression of de Mol would have been within their capabilities, especially since the actual equations had already been worked out and published by de Mol.

120. de Mol, for instance, teaches such an analytic model in which all the equations (1)-(21) are part of a single integrated expression that enables the integrated multivariate analysis for the detection of illness and/or estrus. de Mol,

173. More particularly, de Mol discloses using milk yield ($Y_{D,n}$), milk temperature (T_n), as logical variables input into expressions (1), (2) and (3). *Id.*, 174-175.

121. In Equation (1) an “approximation of the daily milk yield based on the two latest milkings is used:

$$Y_{D,n} = (Y_{M,n} + Y_{M,n-1}) \cdot \frac{24}{24 + M_n - M_{n-2}} \quad (1)$$

with: n , latest milking; $n-1$, previous milking,...; $Y_{D,n}$, daily yield at milking n ;

$Y_{M,n}$, yield at milking n ; and M_n , decimal time of milking n (between 0 and 24 h).”

de Mol, 174. Then de Mol’s model determines the “differences of successive daily yields” with the moving average model of Equation (2):

$$\nabla Y_{D,n} = Y_{D,n} - Y_{D,n-1} = Z_{Y,n} - \alpha_Y \cdot Z_{Y,n-2} \quad (2)$$

“with: $\nabla Y_{D,n}$, difference of daily milk yield at milking n ; $Z_{Y,n}$, random disturbance on yield at milking n ; α_Y , parameter of yield model.” de Mol, 174-75.

122. Equation (3) relates to temperature differences between the current milking and two milkings ago, where a cow is milked twice daily. The reason the comparison is not with temperature at the previous milking is because “temperature fluctuates during the day. Therefore [temperature] comparison with the previous milking is not useful.” *Id.*, 175. For example, the POSA would have wanted to compare temperature for the two most recent morning milkings rather

than a morning and evening milking. Thus, Equation (3) is a moving average or “the differences of the milk temperature with two milkings ago ...

$$\nabla T_n = T_n - T_{n-2} = Z_{T,n} - \alpha_T \cdot Z_{T,n-2} \quad (3)$$

with: ∇T_n , difference of milk temperature with lag 2 at milking n ; T_n , milk temperature at milking n ,” where milk temperature is reflective of body temperature, “ $Z_{T,n}$, random disturbance on temperature at milking n ; α_Y , parameter of temperature model.” *Id.* Values from these expressions, for example, $\nabla Y_{D,n}$ and ∇T_n are then input as variables into matrix (17a) to determine y_n , which is in turn used in equations (7), (11), (15), and (19). *Id.*, 178. The expressions in de Mol permit oestrus and illness alerts to be generated based on the “combinations” of the temperature and milk yield input variables. *Id.*, 180-181. The POSA would have been able to implement this type of combined expression in Trevarthen’s system. The system issues alerts when “combinations” of observations “fall[] outside a 95%, a 99% and a 99.9% confidence region.”

An **oestrus alert** is given when the activity is rather high and the sum of standardised errors of activity, yield and temperature falls outside a certain confidence interval. A **mastitis alert** is given when the conductivity error is rather high and the sum of standardised errors of conductivity, yield and temperature falls outside a certain confidence interval. An **illness alert** is based on the sum of standardised errors of yield, temperature, activity and concentrates intake.

Id., 180-81. The POSA would have been able to implement this type of combined expression in Trevarthen's system.

7. **1[F]: solve said at least one logical expression to obtain a corresponding at least one logical value.**

123. Element 1[F] requires "solv[ing] said at least one logical expression to obtain a corresponding at least one logical value." I have been informed by counsel that dependent claims narrow an independent claim. Claim 4, which depends from claim 1, states that the "logical value [can] indicate[] an occurrence of an illness...." Ex. 1001, 18:54-55 (claim 4), 14:10-16. Thus, it follows that the logical value of claim 1[F] can be an indication of illness. Patent Owner's complaint confirms this understanding of element 1[F]. Ex. 1022, ¶106 (Describing a "logical value" as an "illness detection alert feature.").

124. Trevarthen describes solving its logical expressions for temperature and milk production, so that the solutions provide values indicating whether the animal is, for example, ill so that an alert may be generated. Trevarthen, 122 ("[W]hen temperature fluctuations are recognised by the system, functionality could be incorporated to allow the system to **alert the farmer** of such fluctuations"). For stored milk production, "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**" *Id.*, 115. In Trevarthen's system if sensed temperature and/or stored milk production for a cow are outside the range of the expected

values (e.g., higher than expected temperature and lower than expected milk production), Trevarthen's system identifies a potential illness and alerts the operator.

125. The POSA would have further understood that solving the combined logical expression of element 1[E] (*supra* §VIII.A.6.c), results in a logical value indicating whether a cow is ill the same way Trevarthen separately solved the logical expressions for temperature fluctuations to determine whether a cow was potentially ill (*supra* §VIII.A.6.a) and solved for reduced milk production to indicate whether a cow was potentially ill (*supra* §VIII.A.6.b).

126. The POSA would have further understood that solving the modified logical expression of 1[E] (*supra* §VIII.A.6.c) that uses **both** temperature and milk production as input variables to more reliably detect illness (as well as oestrus), would similarly result in a logical value indicating whether an animal is ill. *de Mol*, 180-81.

127. Solving the combined logical expression is consistent with Patent Owner's infringement pleadings, which state that elements 1[E]-1[F] are both satisfied when a "system calculates that an alert is appropriate when it 'detects even the smallest deviations from the animal's regular temperature.'" Ex. 1022, ¶106.

128. Finally, the purpose of including a logical expression in a system is to solve for a value that is indicative of an outcome, for example, whether the time is right to artificially inseminate a cow or whether a cow may be ill. Such an expression would be of no use unless it is solved.

B. Claim 2: The system of claim 1, wherein said animal identification information further comprises said animal identification information correspondingly generated by a plurality of RFID devices implanted in a plurality of animals.

129. The POSA would have recognized that Trevarthen’s “*herd* management” system stores information generated by a plurality of RFID devices implanted in multiple individual cows in a herd. Trevarthen, 102 (“In order to derive any use and subsequent benefit from the practice of identifying *every cow* with RFID tags, a farm requires an RFID reader device.”). For example, in the Cochrane dairy each cow in a herd of about 350 lactating and 450 total head of cattle was tagged with an RFID device. *Id.*, 86 (“An RFID reader ... to determine the *identity of each cow*”); *supra* §VIII.A.3.

130. Trevarthen describes *implanting* RFID boluses in cattle and includes an example of an approved bolus for use with livestock. Trevarthen, 99-100; *see also id.*, 20, 22 (disclosing “rumens bolus” and “rumen boluses”). The POSA would have understood that a bolus, by definition, is implanted in a cow, with a rumen bolus implanted in the cow’s first stomach compartment. *Id.*, 99; *supra* §V.A. Indeed, the prior art before September 2008 provided examples of

numerous implantable RFID devices with physiological sensing capabilities, including for temperature. *Supra* §V.B. Trevarthen cites once such device, the Bio-thermo RFID microchip. Trevarthen, 24-25, 121 (citing Ex. 1017). Thus, it would have been obvious to implement Trevarthen’s system with an implantable RFID device.

C. Claim 3: The system of claim 2, wherein said sensed animal information comprises said sensed animal information generated by said plurality of RFID devices implanted in said plurality of animals.

131. Trevarthen describes that the “sensed animal information generated by said plurality of RFID devices implanted in said plurality of animals” includes sensed temperature information for a plurality of cows. *Supra* §VIII.A.4 (element 1[C]). Trevarthen discloses, for example, that “**each cow** has their temperature read at a regular interval at least twice a day,” which would permit the operator to “view patterns of temperature change among the cows.” Trevarthen, 122. Thus, Trevarthen teaches claim 3.

D. Claim 4: The system of claim 1,

1. 4[A]: wherein said sensed animal information comprises sensed physiological information of said animal, and

132. Trevarthen describes that sensed animal information that includes physiological information, such as temperature. *Supra* §VIII.A.4 (element 1[C]).

2. **4[B] wherein said animal information stored in said database comprises health information associated with said animal, and**

133. In addition to storing temperature and milk production information (*supra* §§VIII.A.4-VIII.A.5) that are indicators of animal health, Trevarthen also describes using its herd management software and database to store and to view cow health information such as “treatments.” Trevarthen, 101. Using the system “farmers are able to easily and immediately view information on individual cattle, view an entire cow[']s history (calving date, artificial insemination dates, treatments etc.), produce reports on individual cows, selected cows or the herd as a whole etc.” *Id.*

134. Indeed, the Cochrane dairy’s database described in Trevarthen “include[d] the ability to store data on a range of characteristics for each cow, such as the date of artificial insemination, date calved (date a cow gave birth to a calf), **treatments (such a[s] penicillin)**, milking rates etc., as well as a range of data that may assist in facilitating herd management.” *Id.*, 93; *see also id.* 88-89 (information relating to “artificial insemination, veterinary treatments etc.” for automatic drafting gate operation). Even the less technically savvy Strong dairy stored “[i]nformation such as date of artificial insemination, treatments and a wide variety of other information and individual characteristics pertaining to each of the Strong[s] cows” in the computer “application” used by that dairy. *Id.*, 65.

3. **4[C]: wherein said logical value indicates an occurrence of an illness of said animal.**

135. As explained for elements 1[E]-1[F] (*supra* §§VIII.A.6 -VIII.A.7), Trevarthen renders obvious solving a logical expression by entering temperature and milk production information into a logical expression that solves for a logical value indicating an occurrence of illness.

E. Claim 6: The system of claim 4,

1. **6[A]: wherein said animal identification information further comprises said animal identification information correspondingly generated by a plurality of RFID devices implanted in a plurality of animals**

136. Trevarthen meets element 6[A] for the same reasons as described for claim 2. *Supra* §VIII.B.

2. **6[B]: wherein said sensed animal information comprises said sensed animal information generated by said plurality of RFID devices implanted in said plurality of animals,**

137. Trevarthen meets element 6[B] for the same reasons as described for claim 3. *Supra* §VIII.C.

3. **6[C](i): wherein said at least one logical expression solves as to a selected period of time as to said plurality of animals correspondingly associated with said animal identification information**

138. As an initial matter, this claim element does not explain what the logical expression solves for. However, claim 4 does state that the logical value solved for “indicates an occurrence of an illness.” Thus, I have been directed by

counsel to assume that the claimed said at least one logical expression solves for the occurrence of illness as to a selected period of time.

139. Trevarthen explains that one of the reasons to implement RFID cattle tracking is to control the outbreak of diseases to avoid incidents such as the European mad cow disease outbreak of the 1990s. *Supra* §V.D.1 (citing Trevarthen, 1, 3, 17-18). To effectively monitor disease outbreaks, the system would have had to enable a farm to identify cows who may be at risk of contracting an infection because they were in contact with an infected cow during a specific period of time, as Trevarthen explains:

In the current global livestock environment, awareness, fear and recognition of animal borne diseases such as ‘mad cow disease’ have driven calls for reliable and effective systems for individual identification and tracking of livestock throughout the animals’ entire lifecycle. Such systems empower authorities with rapid and precise information (such as the animals’ farm of origin, ***cows it has been in contact with*** etc.), aiding them to take prompt and direct action to reduce the possibility of a disease outbreak.

Trevarthen, 1; *see also id.*, 18.

140. Moreover, the POSA would have understood that the logical expression generates solutions as to a selected period of time, because the methods that Trevarthen describes and those that were commonly in use in the art before September 2008 rely on moving averages. For example, as explained for elements

1[E] and 1[F], Trevarthen systems tracks temperature “fluctuations” and generates “average” values for milk production. *Supra* §§VIII.A.6-VIII.A.7. These calculations involve calculations on measurements taken over a period of time. For example, “average [milk production] may be taken from the production of the cow during their entire current lactation cycle, or perhaps ***derived from a selected amount of previous milking sessions*** (e.g. the average milk provided over the past 10 milking sessions).” Trevarthen, 109.

141. Further, when the RFID device is interrogated by a reader, Trevarthen’s system records “the ***time and date*** of this read to the central herd management database.” *Id.*, 102. For temperature sensing, Trevarthen discloses that “each cow has their temperature read at a ***regular interval at least twice a day***” when the cow enters the dairy which would permit the operator to “view patterns of temperature change among the cows.” Trevarthen, 122; *supra* §VIII.A.6.a (element 1[E]). Milk volumes would have also been determined around the same time. Thus, it follows that Trevarthen teaches collecting sensed temperature information and milk production information over, for example, a selected five-day period with two milkings and two concurrent temperature readings a day yielding a total of ten milking sessions and temperature measurements. Trevarthen, 109 (determining “the average milk provided over the past 10 milking sessions”); *see*

also id., 122. Thus, Trevarthen teaches solving the logical expression for illness as to a specific period of time.

4. 6[C](ii): if a greater than selected number of said illness have occurred.

142. In order to identify operators to potential disease outbreaks, one of Trevarthen's express objectives, the POSA would have been motivated to configure Trevarthen's herd management system to solve the logical expression and issue an alert when a threshold number of illnesses (i.e., a selected number of illnesses) is met or exceeded. For example, a single incidence of an infection may not be an issue if a cow is rapidly isolated from the herd as to prevent other cows from getting infected. Several cows getting sick, however, not only may indicate an outbreak, but such an occurrence would have had the potential to exponentially increase the number of cows exposed to an infection.

143. Because Trevarthen's system records the data for each identified cow in its database (*supra* §VIII.A.3 (element 1[B])), the database software would be configurable to tabulate the total number of illnesses within the herd through an arithmetical expression. For example, the database could record each incidence of illness determined by solving the logical expression of claim 1 (*supra* VIII.A.6-VIII.A.7), and the operator could set a threshold value, which, when exceeded, would broadcast an alert to the operator.

144. Configuring Trevarthen’s system to add this additional threshold based on the number of ill animals, is merely combining prior-art elements according to known methods to yield predictable results. Moreover, the inclusion of this additional tracking feature would potentially improve the ability of the Trevarthen system to detect disease outbreaks in a predictable manner.

IX. GROUND 2: TREVARTHEN IN VIEW OF BRUNE RENDERS CLAIMS 17-20 OBVIOUS

145. Claims 17-20 recite elements that include “retriev[ing] date-time information from said RFID device.” Ex 1001, element 17[D]. Trevarthen discloses recording time-date information to the central herd database, but this may be done by the RFID interrogator and not stamped by the implanted device itself. Trevarthen, 102-103 (“placing the RFID reader in this position allows data to be automatically recorded regarding the time and date that each cow enters the milking parlour”). Brune (*supra* §V.D.3), however, discloses that its device transmits, via air-borne signals, “a data packet [that] includes ... ***date and/or time stamp data***.” Brune, 4:1-11. The POSA would have considered it obvious to implement or try transmitting Brune’s data packets from the Trevarthen RFID device to the database in Trevarthen’s RFID-based system.

A. Claim 17

1. 17[Pre]: A computer implemented animal management system, comprising

146. As explained in Ground 1 for claim element 1[Pre], Trevarthen teaches a computer implemented animal management system. *Supra* §VIII.A.1.

2. 17[A]: a processor communicatively coupled to a non-transitory computer readable media containing program instructions executable to

147. Trevarthen teaches the processor of element 17[A], as described in Ground 1 for element 1[A]. *Supra* §VIII.A.2.

3. 17[B]: retrieve animal identification information from an RFID device implanted in an animal

148. Trevarthen teaches the retrieval of animal identification information from an RFID device implanted in an animal as explained in Ground 1 for element 1[B] (“retriev[ing] animal identification information from an RFID device”) and for claim 2 (“implanted in an animal”), because claim 1 does not require the RFID device to be implanted. *Supra* §§VIII.A.3, VIII.B.

4. 17[C]: retrieve sensed animal information from said RFID device

149. Trevarthen teaches the retrieval of sensed temperature information from said implanted RFID device as described in Ground 1 for element 1[C] and for claim 3. *Supra* §§VIII.A.4, VIII.C.

5. **17[D]: retrieve date-time information from said RFID device**

150. Modifying Trevarthen's system to use an RFID device that stamps date-time meets element 17[D] of the '206 patent. Brune describes an implantable device from which date-time information can be retrieved, in contrast to other devices where the reader provides a date-time stamp. For example, Trevarthen explains that "fixed readers may be utilised for the purposes of identifying a cow as she enters the milking parlour, and subsequently **recording the time and date** of this read to the central herd management database..." Trevarthen at 102; *see also id.*, 103 ("[P]lacing the RFID reader in this position allows data to be automatically recorded regarding the **time and date** that each cow enters the milking parlour, and should at least be arranged so as to display cow information (displayed via relevant interface of the herd management software) on a computer screen at the end of the dairy."). From this explanation, the POSA would have understood Trevarthen to have teachings related to the importance of obtaining date-time information and recording it in a database, for example, when sensed temperature information is retrieved from the RFID device. Additionally, Trevarthen discloses identifying "fluctuations" and "anomalies" in temperature. *Id.*, 121-22. A POSA would therefore have understood that a time-series of time-date stamped temperature measurements are needed to identify fluctuations and anomalies.

151. Trevarthen, however, teaches having the RFID reader provide date-time information, rather than retrieving date-time information from the RFID device itself. Regardless, the POSA would have found it obvious to have the RFID device itself provide such date-time information as an alternative embodiment. The date-time information stored in the central herd management database indicating when the cow enters the milking parlour (*id.*, 102-103) would be the same regardless of whether the date-time stamp is applied by the reader or retrieved from the RFID device.

152. For example, Brune's device sends "a message in the form of ***an air-borne signal*** which is transmitted from a bolus implanted within the stomach of a cow." Brune, 4:1-3. Brune explains:

The message or signal is preferably in the form of a data packet ... For each message, the data packet includes temperature data representing the ***sensed temperature*** within the stomach, identification data such as an ***identification number which is unique to the specific cow***, and ***date and/or time stamp data*** corresponding to the ***discrete point in time at which the temperature was sensed*** by the bolus.

Brune, 4:3-11.

153. As explained, the data packet transmitted by Brune's device includes identification information (element 17[B]), sensed temperature information

(element 17[C]), and time-date information (element 17[D]) is retrieved from Brune's device.

154. By September 2008, there were many examples of implantable RFID bolus devices with sensing capabilities. *Supra* §V.B. Trevarthen discloses that its system works with a variety of RFID tags, such that “the eventual choice of device to the individual farmer to select the device type that best suits their requirements and farm” (Trevarthen, 99), thereby providing the POSA with a reasonable expectation of success that Trevarthen's herd management system could use an RFID device that provides a date-time stamp. The POSA also would have reasonably expected Brunes's device to work with Trevarthen's herd management system, at least because the same types of information are being retrieved from a similar implanted bolus, for example, both devices obtain body temperature information.

155. Moreover, the GPS-RFID feature proposed in Trevarthen provides another way to retrieve time-date information from the RFID. Trevarthen, 123-25. The POSA would have understood that including a GPS feature in the RFID device would have provided a time-date stamp capability within that device. For example, U.S. Patent No. 5,724,316 (Ex. 1036) confirms that “**time and date information is generally computed** as a side effect of producing a precise position estimate based on the GPS signal. Currently, the time of day information included

with the GPS radio wave signals is referenced to the Greenwich Mean Time (GMT) which is generally recognized as the reference time at the prime meridian.” Ex. 1036, 1:63-2:2; *see also id.* 2:50-53 (“In additional, the system and method determines the time of day from the GPS signals as referenced to a reference time such as GMT. The date is also determined from the GPS signals.”)

6. 17[E]: match said sensed animal information retrieved from said RFID device to animal information stored in a database

156. As explained in Ground 1 for element 1[D], Trevarthen teaches matching sensed temperature information with temperature information stored in the database for each cow, thereby meeting element 17[E]. *Supra* §VIII.A.5.

7. 17[F]: enter said sensed animal information retrieved from said RFID device and said animal information stored in said database as logical variables into at least one logical expression

157. In contrast to element 1[E], which requires entering sensed information and stored information comprising milk production information or days in milk information, element 17[F] can be satisfied by sensed and stored information of the same type, for example, temperature without requiring milk production or days in milk information.

158. As explained in Ground 1 for element 1[E], Trevarthen teaches entering *sensed temperature information* and *stored temperature information* into a logical expression for the detection of illness, thereby meeting element 17[F].

Supra §VIII.A.6.a. Such a logical expression would have been understood by the POSA to compare recent temperature readings with a permissible temperature range, derived from past temperature measurements stored in the database, to determine, for example, whether the cow’s temperature has crossed the upper or lower thresholds of the range, which the POSA would have understood as an indicator of possible illness. Trevarthen, 122 (explaining that “it is important that anomalies in temperatures be identified and investigated as soon as possible ... to allow the system to alert the farmer of such fluctuations ...”). It is implicit that to detect “anomalies” or “fluctuations” in temperature requires an expression that compares present sensed measurements to previously stored measurement

159. Moreover, the 1997 and 1999 de Mol references, and others, further confirm that the POSA would have understood how to implement an illness detection model in Trevarthen’s system using sensed animal information inputs, including “time-series” temperature measurements. *Supra* §§V.C, VIII.A.6.c (citing Exs. 1032, 1033, 1034, 1035).

8. 17[G]: solve said at least one logical expression to obtain a corresponding at least one logical value.

160. As explained for element 1[E]-1[F] (*supra* §§VIII.A.6.a, VIII.A.7), Trevarthen’s logical expression of element 17[F] based on temperature inputs is solved to generate a logical value indicating, for example, whether a cow has a temperature outside an acceptable range, and, if so, alert the operator of a potential

illness in a particular cow. Trevarthen, 115, 122. Trevarthen explains that “when temperature fluctuations are recognized by the system, functionality could be incorporated to allow the system to **alert the farmer** of such fluctuations via means such as a beeper device that the farmer may carry, sending a text message to their mobile phone, or by similar rapid alert device.” Trevarthen, 122. The way that Trevarthen solves its logical expressions for sensed and stored temperature is analogous to how Patent Owner explains the coverage of this element in its amended complaint. Ex. 1022, ¶ 106. Thus, Trevarthen meets element 17[G] by teaching solving a logical expression using sensed and stored temperature inputs to solve for whether a cow may be ill, for example, exhibiting temperature outside its typical range.

161. Finally, the purpose of including a logical expression is to solve for a value that is indicative of an outcome, for example, whether the time is right to artificially inseminate a cow or whether a cow may be ill. Such an expression would make little sense unless it is solved.

B. Claim 18: The system of claim 17,

1. 18[A]: wherein said sensed animal information comprises sensed physiological information of said animal,

162. As described for Ground 1 in element 1[C], Trevarthen discloses sensed animal information that includes physiological information, such as cow temperature. *Supra* §VIII.A.4.

2. **18[B]: and wherein said animal information stored in said database comprises health information associated with said animal,**

163. As described for Ground 1 in element 4[B], Trevarthen discloses storing animal health information in its database, such as animal treatments. *Supra* §VIII.D.2.

3. **18[C]: and wherein as to a selected period of time said at least one logical value indicates occurrence of an illness of said animal associated with said animal identification information.**

164. As explained in Ground 1 for element 1[E]-1[F] (*supra* §§VIII.A.6.a, VIII.A.7) and in Ground 2 for element 17[G] (*supra* §IX.A.8), Trevarthen describes solving a logical expression by entering a particular animal's sensed temperature information, measured by an implanted RFID device, into a logical expression that solves for a logical value indicating an occurrence of illness. As explained for element 6[C](i), the POSA would have understood that Trevarthen's logical expression solves for illness, or renders obvious solving for illness, for a selected period of time. *Supra* §VIII.E.3.

165. Further, as explained in Ground 2 for element 17[D], implementing Trevarthen's system with an RFID device that provides a date-time stamp, like Brune's wireless transmitting device, date-time information would have been retrieved from the RFID device along with sensed animal temperature when a cow passes the reader. *Supra* §IX.A.5. Therefore, the information entered into the

database would have made it feasible to track whether a cow was suffering from an illness from a selected time period by determining whether the cow's temperature fluctuations exceeded a threshold value in that time period. Thus, implementing Trevarthen's herd management system to solve for a logical value indicating whether a cow was ill in a specific period of time was at most combining familiar prior art elements according to known methods to yield a predictable result.

C. Claim 19: The system of claim 18,

- 1. 19[A]: wherein said animal identification information further comprises said animal identification information correspondingly received from a plurality of RFID devices implanted in a plurality of animals,**

166. As explained in Ground 1 for claim 2, Trevarthen discloses retrieving animal identification information correspondingly received from a plurality of RFID devices implanted in a plurality of animals. *Supra* §VIII.B.

- 2. 19[B]: wherein said sensed animal information comprises said sensed animal information receive from said plurality of RFID devices implanted in said plurality of animals,**

167. As explained in Ground 1 for claim 3, Trevarthen discloses retrieving sensed animal temperature information received from a plurality of RFID devices implanted in a plurality of animals. *Supra* §VIII.C.

3. 19[C]: wherein said logical value indicates a number of occurrences of said illness in a plurality of animals.

168. As explained in Ground 1 for element 6[C](ii), Trevarthen discloses that said logical value would indicate the number of occurrences of said illness.

Supra §VIII.E.4.

D. Claim 20: The system of claim 19, wherein said logical value indicates occurrence of a greater than a pre-selected number of said illness in said plurality of animals.

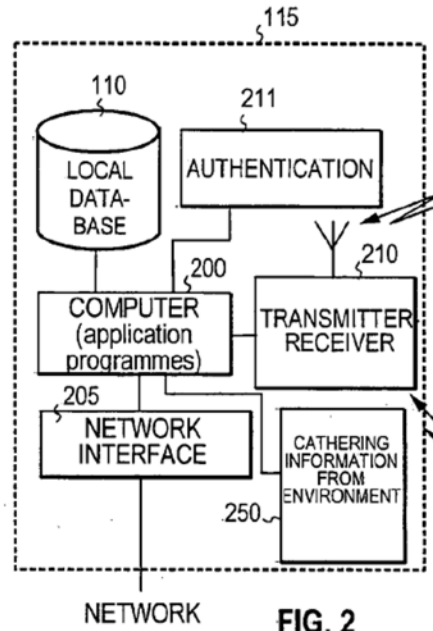
169. As explained in Ground 1 for element 6[C](ii), Trevarthen rendered obvious a logical value that indicates occurrence of a greater than a pre-selected number of said illness in said plurality of animals. *Supra* §VIII.E.4.

X. GROUND 3: LAITINEN IN VIEW OF BUCHANAN AND LIAO RENDER CLAIMS 1-4, 6, AND 11 OBVIOUS

A. Claim 1

1. 1[Pre]: A computer implemented animal management system, comprising

170. Laitinen describes computer-based “system for the surveillance of a group of animals.” *Id.*, 1:12-18. “Based on the collected animal and farm information and expert knowledge, recommendations, treatment measures and management decision are taken and prognosticated on the global level.” *Id.*, 4:50-53. Laitinen’s local level information system, for example, is computer based:



Id., Fig. 2 (excerpt of local level information system (115)). Moreover, Laitinen’s system comprises “computer[s]” at least at the local and global levels, wherein software can be downloaded over a communication network. *Id.*, 4:21-49, Fig. 2.

2. 1[A]: a processor communicatively coupled to a non-transitory computer readable media containing program instructions executable to...

171. The POSA would have understood that Laitinen discloses a processor communicatively coupled to a non-transitory computer readable media containing program instructions. Laitinen, 3:5-10, Figs. 1-3. Laitinen describes the use of a “personal computer” and a “computer” as part of its system. *Id.*, 4:5-9, 4:23-25, 4:42-45, Figure 2. Laitinen’s system includes “a local information system [that] comprises a 105 terminal unit typically featuring the 110 data base into which the terminal gathers local measuring and surveillance and other important information.

Gathering, assessing and presenting data concerning the animals' health, the production environment and the farm are the functions of the local system.” Laitinen, 4:9-15; *see also id.*, 4:21-36; 6:10-13. The local level terminal comprises a “personal computer.” *Id.*, 4:21-25. Additionally, the POSA would have understood that gathering and assessing data concerning the animals' health requires “program instructions,” i.e., software. *Id.*, 4:40-41. Indeed, Laitinen teaches that the terminal can download such “software” through a communications network. *Id.*, 4:37-41. Laitinen's global level also comprises a “computer” linked to “software” for gathering, organizing and refining animal information. Laitinen, 4:42-49.

172. The POSA would have understood disclosures of the local and global levels to teach a processor communicatively coupled to a non-transitory computer readable media containing program instructions, for example a hard drive connected to a terminal.

3. 1[B]: retrieve animal identification information from an RFID device

173. Laitinen describes the retrieval of animal identification information from an RFID device associated with an animal, which Laitinen refers to as a “pico level device.” 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.”).

The 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.

174. The use of RFID for animal identification was well-established. For example, US Patent App. Pub. No. 2006/0267767 (Ex. 1009) (“Pohlkamp”) discloses an RFID device that is implanted as a bolus in the rumen. Ex 1009, [0034], [0039], [0041] (“RFID systems can be used for animal identification”). Thus, the POSA would have considered an implantable temperature sensing RFID device like the one disclosed in Pohlkamp, or many other references described above in Section V.B, to be usable in Laitinen’s system.

4. 1[C]: retrieve sensed animal information from said RFID device, said sensed animal information generated by a sensor coupled to said RFID device

175. Laitinen explains that sensed animal information can include “the animal’s *body temperature, occlusion, muscular action, motion or metabolic level*. The [s]ensor 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.” Laitinen, 3:51-57; *see also id.*, 8:9-11 (“To monitor the animal’s heat with a pico level device, *body temperature* and movement are usually measured.”). Laitinen also states that

its device can also include a GPS sensor to provide animal location information.

Id., 3:66-67. As discussed above in 1[B] (*supra* §X.A.3), Pohlkamp also demonstrates that it was well-known to retrieve animal temperature from an implanted RFID bolus having a temperature sensor. Ex 1009, [0034], [0039], [0041]. There are also numerous other implantable devices with capabilities to sense temperature and other physiological parameters. *Supra* §V.B.

5. 1[D]: match said sensed animal information retrieved from said RFID device to animal information of said animal stored in a database including an amount of milk production or a number of days in milk

176. As discussed above for elements 1[B] and 1[C] (*supra* §§X.A.3-X.A.4), Laitinen describes retrieving animal identification and temperature information from the RFID devices associated with each animal. Laitinen, 9:30-33 (“identification and measuring elements having a short-range transmitter-receiver (100) attached to the animals for identification checking and animal-specific measuring”). This information is stored in a database. *Id.*, 6:36-39 (“database 31 comprises certain local measurements and their corresponding results, as measured with the pico devices....”), *see also id.*, 7:6-25 (describing analysis of “initial” and “present” state vectors that comprise animal temperature, indicating that sensed temperature data for an animal is necessarily stored over time).

177. Although Laitinen does not expressly disclose storing milk production information, the POSA considering implementing Laitinen’s system would have

been motivated to do so by express statements in Laitinen. For example, Laitinen states that “it is **vital** that real-time **information about the production of ... milk, is available.**” *Id.*, 1:36-38. Plainly, using Laitinen’s database to track the milk production of the cows would facilitate the availability of such milk production information to have been stored and applied by Laitinen’s system. Indeed, other systems describe storing and using milk production information to monitor dairy cows.

178. For example, Buchanan describes a farm management system that stores milk production information, and thus satisfies the motivation presented in Laitinen to track milk production. Buchanan describes milk meters for taking “milk volume readings to be associated with the particular animal being milked,” and sending those readings to an in-shed module. Buchanan, 19:17-31. That milk production information is then stored in a “database” where it is associated with “**animal identifiers.**” *Id.*, 11:18-22. By September 2008, milk meters were mature technology and the collection and storage of milk production information for individual cows was conventional.

179. Similarly, the Liao reference describes storing milk production data, for example, “peak yield” and days in milk (also referred to as “DIM”) as information associated with each animal. Liao, 10:1-8. There were no meaningful impediments to modifying Laitinen’s farm management system to similarly collect

and store such milk production information, because the POSA would have been aware of such data being stored in systems such as those described by Buchanan and Liao.

180. The POSA would have been additionally motivated to store milk production information in Laitinen's database, because Laitinen and Liao were both concerned with reproduction and detecting when a cow was in heat for purposes of artificial insemination. *Supra* §§V.D.2 (Laitinen), V.D.5 (Liao). For example, Liao expressly teaches that both peak yield of milk and days in milk information are "applicable to insemination decisions." Liao, 9:34-11:10 (identifying days in milk and peak yield as "input parameters" for insemination decisions); *see also id.*, 12:3-15. Because Laitinen was similarly concerned with the timing of artificial insemination (Laitinen, 8:5-39), the POSA would have been motivated to store Liao's milk production and days in milk information in Laitinen's database given their relevance to insemination determinations as discussed in Liao.

181. Additionally, the POSA would also have been motivated to store milk production information and days in milk information in Laitinen's database, because Laitinen and Liao were both concerned with detecting disease, and reduced milk production was a well-known indicator that a cow may be ill. For example, Liao teaches that milk production information and days in milk

information are “input parameter[s]” for deciding whether to test a cow for mastitis. Liao, 15:16-29, 29:15-35. Laitinen was similarly concerned with disease and described how milk samples may be useful in disease detection. Laitinen, 1:33-35 (“infectious disease[]” is a “serious problem[]”). Laitinen explained its “local system can check the information about milk samples from the laboratory server before the commencing of the milking process, which would immediately reveal, say, a latent bovine mastitis.” *Id.*, 4:60-64; *see also id.*, 7:35-37 (describing the analysis of “animal’s present condition” to determine “necessary medical treatment”). The POSA therefore would have been motivated to store Liao’s milk production information and days in milk information in Laitinen’s database to detect disease, because as Liao expresses, the POSA would have understood that low milk yield could be reflective of illness and Laitinen similarly described how the analysis of milk could be a tool in disease detection and monitoring. *Supra* §V.C.

182. As noted above (*supra* §X.A.4), Laitinen discloses storing sensed animal temperature data for each individual animal, Buchanan and Liao disclose storing milk production for each animal, and Liao discloses storing days in milk information for each animal with each animal’s identity. *E.g.*, Buchanan (explaining that milk production information is then stored in a “database” where it is associated with “***animal identifiers.***”) *Id.*, 11:18-22; Liao, 5:14-25 (describing

associating “**animal identity**” with “number of [DIM]” and “peak yield”). The POSA would have understood that the sensed temperature information would be matched to the stored milk production and days in milk information for each animal using the animal’s identification information.

6. **1[E]: enter said sensed animal information retrieved from said RFID device and said animal information stored in said database as logical variables into at least one logical expression**

183. Element 1[E] recites entering “sensed animal information” and “entering “animal information stored in said database” that includes a cow’s “milk production or a number of days in milk” into a logical expression. As explained for 1[D] (*supra* §X.A.5), the POSA would have been motivated to store animal temperature, milk production, and days in milk information in Laitinen’s database. The POSA would have understood Laitinen to apply logical expressions for various surveillance purposes. Laitinen further teaches that “data concerning an animal can be obtained ... throughout the animal’s entire life span” and that the “servers and databases feature **algorithm and models, which are applied in the analysis of these and other possible data.**” Laitinen, 5:24-30. Similarly, Laitinen explains that “**algorithms and knowledge models** ... are essential to the effectiveness of the system’s services.” *Id.*, 6:29-32. The POSA would have considered such algorithms and knowledge models to be logical expressions.

184. Laitinen discloses a first logical expression to determine if a cow is in heat to determine its readiness for artificial insemination. *Id.*, 8:5-15. Laitinen monitors a cow's temperature and movement, and then uses the data as the input variables, and the expression determines whether "alarm limit(s) have been reached." *Id.*, 8:13-15.

185. As explained for element 1[D] (*supra* §X.A.5), Liao teaches that milk production and days in milk information are also useful for determining whether a cow is in heat and ready for artificial insemination. Liao, 12:3-15. The POSA would have been motivated to modify Laitinen's logical expression to include milk production and days in milk information as input variables, along with the temperature and movement information, to improve its accuracy and reliability at determining whether a cow is in heat. Such a modification would merely be applying known techniques, as Liao taught using such variables in its decision engine (*supra* §V.D.5).

186. Laitinen also discloses a second logical expression that determines the appropriate "medical treatment" for an animal. More particularly, Laitinen discloses the logical expression $x=f^{-1}(y,z)$, wherein the treatment x is a function of initial state vector y and present state vector z . Laitinen, 7:6-13, 7:35-37. The state vectors include the animal's temperature at different times. *Id.*, 7:6-11. Laitinen repeatedly expresses concern for detecting animal disease (*id.*, 1:33-35,

4:60-64), and therefore the POSA would have understood that the expression includes determining whether an animal is sick and identifying the appropriate treatment for a diagnosis. Indeed, it was well-known in the art that temperature correlated with animal illness. Brune, 1:36-38 (“the core body temperature of a cow may rise when the cow is sick ...); Ex. 1023, 4:12-18 (temperature is a reliable indicator of illness).

187. The POSA would also have been aware that lowered milk production was also an indicator of illness, or related conditions such as heat stress. Liao, 6:32-7:6 (milk yield and days in milk parameters for determining whether animal should be tested for mastitis); Ex. 1023, 4:12-18 (milk yield as a reliable indicator of illness); Brune, 6:48-50 (“heat stress may cause the milk production of a dairy cow to decrease for several days.”). Therefore, the POSA would have been motivated to modify the second logical expression of Laitinen to include milk yield as an input, along with temperature. Indeed, it was well known for decades that a combination of variables was likely to improve reliability of a logical expression that determined whether a cow is ill and advising on medical treatments. *Supra* §V.C.

188. By combining temperature and milk production as input variables to a logical expression, the POSA would have understood that dairies would have more effectively been able to determine whether temperature and milk production

anomalies are indicators of illness or cause by some other issue. Indeed, the art had been focused for decades on improving illness diagnosis through combining variables using different models and algorithms. *Supra* §V.C. For example, a temperature above the upper limit combined with decreased milk production would tend to indicate illness is highly likely, whereas decreased milk production without elevated temperature may suggest another issue, for example a need to change feed. For example, van den Berg et al. (Ex 1023) expressly teaches 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. Ex. 1023, 4:12-22.

189. Modifying Laitinen’s second logical expression to include both sensed temperature and stored milk production information would have been merely applying the known techniques of using temperature and milk production information to separately detect illness into a system ready for improvement, such as more accurate illness detection by using both inputs concurrently. For example, modifying Laitinen’s logical expressions, or creating a new one, to include both sensed temperature and stored milk production information for the detection of heat or illness would have merely involved the application of algebra, which was well within the capabilities of the POSA. Indeed, as explained in Ground 1 for 1[E] (*supra* §VIII.A.6.c), by the 1990’s it was known to use multivariate

expression solvable by applying linear algebra to determine, based on the input variables including temperature and milk yield, whether a cow was in oestrus or ill. de Mol, 173-81; Ex. 1032, 43-44. The POSA would have been motivated to use the same type of expression described in de Mol with the Laitinen system to provide another, potentially more accurate, indicator of illness in cows. Thus, there was a high probability of success given that the POSA could have used known techniques to implement an expression that uses both temperature and milk yield as input variables in Laitinen's system.

7. 1[F]: solve said at least one logical expression to obtain a corresponding at least one logical value

190. For Laitinen's first logical expression used for purposes of determining whether a cow was in heat, Laitinen discloses that "when the local system notices that the alarm limit(s) have been reached, it signals a heat alarm...." Laitinen, 8:12-15. The POSA would have understood that the first logical expression is being solved to determine whether the alarm limit is reached, and if so, a value is obtained that corresponds to this determination and is used to generate the heat alarm signal. Using the solutions to the logical expression, decisions could be made as to whether to artificially inseminate a cow. *Id.*, 8:33-38. The POSA would have solved the modified Laitinen expression, or new expression, with milk production and temperature inputs to detect if a cow is in

heat and ready for artificial insemination, in the same manner as the first expression disclosed in Laitinen. *Supra* §X.A.6.

191. For Laitinen's second disclosed logical expression directed to detecting illness and identifying appropriate courses of medical treatment, the logical expression is given by the expression $x=f^{-1}(y,z)$, wherein x is the appropriate medical treatment for a sick animal. *Id.*, 7:35-37. The POSA would therefore have understood Laitinen's equation is being solved for x , which indicates the presence of illness and identifies the appropriate medical treatment. The POSA would have solved the modified Laitinen expression, or new expression, with milk production and temperature inputs to detect if a cow is ill, in the same manner as the first expression disclosed in Laitinen. *Supra* §X.A.6

192. Finally, the purpose of including a logical expression is to solve for a value that is indicative of an outcome, for example, whether the time is right to artificially inseminate a cow or whether a cow may be ill. Such an expression would make little sense unless it is solved.

B. Claim 2: The system of claim 1, wherein said animal identification information further comprises said animal identification information correspondingly generated by a plurality of RFID devices implanted in a plurality of animals.

193. Laitinen states that its "[s]ensor 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.” Laitinen, 3:53-57; *see also id.*, 5:38-43 (“[P]ico level devices connected to a local information system” containing sensors “can be either external (100a) or ***implanted inside the animal’s tissue*** (100b).”). Thus, the POSA would have understood Laitinen to teach using implanted RFID temperature sensing devices, which were common as of the effective date. *Supra* §V.B

194. Although Laitinen provides a specific external RFID device (Laitinen, Figure 3), the POSA would not have considered this a limiting embodiment. The POSA would have been motivated to use an internal device, to avoid, for example the risk of detachment. Laitinen, 9:7-11 (describing a need for an “authentication response sent by the pico device [that] must confirm that the device has been attached to the animal at all times”). Indeed, the prior art was replete with examples of implanted temperature sensing RFID devices. *Supra* §V.B; *see also* Exs. 1006; 1009-1010; 1014-1017; 1020-1021. Thus, the POSA would have reasonably expected to be able to successfully use at least one of the many known implanted RFID devices in Laitinen’s system to detect animal temperature.

195. Laitinen further discloses that its sensors are implanted in a plurality of cows, as gathering information from a herd of cattle on the local level and multiple herds on the global level, which is information central to Laitinen’s surveillance capabilities. *Id.*, 3:21-50, Fig. 1. The POSA reading Laitinen would

have understood that Laitinen was compatible with RFID temperature sensing devices implanted in a plurality of animals.

C. Claim 3: The system of claim 2, wherein said sensed animal information comprises said sensed animal information generated by said plurality of RFID devices implanted in said plurality of animals.

196. As explained for 1[C], Laitinen discloses collecting sensed animal information, for example, temperature, location, and movement from each cow in the herd having implanted devices. *Supra* §VIII.A.4.

D. Claim 4: The system of claim 1,

1. 4[A]: wherein said sensed animal information comprises sensed physiological information of said animal

197. As explained for 1[C], Laitinen discloses that its system collects sensed animal physiological information, including temperature and metabolic information. *Supra* §X.A.4.

2. 4[B]: wherein said animal information stored in said database comprises health information associated with said animal

198. Laitinen describes storing animal health information in the database. Laitinen, for example, explains that “[g]athering, assessing and presenting data concerning the animals health, the production environment and the farm are the functions of the local system.” Laitinen, 4:12-15; *see also id.*, 5:4-8 (“Thanks to collected **historical data** and improved diagnosis methods, the system also enables individual **health surveillance** and the creation of remote health care services.

Veterinarians can collect local level information with their server 140 and refine that data in their own database 145.”). The storage of this animal health data is central to Laitinen’s animal health surveillance purpose.

3. 4[C]: wherein said logical value indicates an occurrence of an illness of said animal

199. As explained for 1[E]-1[F] (*supra* §§X.A.6-X.A.7), Laitinen renders obvious solving a logical expression by entering temperature and milk production information into Laitinen’s second logical expression to solve for a logical value indicating an occurrence of illness and the appropriate medical treatment.

E. Claim 6: The system of claim 4,

1. 6[A]: wherein said animal identification information further comprises said animal identification information correspondingly generated by a plurality of RFID devices implanted in a plurality of animals

200. As explained for claim 2, Laitinen discloses implanting RFID devices in a herd or many herds (i.e., a plurality) of cattle. *Supra* §X.B.

2. 6[B]: wherein said sensed animal information comprises said sensed animal information generated by said plurality of RFID devices implanted in said plurality of animals

201. As explained for 1[C], Laitinen describes sensed animal information generated by a plurality of implanted RFID devices (e.g., temperature, location, and movement). *Supra* §X.A.4.

3. 6[C]: wherein said at least one logical expression solves as to a selected period of time as to said plurality of animals correspondingly associated with said animal identification

information if a greater than selected number of said illness have occurred

202. Laitinen's central focus is animal surveillance of a herd of cattle on the local level and multiple herds on the global level. As explained for 1[E]-1[F], Laitinen's second logical expression solves for the occurrence of illness in an animal and the appropriate medical treatment. *Supra* §§X.A.6-X.A.7. Laitinen's system was also for "the surveillance of a group of animals." Laitinen, 1:12-15. For example, Laitinen discloses that the gathered data can be accessed by "authorities, various enterprises linked to animal husbandry, research centers, universities and veterinarians. The system allows the authorities to remotely monitor, check and create statistics by gathering local data through the server **130**." *Id.*, 4:65-5:8, Figure 1. To be useful for this purpose, the POSA would have understood that Laitinen's system made its determinations over selected periods of time, because such monitoring is highly time-dependent.

203. Laitinen itself indicates that its illness determinations are made of a selected period of time. For example, the animal information input to the expression comprises an initial state vector y and a present state vector z containing the animals' physiological data measured, which was measured at discrete points in time. *Id.*, 7:6-11. The disclosure of initial and present state vectors conveys a dependency on time-based parameters.

204. Moreover, at least for regulatory or veterinary purposes, the POSA would have been motivated to implement Laitinen’s system to detect whether the occurrence of illnesses in a herd of cattle is greater than a selected number of illnesses to detect a disease outbreak. Laitinen, 1:30-35 (“Infectious diseases ... have become serious problems, even on the international level.”); de Mol 180-81 (“The detection model” based on inputs of a combination of elements “is meant to draw the attention of the farmer to possible deviations in his cows; the model should generate alerts for that purpose.”). This could be done, for example, by simply counting the detected occurrences of individual illnesses provided by the second expression, and then comparing whether that number exceeds a preselected threshold within a selected period of time, wherein the time period might be the incubation period for one or more diseases that are of concern. This could be accomplished by, for example, a simple arithmetic function as described in Ground 1, element 6[C](ii). *Supra* VIII.E.4

**XI. GROUND 4: LAITINEN IN VIEW OF BRUNE RENDERS CLAIMS
17-20 OBVIOUS**

A. Claim 17

**1. 17[Pre]: A computer implemented animal management
system, comprising**

205. To the extent the preamble is limiting, as explained for 1[Pre], Laitinen teaches a computer implemented animal management system. *Supra* §X.A.1.

2. **17[A]: a processor communicatively coupled to a non-transitory computer readable media containing program instructions executable to**

206. As explained for 1[A], Laitinen teaches the processor of element 17[A]. *Supra* §X.A.2.

3. **17[B]: retrieve animal identification information from an RFID device implanted in an animal**

207. As explained for 1[B], Laitinen teaches retrieving animal identification information from an RFID device implanted in an animal as explained in element 1[B] (“retriev[ing] animal identification information from an RFID device”) and claim 2 (“implanted in an animal”). *Supra* §§X.A.3, X.B.

4. **17[C]: retrieve sensed animal information from said RFID device**

208. As explained for 1[C], Laitinen teaches the retrieving sensed temperature, movement, and location information from said implanted RFID device as described in element 1[C] and claim 3. *Supra* §§X.A.4, X.C.

5. **17[D]: retrieve date-time information from said RFID device**

209. Modifying Laitinen’s system to use an RFID device that stamp meets element 17[D] of the ’206 patent. The POSA would have understood that date-time information is among the information stored in the Laitinen’s databases. For example, Laitinen stores the time of administration of medicaments so that the “*time elapsed*” may be calculated. Laitinen, 7:1-3. Further, Laitinen generates an

initial state vector containing sensed animal parameters, such as temperature, “**at the time** when the medication commenced.” *Id.*, 7:6-9. Additionally, Laitinen teaches the monitoring of temperature and movement to determine if a cow is in heat. *Id.*, 8:5-15.

210. The POSA would have understood that such a system would not look at a single measurement, but would instead look at several measurements collected over a period of time to filter out anomalies and increase reliability based on a cow’s historical measurements. Moreover, in order to determine an animal’s movement, past location/position measurements must be stored. As a result, multiple temperatures and locations would be stored for analysis, each one bearing a date-time stamp. In view of the foregoing, the POSA would have understood that the sensed animal parameters from the RFID device would be stored with associated time-stamp information.

211. Brune discloses “a bolus implanted within the stomach of a cow.” Brune, 4:1-3. The bolus includes a “temperature sensor and transmitter.” *Id.*, 2:4-5. A plurality of temperature values are sensed and then “transmitted” using “air-borne signals” to a remote receiver. *Id.*, 2:6-11. Each transmitted message includes the temperature data, identification data unique to a specific cow, and “**date and/or time stamp data** corresponding to the **discrete point in time at which the temperature was sensed** by the bolus.” *Id.*, 4:1-11.

212. In view of Laitinen’s use of date-time information, and Brune’s explicit disclosure of transmitting date/time-stamped animal temperature data from an implanted bolus, the POSA would have been motivated to modify Laitinen’s RFID system to retrieve from the bolus date-time stamp data associated with each retrieved temperature measurement.

213. The likelihood of success would have been high since date-time information is simple and well understood, and it would merely comprise some addition data sent along with each temperature measurement.

214. Further, Laitinen teaches that its RFID implant can accommodate a wide variety of sensors and hardware components including for temperature, occlusion, muscular action, motion, metabolic level, medicament disbursements, GPS, EKG, EMG, and oxygen saturation. Laitinen, 3:51-67, 5:50-55. Therefore, adding a simple clock to generate time-stamps would have been relatively easy; for example the use of GPS in Laitinen’s RFID implant would inherently provide a date-time source. For example, U.S. Patent No. 5,724,316 confirms that “**time and date information is generally computed** as a side effect of producing a precise position estimate based on the GPS signal. Currently, the time of day information included with the GPS radio wave signals is referenced to the Greenwich Mean Time (GMT) which is generally recognized as the reference time at the prime meridian.” Ex. 1036, 1:63-2:2; *see also id.* 2:50-53 (“In additional, the system and

method determines the time of day from the GPS signals as referenced to a reference time such as GMT. The date is also determined from the GPS signals.”)

6. 17[E]: match said sensed animal information retrieved from said RFID device to animal information stored in a database

215. Laitinen discloses a first logical expression that uses both body temperature and animal movement as input variables to determine if a cow is in heat — rising temperature and increased movement are both indicators that a cow may be in heat. Laitinen, 8:5-11. This temperature and movement/location information is retrieved from the RFID device (*id.*, 3:51-57, 3:66-67) along with animal identification information. *Id.*, 2:46-47, 3:29-31, 3:53-57, 6:2-4. Further, this retrieved information is stored in the database for each animal. *Id.* 4:9-15, 4:45-49, 5:26-30. A manner of determining cow movement requires the storage of multiple locations over time to track a cow’s movement, which can correlate to its activity level. In order to track movement in this manner, the POSA would have understood the database to store a history of location information for each animal associated with particular time stamps. In view of the foregoing, the POSA would have understood that the sensed temperature data would be matched to the stored movement/location data using the animal’s identification information retrieved from the RFID device.

216. Laitinen also describes a second expression — $x=f^{-1}(y,z)$ —that determines whether an animal is ill and identifies the appropriate medical treatment x based on both “initial” and “present” state vectors y and z , both of which include the animal’s temperature at different points in time. *Id.*, 6:62-64, 7:6-11 (“The initial state vector y representing the same animal conveys the results obtained from the animal (e.g., *temperature ...*) *at the time* when the medication *commenced* ... [c]onveying the *latest results* from the animal, there is also the present state vector.”), 7:35-37. The POSA would have understood that the sensed present temperature measurement (a component of the present state vector z) would be matched to the previously stored initial temperature measurement (a component of the initial state vector y) using the animal’s identification information retrieved from the RFID device, thereby meeting element 17[E]’s “match” requirement.

7. 17[F]: enter said sensed animal information retrieved from said RFID device and said animal information stored in said database as logical variables into at least one logical expression

217. In contrast to element 1[E], which requires entering sensed information and stored information comprising milk production information or days in milk information, element 17[F] can be satisfied by sensed and stored information of the same type, for example, temperature without requiring milk production or days in milk information.

218. Laitinen's first logical expression to determine if the cow is in heat is based in part on the entry of temperature information. Laitinen, 8:5-11; *supra* §X.A.6 (element 1[E]). The sensed animal temperature information retrieved from the RFID device is entered as a first input variable into this expression and the stored animal movement/location information from the database is entered as a second input variable into this expression. *Id.*, 8:9-12; *supra* §X.A.6 (element 1[E]). The expression compares these temperature and movement variables to threshold "alarm limits" to determine whether to signal a "heat alarm" indicating a cow's readiness for artificial insemination. Laitinen, 8:12-15

219. Laitinen also discloses a second logical expression $x=f^{-1}(y,z)$, for which the sensed animal temperature (i.e., the temperature part of the "present state vector" z) is entered as a first input variable. Laitinen, 7:6-11, 7:35-37; *supra* §X.A.6. The previously stored temperature data from the database (i.e., the temperature part of "initial state vector" y) is also entered into the expression as a second input variable. *Id.*, 7:6-11. The expression uses these initial and present temperatures to determine if an animal is ill and, if so, identify the appropriate medical treatment. *Id.*, 7:35-37. For example, the POSA would have understood that a spike in temperature could indicate illness.

220. As noted previously (*supra* §V.C), it was known in the art to use a time-series of sensed temperature measurements in logical expressions, alone or in

combination with other parameters, to determine if an animal was in oestrus or ill.
de Mol, 175, 181; Ex. 1032, 42.

8. 17[G]: solve said at least one logical expression to obtain a corresponding at least one logical value

221. Laitinen's first logical expression based on temperature and activity inputs is solved to obtain a value indicative of whether a cow is in heat, and if so to signal a "heat alarm" to assist a breeder, for example, to determine whether to proceed with artificial insemination. Laitinen, 8:9-15; *supra* §IX.A.7 (element 17[F]).

222. Laitinen's second logical expression is solved using the presently sensed and previously stored temperature information to generate a value indicative of whether a cow is ill and to indicate the appropriate medical treatment x. Laitinen, 6:62-64, 7:6-11, 7:35-37; *supra* § IX.A.7 (element 17[F]).

223. Finally, the purpose of including a logical expression is to solve for a value that is indicative of an outcome, for example, whether the time is right to artificially inseminate a cow or whether a cow may be ill. Such an expression would make little sense unless it is solved.

B. Claim 18: The system of claim 17,

1. 18[A]: wherein said sensed animal information comprises sensed physiological information of said animal

224. As explained for 1[C] (*supra* §VIII.A.4), Laitinen discloses entering sensed animal temperature information.

2. 18[B]: wherein said animal information stored in said database comprises health information associated with said animal

225. As explained for 4[B] (*supra* §VIII.D.2), Laitinen in view of Buchanan renders obvious storing animal health information in the database.

3. 18[C]: wherein as to a selected period of time said at least one logical value indicates occurrence of an illness of said animal associated with said animal identification information

226. Laitinen teaches the use of a logical expression $x=f^1(y,z)$ to generate a value x indicating occurrence of an illness and identifying the appropriate treatment, thereby meeting the requirements of element 18[C]. Laitinen, 7:1-3, 7:35-37. This determination is made over a selected period of time, because the information input to the expression comprises an initial state vector y and a present state vector z containing the animals' physiological data measured at discrete points in time to track the course of treatment. *Id.*, 7:6-11, Figure 4. The POSA would have understood the discussion of initial and present state vectors necessarily indicates an elapsed time period. The occurrence of an illness is associated with said animal identification information because the sensed animal information is retrieved from the RFID device along with the animal's identification information. Laitinen, 2:47-48, 3:28-31, 6:2-4. Further, surveillance and analysis are performed for individual cows. *Id.*, 5:26-30; 7:35-37 ("analysing the animal's present condition").

C. Claim 19: The system of claim 18,

- 1. 19[A]: wherein said animal identification information further comprises said animal identification information correspondingly received from a plurality of RFID devices implanted in a plurality of animals**

227. As explained for claim 2 (*supra* §VIII.B), Laitinen discloses retrieving animal identification information correspondingly received from a plurality of RFID devices implanted in a plurality of animals.

- 2. 19[B]: wherein said sensed animal information comprises said sensed animal information receive from said plurality of RFID devices implanted in said plurality of animals**

228. As explained for 1[C] and claim 3 (*supra* §§VIII.A.4, VIII.C), Laitinen renders obvious retrieving sensed animal temperature information received from a plurality of RFID devices implanted in a plurality of animals.

- 3. 19[C]: wherein said logical value indicates a number of occurrences of said illness in a plurality of animals**

229. As explained for 6[C] (*supra* §X.E.3), Laitinen renders obvious that said logical value would indicate the number of occurrences of said illness when the logical expression is applied to a plurality of animals.

D. Claim 20: The system of claim 19, wherein said logical value indicates occurrence of a greater than a pre-selected number of said illness in said plurality of animals

230. As explained for 6[C] (*supra* §X.E.3), Laitinen renders obvious a logical value that indicates occurrence of a greater than a pre-selected number of said illness in said plurality of animals.

XII. OPINIONS REGARDING AUTHENTICITY AND PUBLIC ACCESSIBILITY

231. I have been informed by counsel that a printed publication qualifies as publicly accessible as of the date it was disseminated or otherwise made available such that any member of the public interested in the subject matter could, using reasonable diligence, locate it.

232. I have also been informed that the determination of public accessibility is a case-by-case analysis particular to an individual publication. I also understand that one way a printed publication can be deemed publicly accessible if it is catalogued and indexed by a library such that a member of the public interested in the subject matter could locate it exercising reasonable diligence. One manner of sufficient indexing is indexing according to subject matter category.

233. I understand that the cataloging and indexing by a single library of a single instance of a particular printed publication is sufficient, even if the single library is in a foreign country. I also understand that the cataloging and indexing of information that would guide a person interested in the relevant subject matter to the printed publication, such as the cataloging and indexing of an abstract for the printed publication, is sufficient to render the printed publication publicly accessible. I understand that a document may also be publicly accessible if it is

catalogued and indexed online such that a person interested in the relevant subject matter could locate the document online using reasonable diligence.

234. I have personally used these databases and, in my opinion, POSAs would have been aware of these databases and would have used them to search for and retrieve publications in the art of sensor systems for livestock management at the time of the alleged invention.

235. I understand that routine business practices, such as general library cataloging and indexing practices, can be used to establish an approximate date on which a printed publication became publicly accessible. I further understand that the date on which digital databases indicate a document was published and/or added to the database can be used to establish a date on which the document became publicly accessible.

A. De Mol 1997 (Ex. 1032)

236. Ex. 1032 by de Mol et al. is titled “Results of a multivariate approach to automated oestrus and mastitis detection.” Based on the evidence I discuss below, it is my opinion that the reference Ex. 1032 is an authentic copy of the article it purports to be and is prior art to the challenged patent because it was publicly accessible over a year before the priority date for the challenged patent (September 15, 2009) by being disseminated or otherwise made available to POSAs exercising reasonable diligence.

237. Ex. 1032 appears to be a true and correct copy in a condition that creates no suspicion about its authenticity. The cover page includes the journal name (“Livestock Production Science”), one of the most important journals in the fields of animal science and agricultural engineering. The cover page also includes an issue identification, including the volume number (Volume 48), issue number (Issue No. 3) and pages of the volume, and the year the article issued. The text of the article is complete and the page numbers of the article, 219-227, match the page range identified in TOC and the first page of the reference. The first page of the article shows the correct issue information and bears a copy right notice from the publisher (“© 1997 Elsevier Science B.V.”). The cover page of Ex. 1032 also bears an ISSN number, which “is an 8-digit code used to identify newspapers, journals, magazines and periodicals of all kinds and on all media-print and electronic” and is used “to identify a publication.” *See* <https://www.issn.org/understanding-the-issn/what-is-an-issn/> (last checked Apr. 23, 2024).

238. In my opinion, Ex. 1032 is an authentic copy of the article it purports to be because it includes a publication number, copyright notice, publisher information, an ISSN number, and pages that match the TOC and the page range identified in the citation identifier listed on the first page of the reference.

239. According to the face of Ex. 1032, the reference was published in an issue of *Livestock Production Science* by Elsevier. Ex. 1032 was copyrighted and thus publicly accessible by 1997. Ex. 1032 bears the stamp of the OARDC Library on July 23, 1997. In my experience, such library stamps indicate when libraries receive and make public periodical journal articles that are received from journal publishers. Thus, in my opinion, Ex. 1032 is a true and correct copy of the article it purports to be. Ex. 1032 was publicly accessible before September 15, 2008 by being disseminated or otherwise made available to POSAs exercising reasonable diligence.

B. Mottram (Ex. 1018) and de Mol 1999 (Ex. 1033)

240. Ex. 1018 is titled “Technical note: A wireless telemetric method of monitoring clinical acidosis in dairy cows.” Ex. 1033 is titled “Description of a detection model for oestrus and diseases in dairy cattle based on time series analysis combined with a Kalman filter.” Based on the evidence I discuss below, it is my opinion that the references of Ex. 1018 and Ex. 1033 are authentic copies of the articles they purport to be and are prior art to the challenged patent because they were publicly accessible before the priority date for the challenged patent (September 15, 2009) by being disseminated or otherwise made available to POSAs exercising reasonable diligence.

241. Ex. 1018 appears to be a true and correct copy in a condition that creates no suspicion about its authenticity. The cover page includes the journal name, “Computers and electronics in agriculture,” which is a leading journal in this field. It further identifies the issue (Volume 64, issue 1) and the issue date (November 2008). The text of the article is complete and the page numbers of the article match with the page range identified in the TOC for the volume. The first page of the article shows the correct issue information and bears a copyright notice from the publisher (“© 2008 Elsevier B.V.”). The cover page of Ex. 1018 also bears an ISSN number. Thus, in my opinion, Ex. 1018 is an authentic copy of the article it purports to be because it includes a publication number, copyright notice, publisher information, an ISSN number, and page numbers that match the TOC and the page range identified in the citation identifier listed on the first page of the reference.

242. Ex. 1033 appears to be a true and correct copy in a condition that creates no suspicion about its authenticity. The cover page includes the journal name, “Computers and Electronics in Agriculture,” which is a leading journal in this field. It further identifies the issue (Volume 22, issue 1) and the issue date (February 1999). The text of the article is complete. The first page of the article shows the correct issue information and bears a copyright notice from the publisher (“© 1999 Elsevier Science B.V.”). The page numbers of the article also align with

the page range identified in the citation identifier listed on the first page of the reference. The cover page of Ex. 1033 also bears an ISSN number. Thus, in my opinion, Ex. 1033 is an authentic copy of the article it purports to be because it includes a publication number, copyright notice, publisher information, an ISSN number, and page numbers that the page range identified in the citation identifier listed on the first page of the reference.

243. According to the face of Ex. 1018 and Ex. 1033, both references were published in issues of Computers and Electronics in Agriculture by Elsevier. Ex. 1018 was copyrighted and thus publicly accessible by 2008, and Ex. 1033 was copyrighted and publicly accessible by 1999. Ex. 1018 bears the stamp of the OARD Library on September 29, 2008. Ex. 1033 bears the stamp of Stephen & Lucy Chang Science Library on April 4, 1999. In my experience, such library stamps indicate when libraries receive and make public periodical journal articles that are received from journal publishers. Thus, in my opinion, Ex. 1018 and Ex. 1033 are true and correct copies of the articles they purport to be. Ex. 1018 was publicly accessible before September 15, 2009 by being disseminated or otherwise made available to POSAs exercising reasonable diligence. Ex. 1033 was publicly accessible before September 15, 2008 by being disseminated or otherwise made available to POSAs exercising reasonable diligence.

C. Bewley (Ex. 1015)

244. Ex. 1015 is titled “Comparison of Reticular and Rectal Core Body Temperatures in Lactating Dairy Cows.” Based on the evidence I discuss below, it is my opinion that reference Ex. 1015 is an authentic copy of the article it purports to be and is prior art to the challenged patent because it was publicly accessible before the priority date for the challenged patent (September 15, 2009) by being disseminated or otherwise made available to POSAs exercising reasonable diligence.

245. Ex. 1015 appears to be a true and correct copy in a condition that creates no suspicion about its authenticity. The cover page includes the journal name, “Dairy Science,” a leading journal persons of skill in the art in dairy science would look to. It further identifies the issue (Volume 91, issue no. 12) and the issue date (December 2008). The text of the article is complete. The first page of the article shows the correct issue information and bears a copyright notice from the publisher (“© American Dairy Science Association”). The page numbers of the article also align with the page range identified in the citation identifier listed on the first page of the reference. Thus, in my opinion, Ex. 1015 is an authentic copy of the article it purports to be because it includes a publication number, copyright notice, publisher information, and page numbers that match the page range identified in the citation identifier listed on the first page of the reference.

246. According to the face of Ex. 1015, the reference was published in an issue of *Dairy Science* by the American Dairy Science Association a leading journal in dairy science. Ex. 1015 was copyrighted and thus publicly accessible by 2008. Ex. 1015 bears a stamp from UC San Diego on December 8, 2008. In my experience, such library stamps indicate when libraries receive and make public periodical journal articles that are received from journal publishers. Thus, in my opinion, Ex. 1015 is a true and correct copies of the article it purports to be and was publicly accessible before September 15, 2009 by being disseminated or otherwise made available to POSAs exercising reasonable diligence.

D. Hicks (Ex. 1016)

247. Ex. 1016 is titled “Comparison of Methods of Measuring Deep Body Temperatures of Dairy Cows.” Based on the evidence I discuss below, it is my opinion that reference Ex. 1016 is an authentic copy of the article it purports to be and is prior art to the challenged patent because it was publicly accessible over a year before the priority date for the challenged patent (September 15, 2009) by being disseminated or otherwise made available to POSAs exercising reasonable diligence.

248. Ex. 1016 appears to be a true and correct copy in a condition that creates no suspicion about its authenticity. The cover page includes the publication name, “Livestock Environment VI: Proceedings of the 6th International

Symposium,” a book that persons of skill would look to. It further identifies the dates of the symposium, May 21-23, 2001. The text of the article is complete and the page numbers of the article match with the page range identified in the TOC for the volume. The document bears a copyright notice from the publisher (“© 2001 BY AMERICAN SOCIETY OF AGRICULTURAL ENGINEERS”). The document contains an ISBN number. See <https://www.isbn-international.org/content/what-isbn/10> (last accessed April 23, 2024) (“Any book made publicly available, whether for sale or on a gratis basis, can be identified by ISBN.”). Thus, in my opinion, Ex. 1016 is an authentic copy of the article it purports to be because it includes a publication number, copyright notice, publisher information, and page numbers that match the TOC.

249. According to the face of Ex. 1016, the reference was published in Livestock Environment VI by the American Society of Agricultural Engineers. Ex. 1016 was copyrighted and thus publicly accessible by 2001. Ex. 1015 bears a stamp from the Library of Congress on June 4, 2001. In my experience, such library stamps indicate when libraries receive and make public periodical journal articles that are received from journal publishers. Thus, in my opinion, Ex. 1016 is a true and correct copies of the article it purports to be and was publicly accessible before September 15, 2008 by being disseminated or otherwise made available to POSAs exercising reasonable diligence.

E. Higgins (Ex. 1017)

250. Ex. 1017 is titled “Temperature readings by remote control.” Based on the evidence I discuss below, it is my opinion that reference Ex. 1017 is an authentic copy of the article it purports to be and is prior art to the challenged patent because it was publicly accessible over a year before the priority date for the challenged patent (September 15, 2009) by being disseminated or otherwise made available to POSAs exercising reasonable diligence.

251. Ex. 1017 appears to be a true and correct copy in a condition that creates no suspicion about its authenticity. The cover page includes the magazine name, “Food Engineering.” It further identifies that it is the May 2003 issue. The text of the article is complete. The first page of the article shows the magazine name, issue year and month, and the first page of the article also aligns with the first page identified in the TOC. Thus, in my opinion, Ex. 1017 is an authentic copy of the article it purports to be.

252. According to the face of Ex. 1017, the reference was published in an issue of *Food Engineering* in May 2003. Ex. 1017 was thus publicly accessible by 2003. Ex. 1017 bears a stamp from the Steenbock Memorial Library on May 13, 2003. In my experience, such library stamps indicate when libraries receive and make public magazine articles that are received publishers. Thus, in my opinion, Ex. 1017 is a true and correct copies of the article it purports to be and was

publicly accessible over a year before September 15, 2009 by being disseminated or otherwise made available to POSAs exercising reasonable diligence.

F. ASAE International Meeting (Ex. 1020)

253. Ex. 1020 is titled “Telemetry System for Measuring Core Body Temperature in Livestock and Poultry.” Reference Ex. 1020 is an authentic copy of the article it purports to be and is prior art to the challenged patent because it was publicly accessible over a year before the priority date for the challenged patent (September 15, 2009) by being disseminated or otherwise made available to POSAs exercising reasonable diligence.

254. Ex. 1020 is a true and correct copy that is authentic. The cover page includes the conference it was written for presentation at, the “2001 ASAE Annual International Meeting.” I am an author on this paper and helped to prepare this paper, which was in fact presented at the 2001 ASAE Annual International Meeting. The text of the article is complete and accurate. The article has also been published by the American Society of Agricultural and Biological Engineers and was accessible to the public since 2001. Ex. 1020 is a true and correct copy of the article it purports to be and was publicly accessible before September 15, 2009 by being disseminated or otherwise made available to POSAs exercising reasonable diligence.

G. Beef Production Series (Ex. 1021)

255. Ex. 1021 is titled “Radiotelemetry Systems for Measuring Body Temperature” Based on the evidence I discuss below, it is my opinion that reference Ex. 1021 is an authentic copy of the article it purports to be and is prior art to the challenged patent because it was publicly accessible over a year before the priority date for the challenged patent (September 15, 2009) by being disseminated or otherwise made available to POSAs exercising reasonable diligence.

256. Ex. 1021 appears to be a true and correct copy in a condition that creates no suspicion about its authenticity. The cover page includes the book name, “Beef Production Series.” It further identifies that it is No. 57 in the series and has a date of June 2002. The document also contains an ISBN number. Ex. 1021 is a copy of library-stamped portion of this publication, including the cover page, TOC, and the first page of the reference. Ex. 1021 bears a stamp from the Trinity College Library from December 2006, lists the same authors, same book name, and has the same introduction as Ex. 1021. Thus, in my opinion, Ex. 1021 is an authentic copy of the article it purports to be.

257. According to the face of Ex. 1021, the reference was published in 2002 and according to Ex. 1021, the document was available in the Trinity College Library as of December 2006. Thus, in my opinion, Ex. 1021 is a true and correct

copies of the reference it purports to be and was publicly accessible before September 15, 2008 by being disseminated or otherwise made available to POSAs exercising reasonable diligence.

H. Hillerton (Ex. 1034)

258. Ex. 1034 is titled “Detecting Mastitis Cow-Side.” Reference Ex. 1034 is an authentic copy of the article it purports to be and is prior art to the challenged patent because it was publicly accessible over a year before the priority date for the challenged patent (September 15, 2009) by being disseminated or otherwise made available to POSAs exercising reasonable diligence.

259. Ex. 1034 appears to be a true and correct copy in a condition that creates no suspicion about its authenticity. The article has been published by the National Mastitis Council and was accessible to the public since 2000, stating that “This proceedings includes papers presented at the National Mastitis Council 39th Annual Meeting, February 13-16, 2000, Atlanta, Georgia. These papers report research results and/or opinions of the authors.” Ex. 1034 Ex. 1032 bears the stamp of the KSU Libraries.

I. Hyde Thesis (Ex. 1035)

260. Ex. 1035 is titled “Milk Yield As a Factor in Dairy Herd Management by Exception.” I personally obtained a copy of this thesis and it is my opinion that Ex. 1035 is an authentic copy of the thesis it purports to be and is prior art to the

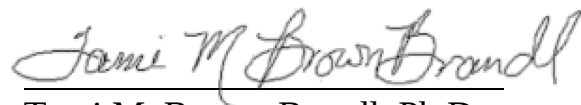
challenged patent because it was publicly accessible over a year before the priority date for the challenged patent (September 15, 2009) by being disseminated or otherwise made available to POSAs exercising reasonable diligence.

261. Ex. 1035 appears to be a true and correct copy in a condition that creates no suspicion about its authenticity. The thesis includes details regarding the submission of the thesis and signatures from the thesis committee who oversaw the student's work. The text of the thesis is complete and the page numbers of the thesis match with the pages identified in the TOC. Thus, in my opinion, Ex. 1035 is an authentic copy of the publication it purports to be.

XIII. CONCLUSION

I declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true, and that these statements were made with 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: May 1, 2024


Tami M. Brown-Brandl, Ph.D.