

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

SMAXTEC INC. AND
SMAXTEC ANIMAL CARE GMBH,

v.

ST REPRODUCTIVE TECHNOLOGIES, LLC,
Patent Owner.

IPR2024-01067

Patent 10,231,644

DECLARATION OF PROFESSOR DARRIN J. YOUNG

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1. I, Darrin J. Young, make this declaration in connection with the proceedings identified above.

I. INTRODUCTION

2. I have been retained as an expert on behalf of smaXtec Inc. and smaXtec Animal Care GmbH (“smaXtec” or “Petitioner”) in connection with the proceedings identified above. I submit this Declaration on behalf of smaXtec in support of its Petition for *Inter Partes* Review (“IPR”) and cancellation of Claims 5-7, 9, 10, and 13 (“the Challenged Claims”) of U.S. Patent No. 10,231,644 (“the ’644 Patent”) (Ex. 1001).

3. The opinions in this Declaration are based on my professional training and experience and my review of the exhibits discussed herein.

4. I am being compensated for my services in connection with the proceedings identified above at a rate of \$700 per hour (plus reimbursement for expenses). My compensation is in no way contingent on the outcome of the proceedings identified above or on any of the opinions I provide below.

II. QUALIFICATIONS

5. I have summarized in this section my educational background, career history, publications, and other relevant qualifications. My curriculum vitae is submitted as Ex. 1003.

6. I received my Bachelor of Science from the department of Electrical Engineering and Computer Sciences (EECS) at the University of California at

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Berkeley in 1991. In 1993, I received a Master of Science in EECS from the University of California at Berkeley, and in 1999, I received a Ph.D. in EECS from the University of California at Berkeley. My studies included classes in radio transmitter and receiver circuit design.

7. From 1999 through 2009, I was a member of the faculty of the Electrical Engineering and Computer Science Department at Case Western University, Ohio, where I taught courses in electronic circuits design at both undergraduate and graduate levels, including courses on radio transmitter and receiver circuit design. I also conducted research in the area of wireless microsystem technology development for biomedical implants, industrial sensing, wireless sensing, wireless power transfer, wireless data telemetry, as well as harsh environment sensing applications.

8. In the area of biomedical implants, I developed a wireless, batteryless, and implantable multi-channel monitoring system to monitor real-time physiological parameters of freely roaming laboratory mice and rodents including their blood pressure pulse waveform, core body temperature, and ECG signals. The demonstrated implantable system exhibits the smallest size, lightest weight, and lowest power dissipation compared to the state-of-the-art technology. To achieve the high performance, a miniature high-Q (low loss) coil implemented as a part of the overall wireless sensing system is implanted inside a laboratory animal's body and receives a radio frequency (RF) power transmitted from an external coil loop

positioned at the bottom of an animal cage through inductive coupling. The received RF power is rectified and regulated to deliver a DC power to energize the implant, therefore enabling a wireless, batteryless and implantable sensing application. The wireless RF powering eliminates the need of an implantable battery, which substantially reduces the overall implant size, weight, and cost. Another miniature coil inductor, serving as a data telemetry antenna, is also incorporated in the implantable system design to enable wireless data communication between the implant and an external system.

9. Furthermore, the implantable system employs an instrumented circular elastic cuff, wrapped around a blood vessel to sense real-time blood pressure waveforms. The elastic cuff is made of bio-compatible silicone and is filled with bio-compatible insulating fluid with an immersed micro-electro-mechanical system (MEMS) pressure sensor and low-power integrated circuit chip. The MEMS sensor measures the pressure waveform coupled from the expansion and contraction of the vessel. The MEMS sensor output is then processed nearby by a low-power integrated circuit chip, consisting of MEMS sensor interface circuitry, analog-to-digital converter (ADC) and system configuration and control unit, for signal conditioning and encoding followed by wireless data telemetry to an external receiver.

10. In addition to the development of the wireless, batteryless, and implantable multi-channel physiological monitoring system described above, I developed a wireless, batteryless, subfascially implantable electromyogram (EMG)-

sensing microsystem for intelligent myoelectric control of powered prostheses. The implantable system consists of two Pt-Ir epimysial EMG electrodes, a custom-designed low-power application-specific integrated circuit (ASIC), and an RF telemetry coil. The prototype implantable system was characterized in a laboratory animal and demonstrated its capability of wirelessly transmitting EMG data to an external data receiver.

11. I also developed a wireless power recharging system for an implantable bladder pressure chronic monitoring application. A wireless implantable bladder pressure sensor with a miniature pressure sensor powered by a rechargeable battery can be implanted under the bladder mucosa layer to chronically monitor the bladder pressure. The bladder pressure information can be wirelessly transmitted to an external receiver for biomedical analysis and ultimately for closed-loop control based on nerve electrical stimulation.

12. In a separate biomedical implantable research project, I investigated the feasibility of applying MEMS technology to develop an implantable microphone for achieving a fully implantable cochlear prosthetic system. Based on the accelerometer operating principle, I designed a miniature MEMS accelerometer that can be attached to the middle ear bone structure, known as temporal bone or ossicular chain, to convert the bone vibration as a natural physiological response to an incoming sound to an electrical signal that represents the original sound information. The accelerometer, therefore, functions as an implantable microphone. Further

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processing of the electrical signal can be performed by an existing cochlear implant speech processor, which is then followed by a stimulator to drive cochlear implant electrodes. My demonstrated accelerometer-based middle ear implantable microphone achieves a small size, light weight, and sensitivity requirements for cochlear implant application.

13. In 2009, I moved to the University of Utah and was appointed USTAR Associate Professor in the Electrical and Computer Engineering Department. Between 2013 and 2019, I was appointed as an Associate Chair in the Electrical and Computer Engineering Department. I currently serve as the chair of the solid-state/MEMS/circuit area of the Electrical and Computer Engineering Department, where I teach courses in electronic circuit design and electrical interface for micro-electro-mechanical systems at both undergraduate and graduate levels. I have also conducted research in the area of microsystems technology development for biomedical implants, wearable health monitoring, wireless sensing, wireless power transfer, wireless data telemetry, environmental sensing, and personal navigation applications, as well as developing long-term robust implantable packaging technologies.

14. Additionally, I have served as a technical program committee member and session chair for a number of reputable international conferences. I also served as an associate editor of the IEEE Journal of Solid-State Circuits, the chair of the IEEE Electron Devices Society MEMS Committee, and a member of the IEEE

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Sensors Council. I currently serve as an editor of the IEEE Transactions on Electron Devices.

15. I have written and/or edited over 130 journal and conference papers, most of which focus on wireless microsystem technologies for wireless sensing, wireless biomedical implants, wearable health monitoring, industrial sensing, environmental sensing, wireless power transfer and communication applications.

16. I have also contributed chapters to several books, including eight book chapters on micro-electro-mechanical systems and technologies for wireless sensing and communication applications.

III. LEGAL FRAMEWORK

17. I am not a legal expert and I offer no opinions on the law. However, I have been advised by counsel about some of the legal principles relevant to an analysis of patentability of claims in a United States patent, as summarized below. I have conducted my analysis in accordance with these principles.

18. I understand that, for an invention claimed in a patent to be found patentable, or to be valid, it must be, among other things, new and not obvious in light of what came before it such as “prior art.”

A. Standard of Proof

19. I understand that, in these proceedings, the burden is on the party asserting unpatentability to prove it by a preponderance of the evidence. I

understand that “a preponderance of the evidence” is evidence sufficient to show that something is more likely than not.

B. Claim Construction

20. I understand that patent claims should be accorded their ordinary and customary meaning as understood by a POSA, in light of the intrinsic record. The intrinsic record includes the patent’s specification and claims, as well as its entire prosecution history. I also understand that a patentee is free to be his or her own lexicographer and thus may use a term in a manner contrary to or inconsistent with its ordinary meaning, provided that the patentee makes the special meaning clear in the specification or as part of the record during prosecution.

21. I further understand that in construing claims, a POSA is deemed to read the claim term not only in the context of the particular claim in which the disputed term appears, but in the context of the entire patent, including the specification and the prosecution history. I understand that the construction that stays true to the claim language and most naturally aligns with the patent’s description of the invention will generally be, in the end, the correct construction. Although the claims themselves provide substantial guidance as to the meaning of particular claim terms, the claims do not stand alone.

22. In addition, it has been explained to me that there is a form of claim element called a “Markush group,” which lists specified alternatives in a patent claim, typically in the form “[a member] selected from the group consisting of [A],

[B], [C], [etc.].” I further understand that, if a claim element is written in Markush form, the entire element is disclosed by the prior art if one alternative in the Markush group is in the prior art.

C. Anticipation

23. I have been informed that a patent claim is invalid as anticipated only if each and every element and limitation of that claim is publicly disclosed, either explicitly or inherently, in a single prior art reference, already in practice in the industry in a single process or method, already in a single marketed product, or otherwise previously invented. I also understand that anticipation requires the presence in a single prior art disclosure of all elements of the claim arranged as in the claim. For a step or limitation to be inherent in a reference, I understand that the step or limitation must necessarily and inevitably occur or be present when one follows the teachings of the reference. I am informed that for a reference to be considered as anticipating, it must disclose the relevant technology in a manner such that a person of ordinary skill in the art would be able to carry out or utilize the technology that the reference describes without having to undertake considerable experimentation.

D. Obviousness

24. I have been informed that a patent claim is invalid as obvious only if it would have been obvious to a person of ordinary skill in the art at the time the patent was filed, in light of the prior art. A claim is invalid as obvious if the differences

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between the claimed invention and the prior art are such that the claimed invention as a whole would have been obvious to a POSA. The prior art may include one or more references that a POSA trying to solve the problem that the inventor addressed would likely have considered, as well as the body of knowledge that such a person would possess.

25. I have been informed that the obviousness inquiry is based on three underlying factual inquiries: (1) the scope and content of the prior art; (2) the differences between the prior art and the claims; and (3) the level of ordinary skill in the art at the time of the invention.

26. I have been informed that, although a challenger may rely on a combination of separate prior art references to support an obviousness challenge, a person of ordinary skill in the art at the time of filing should have had some motivation or reason to combine the references in such a way as to arrive at the claimed invention. That motivation can come from the problem the invention purports to solve, from other references, from the teachings of those references showing the invention is obvious, from market incentives, or from the common-sense knowledge of a person of ordinary skill in the art. However, obviousness findings grounded in common sense must contain explicit and clear reasoning providing some rational underpinning why common sense compels a finding of obviousness. A motivation to combine requires more than the mere fact that a POSA could have made the combination.

27. I have been informed that assessing which prior art references to combine and how they may be combined to match the asserted claim may not be based on hindsight reconstruction or ex-post reasoning. That is, one must view the prior art forward from the perspective of the person of ordinary skill in the art at the time of invention, not backwards from the current time through the lens of hindsight. It is my understanding that it is improper to use a patent claim as a template or road map to the prior art, and to pick and choose prior art references to meet the elements of that claim to show obviousness.

28. I have been informed that a reference qualifies as prior art for determining obviousness when it is analogous to the claimed invention. I understand that prior art may be considered analogous if it is from the same field of endeavor, regardless of the problem addressed, as the claimed invention. I also understand that prior art may be considered analogous if it is “reasonably pertinent” to the particular problem with which the inventor is involved. I have been informed that a reference is “reasonably pertinent” if it is one which, because of the matter with which it deals, logically would have commended itself to an inventor’s attention in considering the inventor’s problem.

IV. BACKGROUND OF THE TECHNOLOGY

29. The ’644 Patent relates to an animal-monitoring bolus which measures one or more physiological parameters of an animal and wirelessly transmits the measurements to an animal monitoring system. Ex. 1001, Title, Abstract, 1:1-7,

2:64-3:1, 3:58-4:61, 8:28-34, 8:62-64, 10:9-11:27, 14:9-13, 17:56-18:20, Figs. 2-5.

The alleged problems with some prior-art boluses, which the '644 Patent purports to solve, is that (1) their operational lifespan may not be long enough to monitor the animal's physiological parameters over the animal's productive lifespan, and (2) uncontrolled orientation of the bolus antenna may cause variations in the quality of the radio signal transmission, causing data loss. *Id.*, 1:21-30. Among other things, the '644 Patent makes a number of acknowledgements regarding features that already existed in the prior art and were conventional at the time of filing, including, for example, the following:

- The '644 specification admits that conventional boluses transmitted “encoded physiological data.” 1:18-30.
- The '644 specification states that the “radio signal generator” comprises an “oscillator” and identifies four available Freescale oscillators by part number. This demonstrates it was conventional. 4:42-47.
- Similarly, the '644 specification acknowledges that “conventional boluses” employed “radio signal transmission” of encoded animal physiological data. 1:18-30. This is another admission as to what was known in the art.

30. The alleged inventions of the '644 Patent enable: (1) conserving energy, and thus increasing the operating lifespan of the bolus, by (a) controlling the

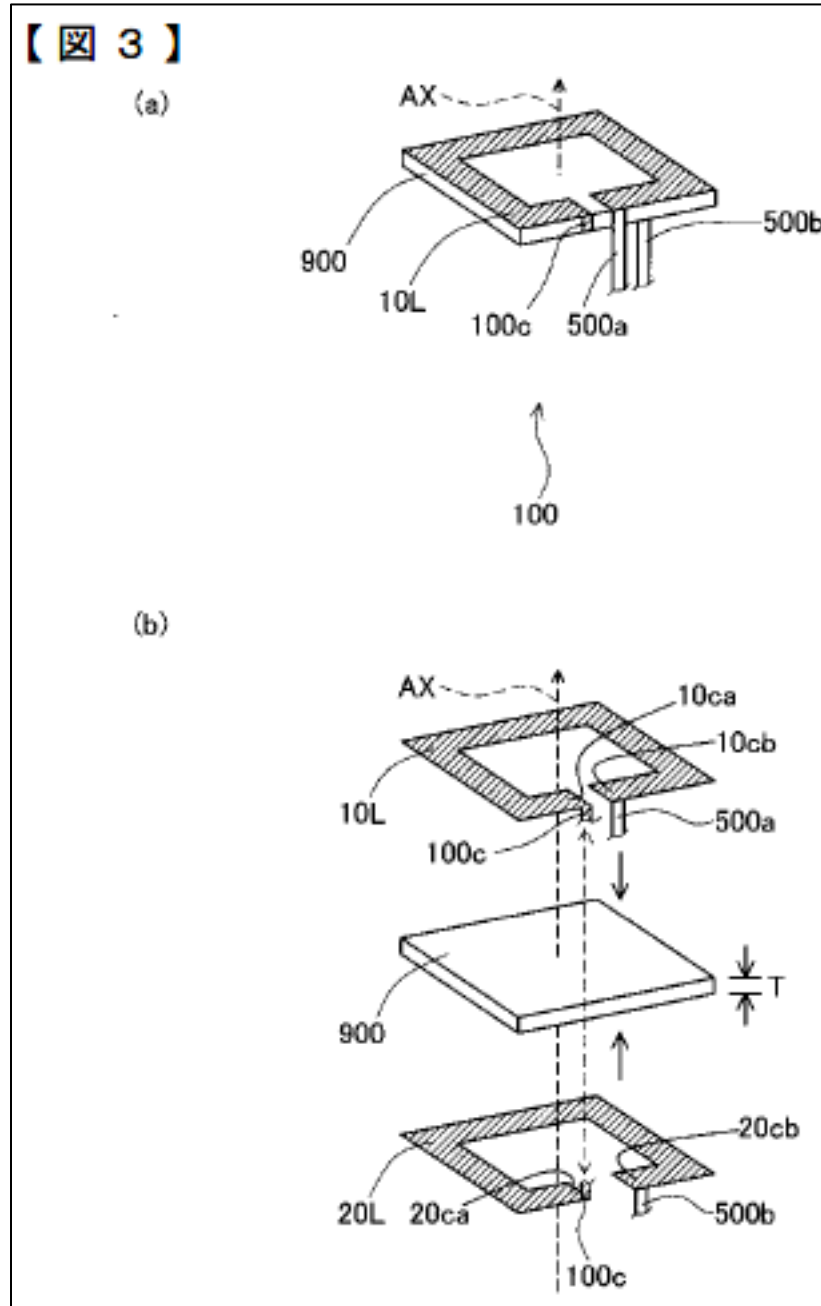
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operation of the radio signal generator, and (b) enabling and disabling the sensors at certain times; and (2) improving the consistency of signal transmission by employing an antenna having a pair of electrically conductive loops. *Id.*, 1:41-2:9, 6:41-7:33, 7:48-8:27, 10:4-9, 10:21-43, 11:51-63, Figs. 6-13. The '644 Patent also refers to encoding of the sensor signals, *e.g.*, 1:45-66, Claims 5, 9, but nowhere does it specify how to perform encoding of the sensor signals.

31. These purported innovations were not new, but known in the prior art. For example, without limitation, Harvey, Risky, and Rettedal all describe boluses which save energy by controlling the operation of a radio signal generator that transmits sensor data. *See, e.g.*, Ex. 1004, 27:22-28:5 (“XPDR 5000 can reduce overall transponder power consumption by performing a predetermined power management operation ... in response to a predetermined communication operation....”), 68:25-29; Ex. 1005, [0049] (“burst mode” in which the bolus stores sensor readings in memory and controls radio transmission to “reduce the power consumed by bolus”), [0055]; Ex. 1006, Abstract (controlling radio transmission of “sensed animal characteristic information”), [0061]-[0062] (similar).

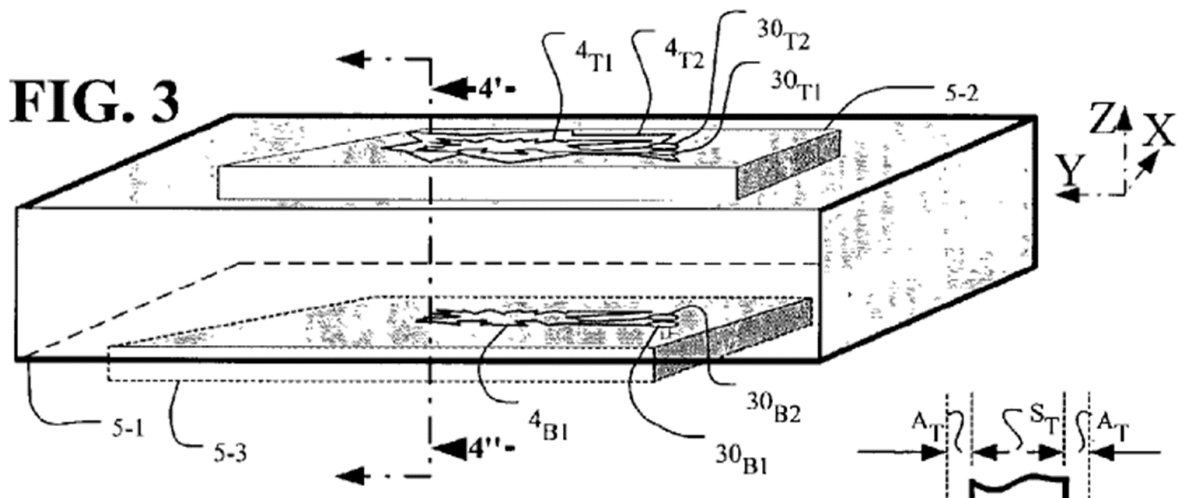
32. Risky further describes reducing the power consumed by the bolus by deactivating the sensors and re-activating them only when measurements are required. Ex. 1005, [0042] (Sensors are “deactivated in order to reduce the power consumed by bolus” and then “re-activated.”), [0056] (“deactivat[ing] certain sensors...in order to conserve power”).

33. Double-loop antennas were also common and known in the art in 2015. For example, Kunda depicts such an antenna for operation at 900 MHz, comprising a pair of electrically conductive loops 10L and 20L separated by a dielectric substrate 900:



Ex. 1007, Figs. 3(a), 3(b); *see also id.*, [0001], [0023]-[0024] (device using antenna 100 illustrated in Figs. 1, 2(a), 2(b), 3(a), 3(b) transmits and receives wirelessly in 900 MHz band).

34. As another non-limiting example, U.S. Patent Publication No. 2003/0096637 (“Keller”) discloses an antenna comprising at least two loops—loop 4_{B1} and either of loops 4_{T1} and 4_{T2}—separated by an insulating substrate layer 5-1:



Ex. 1019, [0089]-[0092], Fig.3.

V. PERSON OF ORDINARY SKILL IN THE ART

35. A person of ordinary skill in the art (“POSA”) as of the claimed priority date would have had at least a bachelor’s degree in electrical engineering or a related or equivalent field, and three or more years of experience researching, developing, designing and/or evaluating sensor systems for humans or other animals. However, additional years of education in the above-referenced fields may compensate for fewer years of experience. My level of skill as of the priority date of the ’644 Patent

exceeded that of a POSA, and I consider myself to be an expert in the field of sensor systems for humans and other animals.

VI. THE '644 PATENT

A. Summary of the Specification

36. The '644 Patent describes a bolus which is orally administered to a ruminant animal and remains in the animal's reticulorumen over the animal's productive lifespan. Ex. 1001, Abstract, 1:1-7, 1:34-40, 7:66-8:12. The bolus has one or more sensors that measure, *e.g.*, the animal's movement, temperature, and/or sound. *Id.*, 3:58-4:39, 8:28-34, 8:62-64, Figs. 2, 4, 5. The bolus converts the sensor measurements into encoded physiological data and transmits the encoded data wirelessly to an animal monitoring system by using a radio-frequency ("RF") signal produced by a radio signal generator. *Id.*, 4:24-61, 10:9-11:27, 14:9-13, 17:56-18:20, Figs. 2, 3. The radio signal generator can generate a radio signal having a frequency between about 700 MHz to about 1 GHz. *Id.*, 4:53-61.

37. The bolus is powered by a battery which cannot be recharged; thus the device's operational lifespan depends on battery capacity and the load current required to power the bolus's internal circuitry. *Id.*, 7:34-50, Figs. 2, 4, 5. The bolus contains a microcontroller having a processor in communication with a memory element storing computer code, the computer code including a power management module. *Id.*, 3:8-16, 4:24-26, Figs. 2, 4, 5. The computer code, including the power

management module, can be re-programmed based on programming data received by the bolus via a radio signal. *Id.*, 1:59-66, 11:28-33, 11:64-12:13, 16:51-58.

38. To conserve energy and thus extend the operational life of the bolus, the computer code includes a power management module which regulates energy consumption. *Id.*, 7:56-65, Figs. 2, 4, 5. For example, the power management module can regulate energy consumption by enabling or disabling one or more sensors depending on how frequently sensor readings have to be taken. *Id.*, 10:4-31, 10:55-11:27, 11:60-63. In addition, (1) the majority of energy consumed by the bolus is for operating the radio signal generator, and (2) the limited amount of encoded physiological data needed to monitor a particular animal can be transmitted using very short—*e.g.*, a few milliseconds—transmission bursts separated by substantial—*e.g.*, 24-hour—time periods. *Id.*, 10:26-38. In addition, the usefulness of an animal's physiological data is different during different life stages (*e.g.*, between birth to puberty compared to between puberty and the end of the animal's reproductive age). *Id.*, 10:4-16. Therefore, the power management module saves energy and extends the bolus's operating lifespan by (1) reconfiguring the time between transmission bursts, and (2) controlling the operational period of the transmitter (*i.e.*, the amount of time it is turned on during a transmission), depending on the animal's life stage. *Id.*, 1:59-66, 10:37-43, 11:18-20, 11:51-60; *see also id.*, 1:41-53, 7:48-8:27, 10:21-26. For example, the transmission interval can be

increased during less important life stages (*e.g.*, pregnancy) in order to save power.

Id., 1:59-66, 10:37-43, 11:21-27, 11:55-58.

39. The bolus described in the '644 patent includes an antenna 28 having a pair of electrically conductive loops 32 and 33 separated by an insulating substrate such as circuit board 31. *Id.*, 6:33-7:33, Figs. 6-13. Such an antenna is advantageous because it does not rely on a winding around a magnetic core to transmit the radio signal; thus, it improves transmission by avoiding the interference that such a core can cause. *Id.*, 6:51-61. The bolus includes matching elements—inductors and capacitors—to match and/or balance the impedance between the radio signal generator and the antenna. *Id.*, 5:4-10, 6:12-17, Figs. 2, 4, 5.

B. Claims

40. The '644 Patent has 19 claims, of which I understand that Claims 5-7, 9, 10, and 13 are being challenged. Of the Challenged Claims, Claims 5, 9, and 13 are independent. All of the Challenged Claims refer to monitoring physiological parameters of a ruminant animal using a bolus administered to the animal, a technique which the '644 Patent acknowledges was known in the prior art, as it is described in the Background section of the patent. *Id.*, 1:16-30, 21:28-34, 22:14-20, 22:45-47. The '644 Patent also admits that the radio signal generator was known in the prior art, as the specification describes it as being an oscillator and provides commercially available part numbers. *Id.*, 4:42-47. Challenged Claims 5-7, 9, and 10 further refer to encoding the physiological data and generating a radio signal to

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carry the encoded physiological data, which the patent also admits was known in the prior art. *Id.*, 1:28-30, 21:35-45, 22:21-30. Additional limitations of the independent Challenged Claims include, but are not limited to:

- In Claim 5: activating the radio signal generator at pre-determined intervals to generate a radio signal to carry the encoded physiological data, the radio signal having a frequency of between about 700 MHz to about 1 GHz;
- In Claim 9: an antenna having a pair of electrically conductive loops disposed a distance apart; and
- In Claim 13: enabling or disabling one or more sensors in said bolus by execution of a computer code, and re-programming said computer code based on a radio signal.

Id., 21:43-47, 22:31-33, 22:48-49, 22:58-60.

C. Summary of the Prosecution History

41. U.S. Patent App. No. 14/738,789 (“the ’789 Application”), which ultimately became the ’644 Patent, was filed on June 12, 2015. Over the course of prosecution, the U.S. Patent & Trademark Office (“PTO”) rejected the pending claims several times over U.S. Patent No. 6,371,927 (“Brune,” Ex. 1008) and/or U.S. Patent Publication No. 2009/0030279 (“Zander,” Ex. 1009) and for other, non-prior-art-related grounds. Ex. 1010, at 189-99, 427-39, 493-502. In each instance, the Applicant responded by amending and/or canceling claims. *Id.*, 310-14, 475-81,

551-56. The PTO issued a Notice of Allowance on November 7, 2018 and issued the '644 Patent on March 19, 2019. *Id.*, 562-63, 600.

42. Brune and Zander are the only prior-art references substantively discussed during prosecution of the '644 Patent. Although the Applicant filed Information Disclosure Statements (“IDSs”) disclosing Risky and Rettedal, among others, and although the examiner added the footnote “ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH” (Ex. 1010 at 163, 174, 203, 205), there is no evidence that the PTO gave substantial consideration to Risky, Rettedal, or any references other than Brune and Zander.

VII. OVERVIEW OF THE PRIOR ART

A. Harvey

43. Harvey describes a management system for livestock—*e.g.*, cattle or other ruminants—in which each animal (referred to as a “monitored subject”) is provided with an “intelligent active tag” (“IAT”) containing one or more RF-enabled, battery-powered transponders (“XPDRs”). Ex. 1004, 1:16-19, 2:16-26, 3:3-6, 7:26-29, 11:10-14, 13:22-23, 17:29-33, 22:29-32, 45:21-33 (describing battery), 60:31 (monitored subject is an animal). Although one embodiment of the IAT is an ear tag, the disclosed IAT is not limited to that embodiment but also can be a digestive tract bolus device which may remain indefinitely within the animal. *Id.*, 11:10-14. Harvey illustrates the IAT and its embedded transponder in multiple drawings, including Figs. 1, 2A-2C, 4, 5, and 7, and explains that the descriptions in

the specification apply equally to the devices illustrated in any and all of those drawings. *Id.*, 48:31-33 (“Like XPDR 5000 in FIG. 5, XPDR 7020 [illustrated in Fig. 7] may be included in an embodiment of an intelligent active tag, such as IAT 1110 in FIG. 1, and may be additionally described with respect to tag 2000 in FIGS. 2A-2C and FIG. 4.”), 57:19-26 (software in INT 7100 illustrated in Fig. 7 receives data and alerts from transponder 5000 illustrated in Fig. 5), 70:22-23 (“XPDR 5000 may be a constituent of an intelligent active tag, such as IAT 1110 in FIG.1, and tag 2000 in FIG. 2C and FIG. 3B.”). Thus, for example, the transponders 4300 in Fig. 4, 5000 in Fig. 5, and 7020 and 7021 in Fig. 7 are interchangeable examples of the same device.

44. Harvey’s transponder has a number of sensors for monitoring physiological quantities or parameters of the animal, including, *e.g.*, body temperature, heart rate, respiration, “corpus sounds” (sounds produced by the animal’s body), humidity, hydration state, substances in body fluids, and electrophysiological events such as electroencephalogram (“EEG”), electrocardiogram (“ECG”) or electromyogram (“EMG”) waves. Ex. 1004, 2:27-30, 2:35-3:2, 11:15-17, 37:35-38:31, 39:15-41:28, 65:1-16, 71:17-20, 73:6-8, 75:18-22, 75:18-22.

45. The transponder includes a transceiver with an antenna configured to transmit wireless signals to one or more fixed or hand-held monitoring transceivers located in or near the “monitored region” where the cattle are. *Id.*, 2:30-32, 8:21-

23, 15:24-26, 16:28-36, 23:11-21, 24:14-25. The wireless signals carry messages containing the physiological measurements made by the sensors in the transponder. *Id.*, 2:27-32, 3:18-20, 17:21-22. Communications are carried out within a selected frequency band which can be, *e.g.*, 850-950 MHz. *Id.*, 43:4-6, 55:14-18.

46. Harvey was not before the examiner during prosecution of the '644 Patent.

B. Riskey

47. Riskey describes an ingestible bolus containing sensors for monitoring physiological parameters of a bovine or other ruminant animal. Ex. 1005, Abstract (“An ingestible bolus may be disposed within the stomach of an animal. The bolus may comprise one or more sensors to monitor one or more internal and/or external animal characteristics.”), [0016]-[0017] (“In FIG. 1, an ingestible bolus 10, 20 may be disposed within the body of an animal 12, 22. Bolus 10, 20 may be configured to be ingested via the esophagus 13, 23 of a ruminant animal 12, 22, such as a bovine.”). “Monitored animal characteristics may include physiological characteristics, such as animal temperature, stomach pH, blood pH, heart rate, respiration, stomach or rumen contractions, and the like.” *Id.*, [0025]; *see also id.*, [0033], [0035], [0063], [0067]-[0068], [0075]-[0081], [0086]-[0087], [0116], Figs. 1-8. The measurement information from each of the sensors is stored in an on-board memory within the bolus and then transmitted wirelessly to a base station at periodic intervals via a radio-frequency signal. *Id.*, Abstract (“The bolus may comprise a data transmitter

in wireless communication with a base station.”), [0019], [0021], [0037], [0044] (“Sensor 220 may store such measurements on an internal sensor storage location or on memory unit 250.”), [0049]-[0050] (“[P]rocessor 240 may transmit sensor measurements obtained by polling sensors 220 via data transmitter 232....In [a] mode of operation, processor 240 may not immediately transmit the sensor readings polled from sensors 220, but instead store them on memory unit 250. In this mode, machine readable instructions 252 may specify a transmission interval [sic:interval], wherein processor 240 may transmit an animal characteristics message comprising some or all of the measurements stored in memory unit 250 at each transmission interval.”), [0055]-[0056], [0059], Fig. 2.

48. Although Risky appears in the prosecution history of the '644 Patent in a September 23, 2015 IDS initialed by the examiner, Ex. 1010 at 174, 203, it was never substantively discussed or even addressed during the patent's prosecution. Risky does not appear in any office action or any other correspondence with the PTO except the above-referenced IDS.

C. Rettedal

49. Rettedal describes a bolus which is orally administered to a ruminant animal and remains in the animal's stomach—*e.g.*, in its reticulum. Ex. 1006, Abstract (“An animal monitoring device configured as a bolus for oral administration to reside in an animal's stomach.”), [0002], [0003], [0022] (bolus “can be orally administered to reside in a reticulum (5) of the animal (3), including

ruminant animals such as cows, deer sheep, or the like”), [0025], [0037], [0046], [0051]-[0053], Claim 69, Figs. 1. The bolus has one or more sensors which measure, *e.g.*, the animal’s temperature, stomach pH, heart rate, and other physiological parameters. *Id.*, Abstract (device includes “sensors to detect physiological and non-physiological animal characteristics such as temperature”), [0002], [0003], [0022], [0023], [0023], [0061]-[0062] (sensors measure “physiological characteristics of the animal (3) such as temperature, pH, conductivity of a fluid, heart rate, blood pressure, partial pressures of dissolved gases, or the like”), Claims 69, 76, 77, Figs. 4-6.

50. Rettedal’s bolus uses a radio signal generator to wirelessly transmit the physiological measurements to a base station. *Id.*, [0003] (temperature measurements “transmitted by radio-frequency to a radio-frequency receiver.”), [0024] (RF signal carries “sensed animal characteristic information”), [0044], [0046], [0051], Claims 69, 79-81, Figs. 1, 4-6. The radio signal generator can operate at, *e.g.*, 800 or 900 MHz. *Id.*, [0062]-[0063] (radio communication at “about 800 MHz or about 900 MHz”), Claim 81.

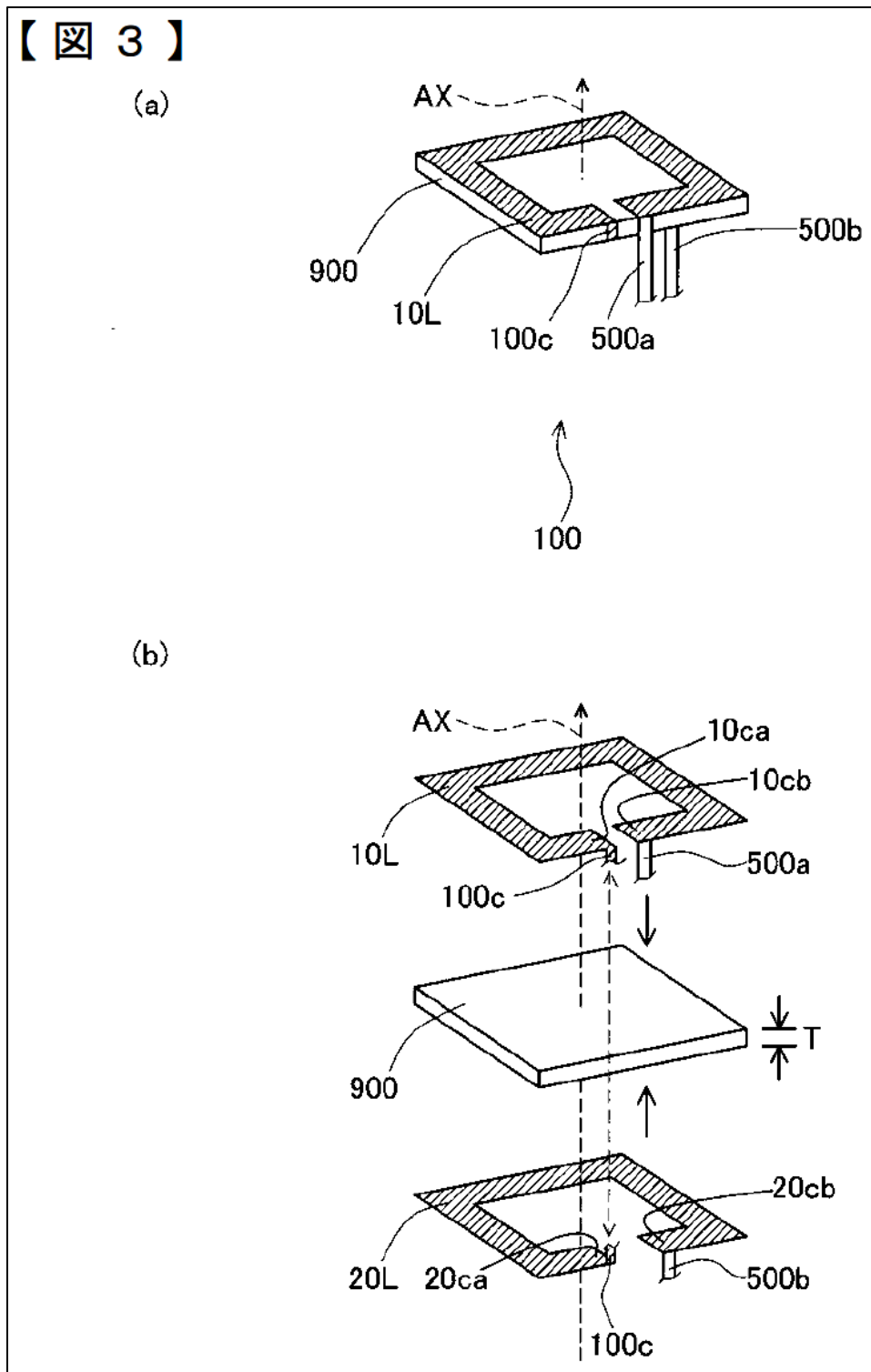
51. Rettedal’s bolus also includes an antenna for transmitting the radio signals, and a matching circuit 118 connected to the antenna. *Id.*, [0011], [0051], [0064], [0066], Fig. 6. The matching circuit comprises matching elements which adjust the frequency of the radio signal to compensate for the effect that the mass of the animal has on the radio signal. *Id.*, [0011], [0064] (matching circuit can “detune”

the RF signal to “compensate for demodulation of the...signal (13) due to interaction with the mass of animal (3)”).

52. Similarly to Risky, Rettedal appears in the prosecution history of the '644 Patent in a June 12, 2015 IDS initialed by the examiner. Ex. 1010 at 163, 205. But like Risky, Rettedal was never substantively discussed or addressed during prosecution. Rettedal does not appear in any PTO correspondence except the above-referenced IDS.

D. Kunda

53. Kunda describes radio-communication antennas for use in wireless networks, portable wireless communication devices, and Bluetooth applications. Ex. 1007, [0001]-[0002], [0023]. Kunda describes several examples in which the antenna comprises a pair of electrically conductive loops disposed on either side of a dielectric substrate—*e.g.*, loops 10L and 20L and substrate 900 depicted in Figs. 3(a) and 3(b):



See also id., Summary, Claims 1-7, [0007]-[0021] (two-loop antenna used for radio communication), [0028]-[0066] (similar), [0072]-[0078], Figs. 1, 2, 4, 6-8, 11.

54. Kunda was not before the examiner during prosecution of the '644 Patent.

VIII. SPECIFIC GROUNDS FOR INVALIDITY

A. Ground 1: Claims 5 and 6 are Anticipated by Harvey

1. Claim 5

a. 5[Pre]: “A method of monitoring physiological parameters of a ruminant animal, comprising:”

55. Regardless of whether the preamble of Claim 1 is limiting, it is taught by Harvey. Harvey teaches a method of monitoring physiological parameters—*e.g.*, body temperature, heart rate, respiration, “corpus sounds” (sounds produced by the animal’s body), humidity, hydration state, substances in body fluids, and/or electrophysiological events such as electroencephalogram (“EEG”), electrocardiogram (“ECG”) or electromyogram (“EMG”) waves—of one or more ruminant animals, *e.g.*, cattle. Ex. 1004, 1:16-19 (invention relates to “livestock management system”), 7:26-29 (“monitored subjects [are] cattle”), 11:10-14 (“In ruminant monitored subjects such as cattle, a digestive tract bolus tag may be retained indefinitely within the animal.”), 13:22-23 (monitoring “beef cattle”), 37:35-38:18 (measuring “biological property” of subject animal), 38:25-31 (measuring animal’s “corpus [*i.e.*, body] temperature...or...cardiac pulse rate”), 39:15-36 (using accelerometer to measure animal’s “pulse,...blood pressure,...respiration, or other physiologically-based motion”), 40:17-20 (sensing “corpus sound”), 40:25-41:28 (measuring animal’s “body temperature,...water

vapor or humidity...indicat[ing] [animal's] hydration state...,...bodily fluid transport or flow;...a level of a substance within a fluid sample of...subject...,...EEG..., ECG..., and EMG”), 71:17-20 (sensing a physical quantity), 73:6-8 (sensing “biological parameter” of monitored animal), 74:6-7 (sensor module providing measured physical quantity pertaining to monitored animal), 75:18-22 (biosensor to sense animal’s biological function).

b. **5[A]: “generating a sensor signal from one or more sensors contained in a bolus orally administered to said ruminant animal”**

56. Harvey teaches generating a sensor signal from one or more sensors contained in a bolus orally administered to said ruminant animal. First, Harvey states: “IAT 1110 may be...a digestive tract bolus device.... In ruminant monitored subjects such as cattle, a digestive tract bolus tag may be retained indefinitely within the animal.” *Id.*, 11:10-14. A POSA would interpret Harvey’s reference to a “digestive tract bolus device” as meaning an orally administered device, since that is how the term “bolus” is used in ruminant agriculture. *See, e.g.*, Ex. 1011, 3:21-22 (describing a “bolus” as “a body which can be administered orally to a ruminant animal”); Ex. 1012, 1:17-19 (describing device “commonly referred to as a bolus, which is ingestible by animals”); Ex. 1013 (describing “safe administration of a rumen bolus” to a ruminant animal, which consists of oral administration). The background section of the ’644 Patent also acknowledges that oral administration is the conventional way to administer a bolus to a ruminant animal. *See* Ex. 1001,

1:18-20 (in discussing the prior art, referring to “conventional boluses” as being “orally administered to reside in the reticulorumen” of a ruminant animal). Furthermore, a POSA would understand the term “bolus” to refer to a device that is orally taken by the animal. Thus, oral administration is necessarily present in Harvey’s disclosure of a digestive tract bolus tag may be retained indefinitely in a ruminant animal.

57. The transponder disclosed in Harvey has multiple sensors, as illustrated, *e.g.*, in Fig. 5:

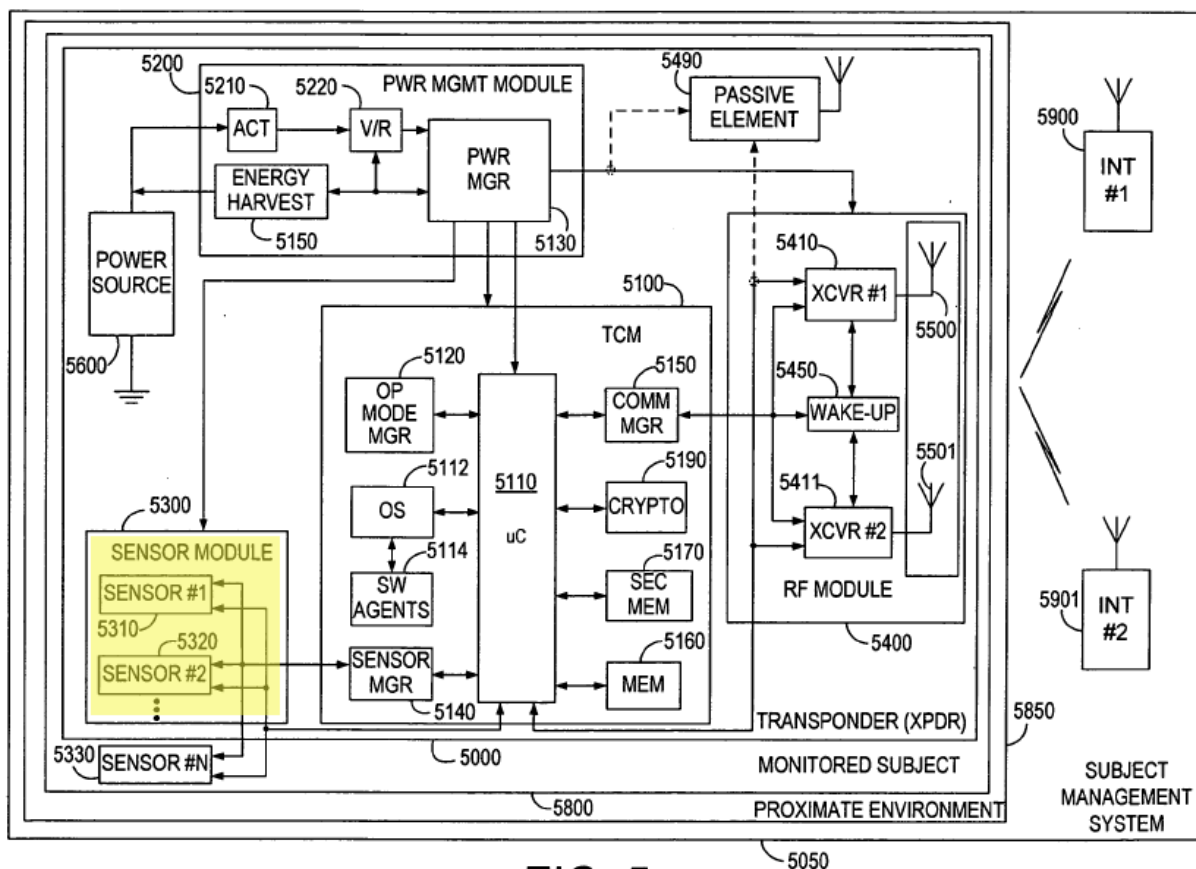


FIG. 5

58. Examples of sensors within Harvey’s bolus include, without limitation, a body-temperature sensor, a heart-rate sensor, one or more accelerometers to sense

Declaration of Professor Darrin J. Young

respiration or “corpus sounds,” a humidity sensor, a sensor for detecting substances in body fluids, and/or electrical sensors to measure EEG, ECG, or EMG waves. Ex. 1004, 38:25-31 (sensors for measuring animal’s “corpus temperature...or...cardiac pulse rate”), 39:15-36 (accelerometer to measure animal’s “pulse,...blood pressure,...respiration, or other physiologically-based motion”), 40:17-20 (acoustic sensor senses “corpus sound”), 40:25-37 (thermal sensor which measures animal’s “body temperature [to] provide a sensed thermal parametric signal [or] a sensed thermal gradient parametric signal”), 41:1-6 (“impedancemetric sensor for sensing water vapor or humidity, which may indicate [animal’s] a hydration state...; an electrokinetic sensor [to] sense bodily fluid transport or flow; an electrophoretic sensor for detecting a level of a substance within a fluid sample of monitored subject..., or a biopotential sensor for identifying...EEG..., ECG ..., and EMG...waves”). These sensors generate signals representing the sensed parameters. *See, e.g., id.*, 37:35-38:18 (transponder “transform[s] the sensed physical quantity representation to a sensed data signal”; “A sensor can be a transducer configured to sense a measurable physical property of a physical system, and to produce a measurand representative of an attribute of the measurable physical property. A measurable physical property may be a mechanical, an electrical, a chemical, an optical, or a biological property.”), 41:24-25 (“Sensor manager 5140” receives input signals from one or more of the sensors, 71:17-21, 73:6-8, 74:6-7 (sensor module providing sensed physical quantity), 75:18-22, Fig. 5 (illustrating sensor signals

going to sensor manager 5140), Fig. 12 (sensing and storing physical quantity, steps S12420, S12430). Thus, a POSA would understand that that the sensors in Harvey's orally administered bolus generate sensor signals.

c. **5[B]: "said sensor signal varies based on a corresponding change in one or more physiological parameters of said ruminant animal"**

59. As discussed *supra* § VIII.A.1.a, Harvey teaches numerous sensor signals representing various physiological parameters of a ruminant animal. Each of the sensor signals varies based on any corresponding change in the ruminant physiological parameter that the signal represents. For example, Harvey states that the disclosed transponder can store "subject dynamic information" that includes "a sensed physiological parameter" of the animal. Ex. 1004, 11:20-24. A POSA would understand that the ability to store a "dynamic" physiological parameter means that changes in that parameter can be stored, and therefore that the sensor signal must be varying based on changes in that physiological parameter. Indeed, Harvey further states that the "subject dynamic information" can include "a change in one or more of a ... [physiological] parameter...." *Id.*, 11:20-24. In order to capture and store a changing physiological parameter, the sensor signal must necessarily vary based on changes in that parameter. Similarly, Harvey also explains that "a sensor can be a transducer configured to sense a measurable physical property... and to produce a measurand representative of an attribute of the measurable physical property....," wherein said attribute may be "dynamic, or substantially dynamic in nature." *Id.*,

38:2-6. Again, in order to sense and produce a measurand representative of a dynamic attribute, the sensor signal must vary in accordance with changes in that attribute (*e.g.*, a physiological parameter like pulse rate, *id.*, 38:25-27).

60. Moreover, a POSA would understand that any signal representing a changing physiological parameter—*e.g.*, temperature or heart rate—necessarily must vary with that parameter. Thus, even if Harvey did not expressly indicate that the sensor signals vary with changes in the animals physiological parameters—which it does—signal variation is inherent in any signal representing a changing parameter.

d. **5[C]: “encoding said sensor signal from said one or more sensors as encoded physiological data corresponding to said one or more physiological parameters of said ruminant animal”**

61. Fig. 5 discloses a transponder control module (5100) comprising a microprocessor (5110), MEM (5160), SECMEM (5170), operational system code (5112), and application program code (5114). The specification implicitly discloses that said sensor signal from said one or more sensors are digital representation of an analog signal produced by the said sensor. The digital representation of an analog signal is an encoded signal.

62. A POSA would recognize that the sensors described in Harvey—*e.g.*, the thermal sensors, heart-rate sensor, accelerometers, acoustic sensor, humidity sensor, substance-detector, biopotential sensor (for EEG, ECG, and/or EMG),

electrokinetic sensor, and electrophoretic sensor discussed *supra* § VIII.A.1.c—produce signals which start out in analog form, since these sensors are producing electrical signals, for example, voltages, corresponding to physical phenomena that continuously vary with the monitored physiological parameter. Ex. 1022 at FIG. 1, 1:31-2:13, 4:22-5:6 (physiological parameters such as ECG, temperature, and heart rate are sensed in analog form and must be converted to digital). Yet the measurements are (1) sent into the transponder's microcontroller 5110, which is a digital device and thus processes incoming information digitally (*see* Ex. 1004, 29:21-28, 39:4-5 (uC receives sensed data from sensors), Fig. 5), (2) stored in the transponder's memory, *see infra* Element 5[D], and (3) transmitted wirelessly using one or more digital protocols such as, *e.g.*, Bluetooth, Zigbee, IEEE 802.15.1, IEEE 802.15.3, IEEE 802.15.4, IEEE 802.15.4a, WiFi, IEEE 802.11 (including IEEE 802.11a, 802.11b, 802.11g, and/or 802.11n), 802.16b, 3G, or 4G (*see* Ex. 1004, 10:3-11:3, 24:20-23, 42:36-43:20). Since storage in memory and transmission by a digital protocol both only work with digital information, Harvey necessarily requires the analog signals representing the animal's physiological parameters to be encoded into digital form as physiological data corresponding to the measured physiological parameters.

63. That encoding would occur in an analog-to-digital converter (“ADC”) within either the sensor module 5300, the sensor manager 5140, or one or more of the sensors themselves. A POSA would understand that an ADC is necessarily

present to produce the digital signals. A POSA would further understand that converting an analog signal to digital form comprises encoding the analog signal, and that the resulting digital representation of the analog signal comprises encoded data. As an example, ADCs commonly convert analog signals into digital signals using pulse-code modulation (“PCM”), which is a form of digital encoding. *See, e.g.*, Ex. 1014, 9:17-20 (describing “PCM encoder and decoder that performs analog-to-digital (A/D) and digital-to-analog (D/A) conversion”); Ex. 1015, 1:49-60 (describing prevalence of PCM encoding in analog-to-digital conversion). But regardless of the type of modulation used, a POSA would consider the process of converting an analog signal to a digital signal to be a type of encoding. In addition, the ordinary English-language definition of the term “encode” in the context of computing is “to change information into a form that can be processed by a computer.” Ex. 1020, 3. Analog-to-digital conversion meets this definition because it changes an analog signal into digital form, which can be processed by a computer.

e. **5[D]: “storing said encoded physiological data in a non-transitory computer readable media”**

64. Harvey’s transponder includes computer readable media—memory 5160 and secure memory (SECMEM) 5170—as illustrated in Fig. 5:

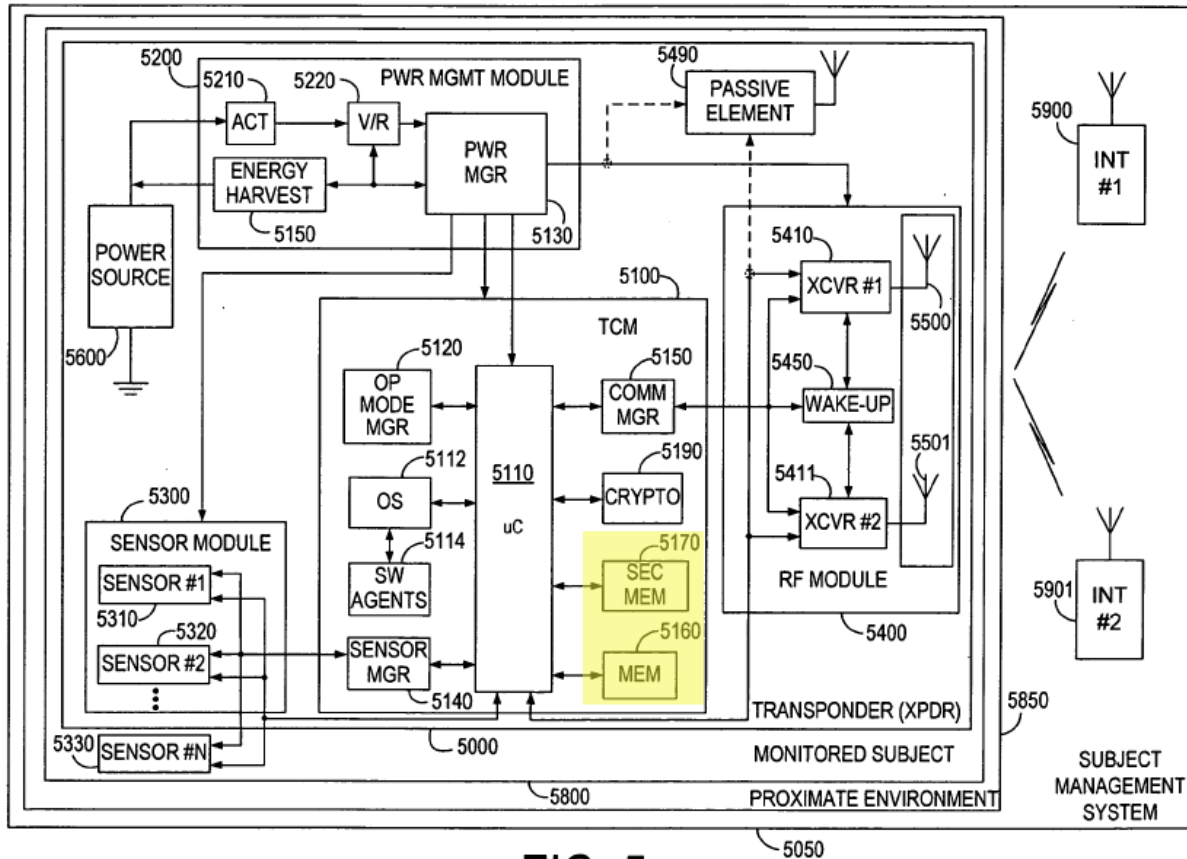


FIG. 5

65. Each of memories 5160 and 5170 comprises “non-volatile” memory—which a POSA would understand is synonymous with “non-transitory” memory. *Id.*, 29:16-24 (The transponder includes “transponder controller module (TCM) 5100,” which includes “memory (MEM) 5160....MEM 5160 may include...non-volatile memory....”), 30:6-9 (“TCM 5100 also may include secure non-volatile memory (SECMEM) 5170....”).

66. The transponder stores the encoded physiological data about the monitored animal in non-volatile (*i.e.*, non-transitory) memory 5160 and/or 5170. *Id.*, 11:20-24 (“IAT 1110 also may be configured to store subject dynamic information as subject data. Non-limiting examples of subject dynamic information

includes a monitored subject vital sign, a sensed physiological parameter,...or a change in one or more of a sign, a parameter, a motion, or a condition.”), 14:1-3 (outbound message includes “stored subject data”), 30:9 (“SECMEM 5170 may store subject data securely.”), 33:32-34:5 (“[S]elected sensitive data may be securely stored in SECMEM 5170. A non-limiting example of selected sensitive data can be a portion of monitored subject-related data....At least a portion of pulled data may be buffered in MEM 5160, SECMEM 5170, or both. Pulled data may include, without limitation, a selected sensed physical quantity representation generated by SDM 5300..., subject data, stored monitored subject-related data, [etc.].”), 34:12-17 (storing “sensed physical quantities [in] MEM 5160”), 71:17-21 (transponder “stor[es]...[the] sensed physical quantity representation in a transponder memory.”), Fig. 5.

f. **5[E]: “enabling a radio signal generator located within said bolus”**

67. The transponder within Harvey’s cattle bolus includes RF module 5400 which includes one or more RF transceivers 5410 and 5411, depicted in Fig. 5:

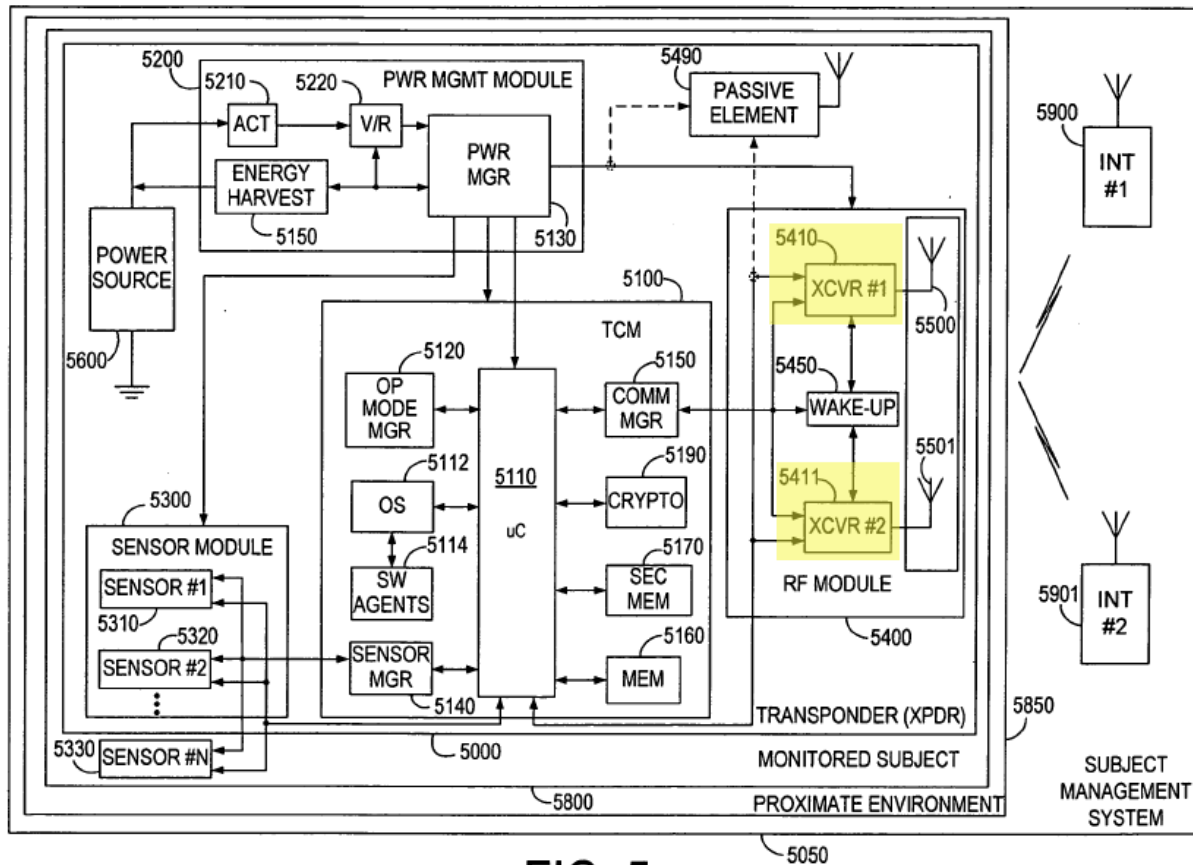


FIG. 5

68. See also Ex. 1004, 29:17-18 (transponder includes RF module 5400), 42:3-11 (RF module 5400 includes RF transceivers 5410 and 5411), 43:4-44:2 (describing operation of, and protocols and frequency bands used by, transceivers 5410 and 5411 to transmit and receive signals), Fig. 5.

69. Each RF transceiver generates radio signals and thus is a radio signal generator, as is the entire RF module. *Id.*, 45:8-15 (describing antennas 5500 and 5501 to transmit the generated radio signals), Fig. 5 (depicting antennas 5500 and 5501); see also *id.*, 2:30-32 (transceiver coupled to antenna which transmits tag message on selected frequency band), 23:11-21 (transponder engaging in wireless transmission), 24:14-25 (examples of circuitry used for wireless transmission),

50:28-32, 51:18-20 (interrogator 7100 receives message from one or more of transponders 7020 and 7021), 51:36-52:19 (similar), 56:18-26 (antenna elements 7170 and 7171 in INT 7100 receive radio signals from transponders 7020 and 7021), Fig. 7.

70. Harvey further discloses a power management module (“PMM”) 5200 which supplies power to RF module 5400, causing communication manager 5150 to transmit the sensed selected subject parameter using RF module 5400. *Id.*, 32:7-17, Fig. 5; *see also id.*, 32:21-34. A POSA would understand that supplying power to an RF module containing RF transceivers enables those transceivers. Additionally, every time Harvey’s bolus activates its RF transceivers 5410 and 5411—*e.g.*, when they begin to transmit subject data at times determined by the “tag transmission interval,” *see infra* Element 5[F]—it is necessarily enabling a radio signal generator. Thus, Harvey teaches enabling a radio signal generator located within the bolus.

g. **5[F]: “activating said radio signal generator at pre-determined intervals to generate a radio signal to carry said encoded physiological data”**

71. Harvey teaches embodiments in which the radio signal generator is activated at predetermined intervals to generate the outgoing radio signal carrying encoded physiological data about the monitored animal. For example, Harvey describes wirelessly transmitting IAT messages which carry the stored and encoded “subject data,” including sensed physiological data of the animal. *Id.*, 14:1-3 (“IAT 1110 may transmit an outbound IAT message including subject data, which may be

stored subject data), 3:18-20, 14:7-9, 15:24-26, 17:18-22, 25:8-11, 33:32-34:5, 65:1-16, 66:3-5, 72:4-73:8, 75:18-22, Fig. 7. Harvey confirms that the transmitted subject data includes the sensed physiological parameters of the monitored animal. 11:20-22 (“IAT 1110 also may be configured to store subject dynamic information as subject data ... includ[ing] a monitored vital sign, a sensed physiological parameter”), 11:15-18, 12:30-35, 44:28-32. Indeed, a POSA would understand that it would make no sense for the orally-administered bolus to take sensor measurements but not to transmit them.

72. The IAT transponder can transmit outbound IAT messages in a “periodic” manner using a “preselected tag transmission interval” such as every two seconds. *Id.*, 26:6-11. The IAT transponder may be assigned its “selected tag transmission interval” during manufacturing or by self-assignment. *Id.*, 27:14-21. See also 28:22-27, 32:12-19, 65:32-66:2, 66:19-22, Fig. 9.

73. Thus, Harvey discloses “generating a radio signal to carry said encoded physiological data.” A POSA would understand that transmitting sensed selected subject parameters through the RFM requires generating a radio signal to carry said encoded physiological data.

74. A POSA would also understand that the RFM and RF transceivers of Harvey are necessarily activated at the beginning of each transmission interval in order to transmit the IAT message containing the encoded physiological data.

- h. **5[G]: “generating said radio signal having a frequency of between about 700 MHz to about 1 GHz”**

75. The transceivers in Harvey’s transponder can generate a radio signal between 700 MHz and 1 GHz. For example, the transponder can generate an 850-950 MHz signal. Ex. 1004, 43:4-6 (transceiver 5410 within transponder “may be...within a selected one of selected communication frequency bands of between about 850 MHz to about 950 MHz....”), 55:14-18 (interrogator module INT 7100 can communicate within 850-950 MHz frequency band); *see also* Ex. 1001, 19:45-47 (“The recitation of numerical ranges by endpoints includes all the numeric values subsumed within that range.”).

2. **Claim 6: “The method of claim 5, wherein said frequency is selected from the group consisting of: between about 700 MHz to about 800 MHz, 750 MHz to about 850 MHz, about 800 MHz to about 900 MHz, 850 MHz to about 950 MHz, 900 MHz to about 1 GHz.”**

76. The transceivers in Harvey’s transponder can operate in the frequency range between 850-950 MHz. *See supra* Element 5[G]. Thus, they meet this Markush limitation, which expressly includes that range. *See* Ex. 1001, 19:45-47 (A numerical range includes all values within that range.).

B. Ground 2: Claims 5 and 6 are Anticipated by Risky

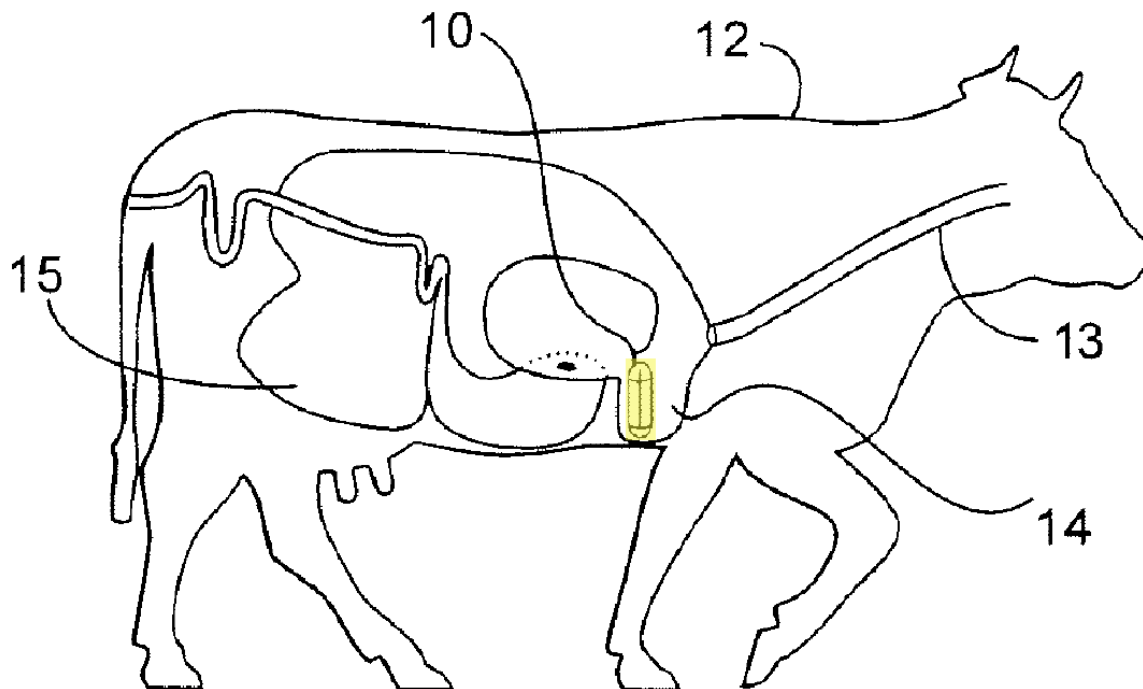
1. Claim 5

a. 5[Pre]: “A method of monitoring physiological parameters of a ruminant animal, comprising:”

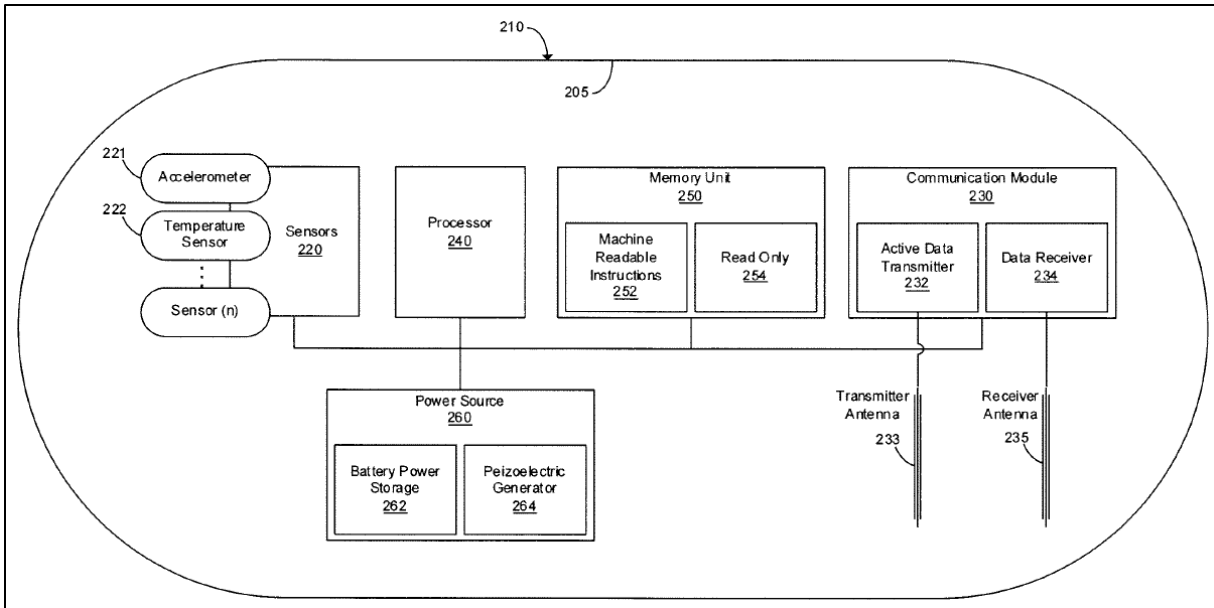
77. Regardless of whether the preamble of Claim 1 is limiting, it is taught by Risky. First, Risky describes a bolus for monitoring cows, which are ruminant animals. Ex. 1005, [0068]. In addition, Risky states: “Monitored animal characteristics may include physiological characteristics, such as animal temperature, stomach pH, blood pH, heart rate, respiration, stomach or rumen contractions, and the like.” *Id.*, [0025]; *see also id.*, Abstract (“[A] bolus...disposed within the stomach of an animal...may comprise one or more sensors to monitor one or more internal and/or external animal characteristics.”), [0007]-[00011] (updating animal characteristics for health monitoring), [0033] (monitoring stomach contractions), [0035] (“One or more sensors 220 of bolus 210 may be used to detect physiological characteristics of an animal including, but not limited to: body temperature; heart rate; respiration; stomach contractions; stomach pH; blood pH; and the like.”), [0063] (similar), [0067]-[0068], [0075]-[0081], [0086]-[0087], [0116] (samples include animal’s “internal physiological...characteristics”), Figs. 1-8 (depicting operation of boluses 10, 20, 210, 410 which monitor animal’s temperature, stomach pH, stomach contractions, etc.).

- b. **5[A]: “generating a sensor signal from one or more sensors contained in a bolus orally administered to said ruminant animal”**

78. Risky describes and illustrates a bolus (item 10, 20, 200, or 410) that sits in a stomach (*e.g.*, the rumen or reticulum) of a ruminant animal such as a cow:



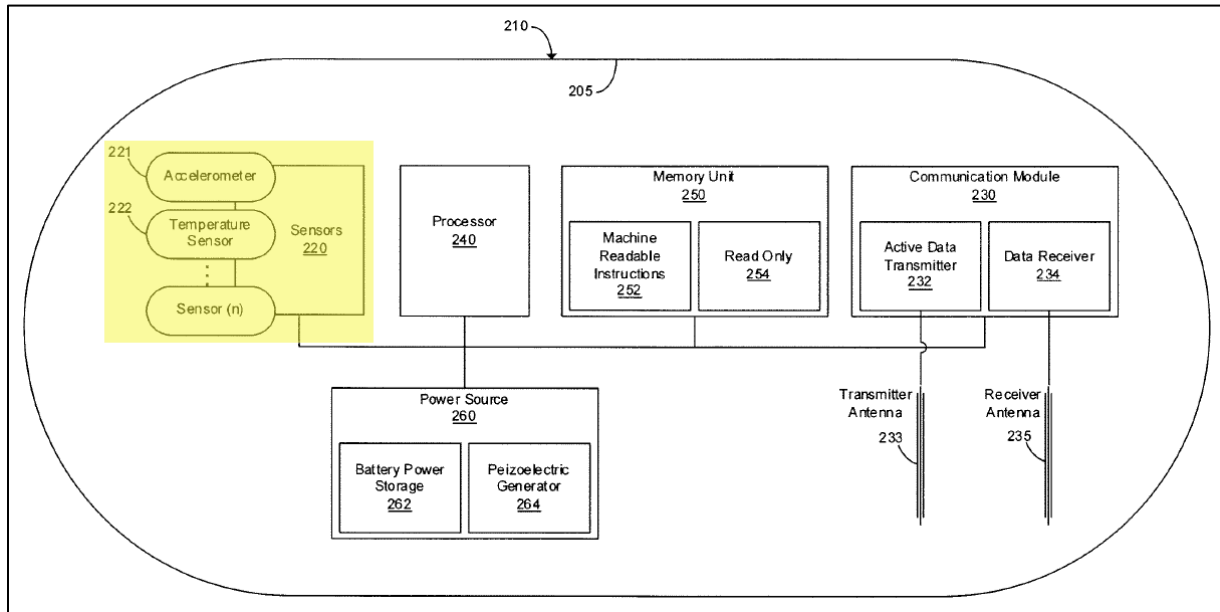
Ex. 1005, Fig. 1.



Id., Fig. 2.

79. The bolus is ingested via the animal's esophagus, which requires that it be orally administered to the animal. Ex. 1005, Abstract ("An ingestible bolus may be disposed within the stomach of an animal."), [0016]-[0017] ("In FIG. 1, an ingestible bolus 10, 20 may be disposed within the body of an animal 12, 22. Bolus 10, 20 may be configured to be ingested via the esophagus 13, 23 of a ruminant animal 12, 22, such as a bovine. In this embodiment, bolus 10, 20 may be configured to have a size and density that will enable it to remain within the stomach of a bovine 12, 22, ensuring that it is not regurgitated from the animal's reticulum 14, 24 and/or rumen 15, 25."), [0101] ("The bolus may be disposed within the stomach (e.g., rumen and/or reticulum of a ruminant animal).").

80. Risky's bolus 210 contains sensors 220—*e.g.*, Accelerometer 221, Temperature Sensor 222, and other sensors—for monitoring the animal's internal characteristics:



Id., Fig. 2; *see also* Abstract (“The bolus may comprise one or more sensors to monitor one or more internal and/or external animal characteristics.”), [0029] (“Bolus 210 may comprise one or more sensors 220 configured to measure one or more animal characteristics.”).

81. The sensors generate sensor signals representing, *e.g.*, “animal temperature, stomach pH, blood pH, heart rate, respiration, [and/or] stomach or rumen contractions....” *Id.*, [0025]; *see also id.*, [0035] (“One or more sensors 220 of bolus 210 may be used to detect physiological characteristics of an animal including, but not limited to: body temperature; heart rate; respiration; stomach contractions; stomach pH; blood pH; and the like.”), [0063] (sensors measuring

animal temperature and stomach pH), [0067]-[0068] (similar), [0075]-[0081], [0086]-[0087], [0116] (samples include animal's "internal physiological...characteristics"), Figs. 1-8 (depicting operation of boluses 10, 20, 210, 410 which monitor animal's temperature, stomach pH, stomach contractions, *etc.*).

82. To the extent that Patent Owner argues that Risky does not disclose generating a sensor signal—which it does, *see, e.g., id.*, Fig. 5 (sensors connected to other components of the bolus through wires which carry signals)—sensor signals are necessarily present, and thus inherent, in Risky, because producing signals representing measurements is how sensors work. Furthermore, a POSA would understand that the sensors would communicate with the other components in the bolus using sensor signals conveying the sensor measurements/readings. For example, the sensors in Risky's bolus store their measurements in memory unit 250. *See infra* Element 5[D]. Sensor signals representing those measurements are required in order to deliver the measurements to the memory unit 250.

c. **5[B]: "said sensor signal varies based on a corresponding change in one or more physiological parameters of said ruminant animal"**

83. As discussed *supra* regarding Element 5[A], Risky describes using sensors 220 to monitor several physiological parameters, including temperature, pH, heart rate, respiration, and stomach or rumen contractions. *Id.*, [0025], [0035]. A POSA would understand that these sensors necessarily generate signals representing

the physiological parameters they are measuring. For instance, Figure 2 illustrates sensors 220 electrically connected to processor 240, memory unit 250 and communication module 230. *See also id.*, [0039], [0043], [0044]. A POSA would understand that the sensors would communicate with these other components using sensor signals conveying the sensor measurements/readings. *See, e.g., id.*, [0043] (“Polling a sensor may comprise processor 240 sending a query to a sensor 220, and responsive to this query, sensor 220 may obtain and return to processor 240 the sensor reading. For example, temperature sensor 222 may respond to polling by reading and returning the current animal temperature.”).

84. A POSA would further understand that the generated sensor signals would necessarily vary in accordance with changes in the measured physiological parameters. An animal’s temperature, heart rate, respiration, etc. will change over time. *See id.*, [0035] (detecting animal temperature, stomach contractions, *etc.*), [0044] (“sensor 220 may have a sensor reading duration to allow sensor 220 to measure animal characteristics over time”). To distinguish a first measured value (*e.g.*, temperature of 101 degrees) from a second measured value (*e.g.*, 103 degrees), the sensor signal must vary in accordance with the two-degree change in temperature. For instance, Risky discloses use of a “thermistor” ([0035]), which is a device that changes its resistance as a function of temperature, and thereby is used to generate a signal that varies as a function of temperature. Similarly, Risky discloses use of a “thermocouple” ([0035]), which is a device comprising two

dissimilar metals than generates a voltage that varies as a function of the junction temperature. A POSA would further understand that signal variation is inherent in any signal representing a changing parameter such as those disclosed in Risky, and therefore signal variation is inherent for a sensor measuring such a changing/varying parameter.

85. Risky teaches numerous sensor signals representing various physiological parameters of a ruminant animal, including animal temperature, stomach pH, blood pH, heart rate, respiration, and stomach or rumen contractions. Each of the sensor signals varies based on any corresponding change in the ruminant physiological parameter that the signal represents. For instance, a thermocouple generates an analog voltage signal that varies with the junction temperature.

- d. **5[C]: “encoding said sensor signal from said one or more sensors as encoded physiological data corresponding to said one or more physiological parameters of said ruminant animal”**

86. A POSA would recognize that the signals produced by the sensors described in Risky—*e.g.*, the temperature sensors, pH sensors, and accelerometers measuring heart rate, respiration, and stomach or rumen contractions discussed *supra* § VIII.B.1.b—start out in analog form, since these sensors are producing electrical signals, for example, voltages corresponding to physical phenomena that continuously vary with the monitored physiological parameter. Ex. 1022 at FIG. 1, 1:31-2:13, 4:22-5:6 (physiological parameters such as ECG, temperature, and heart

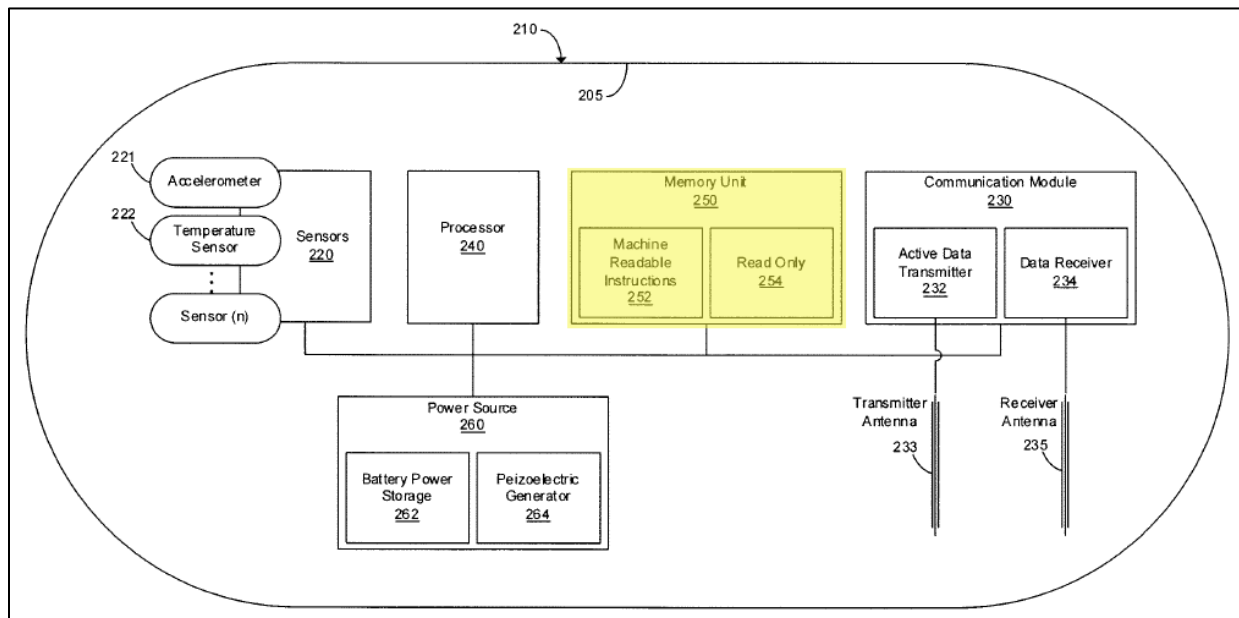
rate are sensed in analog form and must be converted to digital). Yet the measurements are (1) stored in the transponder's memory, *see infra* Element 5[D], (2) organized into an "Animal Information Data Structure," and (3) transmitted wirelessly as data—*i.e.*, digital information, *see* Ex. 1005, Abstract ("The bolus may comprise a data transmitter in wireless communication with a base station."), [0021] (bolus transmits data to base station), [0023], [0037] (bolus transmits data), [0049]-[0051], [0058], Fig. 2 (depicting "Active Data Transmitter 232"). Since storage in memory, organization into a data structure, and transmission by a digital protocol all require digital information, Risky necessarily requires the analog signals representing the animal's physiological parameters to be encoded into digital form as physiological data corresponding to the measured physiological parameters. The digital representation of an analog signal is an encoded signal.

87. For example, as discussed *supra* Ground 1, Element 5[C], encoding of analog signals into digital signals would occur in an ADC within the bolus—*e.g.*, within processor 240 or one or more of the sensors themselves. *See, e.g.*, Ex. 1005 [0041] ("[M]achine readable instructions 252 may configure processor 240 to apply calibration data stored within memory unit 250 to readings returned by sensors 220."), [0043]-[0044] ("[P]olling a sensor may comprise causing processor 240 to read the current sensor value from a sensor 220. In another embodiment, one or more sensors 220 may be configured to store sensor measurements on memory unit 250."), Fig. 2. A POSA would understand that an ADC is necessarily present to generate

the digital signals, that converting an analog signal to digital form comprises encoding the analog signal, and that the resulting digital representation of the analog signal comprises encoded data—for example, without limitation, PCM-encoded data. *See supra* Ground 1, Element 5[C]. In addition, as discussed above with respect to Ground 1, Element 5[C], analog-to-digital conversion meets the ordinary English-language definition of the term “encode” in the context of computing, because it changes an analog signal into digital form, which can be processed by a computer. *See* Ex. 1020, 3 (“encode...(computing) to change information into a form that can be processed by a computer”).

e. **5[D]: “storing said encoded physiological data in a non-transitory computer readable media”**

88. Risky’s bolus has a memory unit 250:



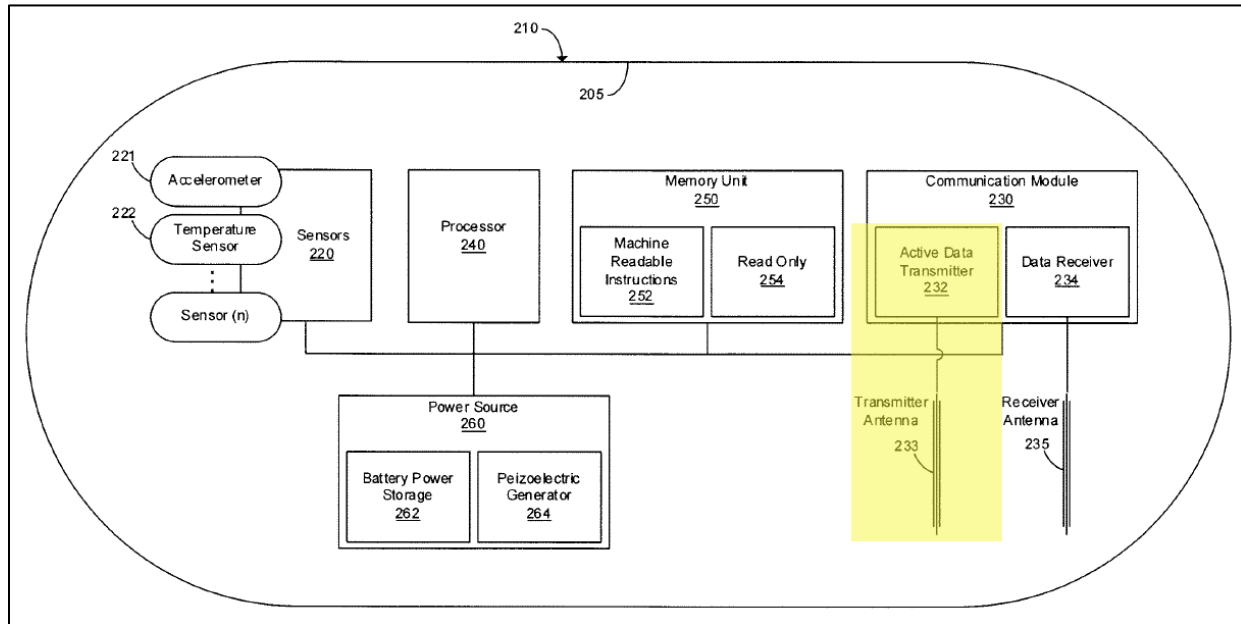
Id., Fig. 2.

89. Risky teaches storing the encoded physiological data within memory unit 250, which can comprise an Electrically Erasable Programmable Read-Only Memory (“EEPROM”). Ex. 1005, [0043]-[0044] (“[P]rocessor 240 may poll sensor 220 by reading a sensor 220 storage location....Sensor 220 may store such measurements...on memory unit 250. The processor 240 may poll such a sensor by reading memory 250....”), [0049] (processor stores sensor readings in memory 250), [0052] (“[M]emory unit 250 may comprise read-only storage 254[, which] may be ...Electrically Erasable Programmable Read-Only Memory (EEPROM)....”), Fig. 2. A POSA would know that an EEPROM is a non-transitory computer readable media. *See* Ex. 1023 at 8:23-32 (“EEPROM” comprises “non-transitory machine-readable medium”).

90. A POSA would understand that, when Risky refers to storing sensor samples in memory unit 250, Ex. 1005, [0043]-[0044], it is referring to non-transitory memory such as the above-referenced EEPROM, because Risky memory unit 250 does not contain any transitory memory. *Id.*, Fig. 2; *see also id.*, [0046] (“[B]olus 210 may comprise sensors 220 having any number of sampling or measurement storage techniques and that processor 240 may be configured by machine readable instructions 252 to poll sensors 220 having such various sampling or measurement storage techniques.”).

f. **5[E]: “enabling a radio signal generator located within said bolus”**

91. Risky’s cattle bolus enables a radio signal generator—data transmitter 232—to wirelessly transmit radio signals to a base station via a connected antenna 233:



Ex. 1005, Fig. 2; *see also id.*, Abstract (“The bolus may comprise a data transmitter in wireless communication with a base station.”), [0019] (“Bolus 10, 20 may comprise wireless communications means to allow bolus 10 to be in wireless communication with base station 40.”), [0021] (“The wireless communication means of bolus 10, 20 may comprise a wireless transmitter and/or receiver operating at 900 MHz or some other suitable radio frequency (RF). In some embodiments, such wireless communication may be two-way, allowing bolus 10, 20 to transmit and receive data from base station 40. In other embodiments, bolus 10, 20 may only be capable of transmitting data to base station 40.”), [0037] (describing location,

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configuration and operation of transmitter 232 and antenna 233), [0049]-[0050] (describing transmission of sensor measurements by data transmitter 232), [0055] (similar), [0056] (“data transmitter 232 of bolus 210 may be considered to be an active transmitter since bolus 210 may actively transmit animal characteristic messages....”), [0059] (“[O]ne or more bolus 10, 20 may be in wireless communication with a base station 40. As such, bolus 10, 20 may periodically transmit animal characteristics messages to the base station 40.”), Fig. 2 (depicting Active Data Transmitter 232 connected to Transmitter Antenna 233); *see also id.*, [0049] (describing “burst” mode transmission). Every time Risky’s bolus activates its data transmitter 232 to transmit data—*e.g.*, at the beginning of each “transmission interval,” *see* discussion of Element 5[F], below—it is necessarily enabling a radio signal generator.

g. **5[F]: “activating said radio signal generator at pre-determined intervals to generate a radio signal to carry said encoded physiological data”**

92. Risky teaches embodiments in which the radio signal generator is activated at predetermined intervals to generate the outgoing radio signal carrying encoded physiological data about the monitored animal. For example, in “burst” mode, the transmitter is activated at predetermined, periodic intervals. Ex. 1005, [0049] (“In one embodiment, processor 240 may transmit sensor measurements obtained by polling sensors 220 via data transmitter 232....In [a] mode of operation, processor 240 may not immediately transmit the sensor readings polled from sensors

220, but instead store them on memory unit 250. In this mode, machine readable instructions 252 may specify a transmission interval [sic:interval], wherein processor 240 may transmit an animal characteristics message comprising some or all of the measurements stored in memory unit 250 at each transmission interval. This operational mode may be referred to as ‘burst’ mode since sensor 220 readings are transmitted as periodic bursts rather than when sensor polling takes place.”).

93. As another example, Risky’s bolus also has an “on-line” mode in which the transmitter is activated at a predetermined “transmission frequency”—*i.e.*, transmission interval—specified by the device’s machine readable instructions. *Id.*, [0055] (“In ‘on-line’ mode, bolus 210 may transmit animal characteristics messages at the ‘online’ transmission frequency specified by machine readable instructions 252. As discussed above, such messages...may be transmitted at a periodic transmission interval.”); *see also id.*, [0059] (“[O]ne or more bolus 10, 20 may be in wireless communication with a base station 40. As such, bolus 10, 20 may periodically transmit animal characteristics messages to the base station 40.”).

h. **5[G]: “generating said radio signal having a frequency of between about 700 MHz to about 1 GHz”**

94. The transmitter in Risky’s bolus operates at 900 MHz, which is within the claimed frequency range. Ex. 1005, [0021] (“The wireless communication means of bolus 10, 20 may comprise a wireless transmitter and/or receiver operating at 900 MHz...”), [0023] (“each base station 40 and transponder 60, 62 may be

configured to communicate on a separate frequency and/or channel within an RF frequency range (e.g., 900 MHz).”), [0037] (“[T]ransmitter antenna 233 may be capable of transmitting data at 900 MHz...”); *see also* Ex. 1001, 19:45-47 (numerical range includes all values within the range).

2. **Claim 6: “The method of claim 5, wherein said frequency is selected from the group consisting of: between about 700 MHz to about 800 MHz, 750 MHz to about 850 MHz, about 800 MHz to about 900 MHz, 850 MHz to about 950 MHz, 900 MHz to about 1 GHz.”**

95. The transceivers in the bolus described in Risky can operate in the 850-950 MHz frequency range. *See supra* Element 5[G]. Thus, they meet this Markush limitation. *See* Ex. 1001, 19:45-47 (numerical range includes all values within the range).

C. **Ground 3: Claims 5 and 6 are Rendered Obvious by Harvey in view of Risky**

1. **A POSA Would have Been Motivated to Combine Harvey and Risky**

96. The teachings of Harvey and Risky provide substantial motivation to combine these references. First, the devices described in both references are the same type of apparatus used for the same purpose. Each is an electronic bolus with a number of sensors, configured to reside in the stomach of a ruminant animal and measure the animal’s physiological parameters. Ex. 1004, 1:16-19, 7:26-29, 11:10-14, 11:20-24, 13:22-23, 37:35-38:18, 38:2-6, 38:25-31, 39:15-36, 40:17-20, 40:25-41:28, 71:17-21, 73:6-8, 74:6-7, 75:18-22, Figs. 5, 12; Ex. 1005, Abstract, [0007]-

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[00011], [0016]-[0017], [0025], [0029], [0033], [0035], [0063], [0067]-[0068], [0075]-[0081], [0086]-[0087], [0101], [0116], Figs. 1-8. Each of the boluses disclosed in Harvey and Risky wirelessly transmits those parameters to a monitoring station so that the health and breeding status (*e.g.*, estrus) of each animal can be monitored. Ex. 1004, 2:30-32, 11:20-30, 23:11-21, 24:14-25, 29:17-18, 42:3-11, 43:4-44:2, 45:8-15, 50:28-32, 51:18-20, 51:36-52:19, 56:18-26, 60:36-37, Figs. 5, 7; Ex. 1005, Abstract, [0019], [0021], [0037], [0049]-[0050], [0055], [0056], [0059], [0062], [0067]-[0068], [0071], [0075], [0081], [0089], [0089], [0091], [0104]-[0105], [0121]-[0122], [0133]-[0135], [0142], [0144], Claim 17, Figs. 2, 3a.

97. The motivation to combine Harvey and Risky is further enhanced by the other similarities and common features of their devices, *e.g.*:

- a. Radio communications in the 700 MHz-1 GHz band. Ex. 1004, 10:3-8, 43:4-6 (communication in 850-950 MHz band), 55:1-18 (same); Ex. 1005, [0021] (operation at 900 MHz), [0023] (same), [0037].
- b. Activating the radio signal generator only at pre-determined intervals. Ex. 1004, 26:21-32 (“preselected tag transmission interval”), 27:14-21 (radio signal generator activated only during “selected tag transmission interval”), 65:32-66:36, Fig. 9; Ex. 1005, [0049] (sensor readings transmitted at specified transmission

intervals), [0055] (describing “on-line” mode in which transmitter is activated at “periodic transmission interval”), [0059].

- c. Enabling sensors only when needed, and disabling them at other times to conserve battery power. Ex. 1004, 32:12-15 (supplying power to sensor module SDM 5300 (which includes sensors 5310, 5320, etc.) to sense a selected parameter, and then terminating power to sensor module), 32:17-19 (purpose is to reduce power consumption and prolong battery life), Fig. 5; Ex. 1005, [0042] (deactivating and re-activating sensors to conserve power), [0056], [0145].

98. The '644 Patent sought to solve the problem of extending the operational life of a bolus having limited battery capacity by regulating energy consumption—*e.g.*, by controlling the operation of the radio signal generator. Ex. 1001, 1:21-25, 7:56-65, 10:31-43, 10:55-61, 11:16-27, 11:51-60; *see also id.*, 7:44-55, 7:66-8:12. Harvey and Risky both recognized and solved that same problem—extending the operational life of a bolus. *See* Ex. 1004, at 27:22-24 (“XPDR 5000 can reduce overall transponder power consumption by performing a predetermined power management operation, which may be a predetermined context-aware power management operation.”); 68:24-29 (removing power from inactive transponder circuitry “to reduce transponder energy consumption”). *See* Ex. 1005, [0042]

(deactivating sensors to “reduce the power consumed”); [0144] (reducing sensor monitoring frequency to “reduce the power consumption”).

99. In addition, as discussed in Grounds 1 and 2, above, there is no element in either of Claims 5 and 6 that does not appear in both Harvey and Risky. Furthermore, the respective elements are standard method steps using well-known, off-the-shelf sensors and wireless communication components that would be familiar to any POSA. There is nothing unpredictable about the claimed use of those components in a bolus residing in the stomach of a ruminant animal. Furthermore, the technology and operation of such components was well-understood in the relevant time period such that the combination of Harvey and Risky would have had a high likelihood of success.

100. Thus, since Harvey and Risky teach the same kind of device which is used for the same purpose, since the problem identified in the '644 Patent was recognized by Harvey and Risky, since Harvey and Risky came up with the same solution to the problem, and since the combination of elements in Claims 5 and 6 is nothing more than the predictable use of those elements according to their established functions, and since the combination of Harvey and Risky would have had a high likelihood of success, a POSA would have been motivated to combine Harvey and Risky.

2. **The Combination of Harvey and Risky Meets All Elements of Claims 5 and 6**

101. The Preambles and every element in each of Claims 5 and 6 is taught by each of Harvey and Risky, *see* Grounds 1 and 2, above. To the extent Patent Owner alleges that either Harvey or Risky fails to teach any claim element, that element is provided by the other reference. Further, to the extent the teachings of Harvey are substantively different than Risky for any given claim element, it would have been at least obvious to try Risky's implementation of that element in Harvey, or vice versa, given the overall similarity in their purpose, design and operation.

102. In addition, to the extent that Patent Owner contends that either Harvey or Risky does not disclose oral administration of their boluses—which they do—or to the extent that Patent Owner contends that oral administration of a bolus is not inherent in Harvey and Risky—which it is, *see* Grounds 1 and 2, Element 5[A]—that limitation would have been obvious to a POSA, since oral ingestion is how boluses are administered in ruminant agriculture. *See, e.g.*, Ex. 1011, 3:21-22 (describing a "bolus" as "a body which can be administered orally to a ruminant animal"); Ex. 1012, 1:17-19 (describing device "commonly referred to as a bolus, which is ingestible by animals"); Ex. 1013 (describing "safe administration of a rumen bolus" to a ruminant animal, which consists of oral administration); Ex. 1001, 1:18-20 ("Conventional boluses" are "orally administered to reside in the reticulorumen" of a ruminant animal.).

103. Thus, since a POSA would have been motivated to combine Harvey and Risky, *supra* § VIII.C.1, and since the combination meets all limitations of Claims 5 and 6, those claims are obvious over the combination of Harvey and Risky.

D. Ground 4: Claim 7 is Rendered Obvious by Harvey in view of Rettedal

1. A POSA Would have Been Motivated to Combine Harvey and Rettedal

104. Claim 7 specifies that “said bolus further comprises matching elements which adjusts said frequency of said radio signal to compensate for a change in said frequency of said radio signal due to passing through a mass of said ruminant animal.” The teachings of Harvey and Rettedal provide substantial motivation to combine these references and, specifically, to add matching elements as taught by Rettedal to Harvey’s bolus.

105. Similarly to Harvey and Risky, discussed above, the devices described in Harvey and Rettedal are the same type of apparatus used for the same purpose. Each is an electronic bolus with a number of sensors, configured to reside in the stomach of a ruminant animal and measure the animal’s physiological parameters. Ex. 1004, 1:16-19, 7:26-29, 11:10-14, 11:20-24, 13:22-23, 37:35-38:18, 38:2-6, 38:25-31, 39:15-36, 40:17-20, 40:25-41:28, 71:17-21, 73:6-8, 74:6-7, 75:18-22, Figs. 5, 12; Ex. 1006, Abstract (“An animal monitoring device configured as a bolus for oral administration to reside in an animal’s stomach....The animal monitoring

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device can further include sensors to detect physiological and non-physiological animal characteristics such as temperature....”), [0002] (similar), [0003] (temperature sensor(s) in “orally administered, inserted, or ingested bolus”), [0022] (bolus for “monitor[ing] one or more sensed physiological...parameters of an animal...can be orally administered to reside in a reticulum (5) of the animal (3), including ruminant animals such as cows, deer sheep, or the like”), [0023] (“change in the sensor signal (10) correspond[s] to change in the sensed animal characteristic”), [0025] (bolus within animal), [0037] (same), [0046] (same), [0051]-[0053] (bolus in animal’s stomach/reticulum), [0061]-[0062] (sensors measure “physiological characteristics of the animal (3) such as temperature, pH, conductivity of a fluid, heart rate, blood pressure, partial pressures of dissolved gases, or the like”), Claims 69, 76, 77 (same), Figs. 1, 4-6. Each of the boluses disclosed in Harvey and Rettedal wirelessly transmits those parameters to a monitoring station so that each animal can be monitored. Ex. 1004, 2:30-32, 11:20-30, 23:11-21, 24:14-25, 29:17-18, 42:3-11, 43:4-44:2, 45:8-15, 50:28-32, 51:18-20, 51:36-52:19, 56:18-26, 60:36-37, Figs. 5, 7; Ex. 1006, [0003] (temperature measurements “transmitted by radio-frequency to a radio-frequency receiver.”), [0024] (RF signal carries “sensed animal characteristic information” to RF reader 14), [0044] (same), [0046] (same), [0051] (“radio frequency generator”), Claims 69, 79-81 (same), Figs. 1, 4-6.

106. The motivation to combine Harvey and Rettedal is further enhanced by other similarities and common features of their devices, *e.g.*:

- a. Radio communications in the 700 MHz-1 GHz band. Ex. 1004, 10:3-8, 43:4-6 (communication in 850-950 MHz band), 55:1-18 (same); Ex. 1006, [0062]-[0063] (radio communication at “about 800 MHz or about 900 MHz”), Claim 81 (“800 MHz or 900 MHz”)
- b. Activating the radio signal generator intermittently. Ex. 1004, 26:21-32 (“preselected tag transmission interval”), 27:14-21 (radio signal generator activated only during “selected tag transmission interval”), 65:32-66:36, Fig. 9; Ex. 1006, Abstract (“The animal monitoring device intermittently transmits...sensed animal characteristic information to a receiver....”).

107. Motivation to add matching elements to Harvey’s bolus is also expressly stated in Rettedal itself. In discussing how to improve upon prior-art boluses for animal monitoring (which would include the bolus described in Harvey), Rettedal states: “Another broad object of the invention of the invention can be to provide a network frequency match element which functions as part of the animal monitoring device to compensate for the mass of the animal such that the radiofrequency signal generated by the animal monitoring device antenna located inside the animal can be received by the radio frequency reader antenna located outside of the animal.” Ex. 1006, [0011]; *see also id.*, [0064] (“The network

frequency match element (118) can include capacitors and resistors in combination to deliver a particular first radio frequency signal (213) under the conditions of the method utilized...to the antenna (90) [and to] compensate for demodulation of the radio frequency signal (13) due to interaction with the mass of animal”), Fig. 6.

108. A problem that the '644 Patent sought to solve was that the center frequency of a radio signal generator operating within the mass of an animal tends to be shifted to a lower frequency than that of the same generator operating in normal atmospheric air. Ex. 1001, 6:25-32. A POSA would have understood, at least from Rettedal, that the implanted bolus of Harvey would have experienced this same problem given that the bolus is surrounded by the mass of the animal. Rettedal provided a solution to this problem, using a network frequency match element 118 which detunes the frequency of the generated signal to produce an RF signal at the desired frequency, and so a POSA would have been motivated to apply this solution to the bolus of Harvey. Ex. 1006, [0064] (“[T]he network frequency match element (118) can detune a 433 MHz first radio frequency signal (13) to generate a signal of between about 418 MHz and about 425 MHz. The detuned signal can compensate for demodulation of the radio frequency signal (13) due to interaction with the mass of animal (3).”). In addition, although Rettedal provides an example of detuning a 433 MHz radio frequency signal to generate a signal between about 418 MHz and about 425 MHz, Rettedal expressly states that this example is “non-limiting” and that the frequency match element can operate at an “other selected frequency.” *Id.*

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Furthermore, Rettedal repeatedly refers to its bolus operating in the 800-900 MHz band. *Id.* [0062]-[0063], Claim 81. Thus, a POSA would understand that Rettedal's frequency match element 118 is also intended for the 800-900 MHz band.

109. In addition, Claim 7—which is met in its entirety by the combination of Harvey and Rettedal, *see infra* § VIII.D.3—consists of standard, predictable method steps using a bolus containing well-known, off-the-shelf sensors and radio communication components that would be familiar to any POSA. Furthermore, the technology and operation of such components was well-understood in the relevant time period such that the combination of Harvey and Rettedal would have had a high likelihood of success.

110. Thus, since Harvey and Rettedal teach the same kind of device used for the same purpose, since Rettedal expressly provides a motivation to combine its matching elements with prior-art boluses such as Harvey's, since the problem identified in the '644 Patent was recognized and solved by Rettedal, since the combination of elements in Claim 7 is nothing more than the predictable use of prior art elements according to their established functions, and since the combination of Harvey and Rettedal would have had a high likelihood of success, a POSA would have been motivated to combine Harvey and Rettedal.

2. **The Combination of Harvey and Rettedal Meets All Elements of Claim 7**

111. Every element in each of Claims 5 and 6, from which Claim 7 depends is taught by Harvey, *see* Ground 1, above. To the extent Patent Owner contends that oral administration of boluses or other claim elements are not disclosed or inherent in Harvey—which they are, *see* Ground 1—those limitations would have been obvious to a POSA. *See* Ground 3. All of the additional elements of Claim 7 are taught by Rettedal, as explained in detail below.

3. **Claim 7: “The method of claim 6, wherein said bolus further comprises matching elements which adjusts said frequency of said radio signal to compensate for a change in said frequency of said radio signal due to passing through a mass of said ruminant animal.”**

112. Rettedal’s bolus teaches the use of matching elements to adjust the frequency of a radio signal to compensate for a change in the frequency of the radio signal due to its passing through the mass of the ruminant animal in which the bolus resides. For example, the bolus includes an antenna 90 for transmitting the radio signals, and a “matching network” (also referred to as a “match element”) 118 connected to the antenna. Ex. 1006, [0011], [0051], [0064], [0066], Fig. 6. The matching network 118 adjusts the frequency of the radio signal to compensate for the effect that the mass of the animal has on the radio signal. *Id.*, [0011] (bolus includes “a network frequency match element which...compensate[s] for the mass of the animal such that the radiofrequency signal generated by the animal monitoring

device antenna located inside the animal can be received by the radio frequency reader antenna located outside of the animal.”), [0064] (“The network frequency match element (118) can include capacitors and resistors in combination to deliver a particular first radio frequency signal (213)...to the antenna (90)...[T]he network frequency match element (118) can detune a 433 MHz first radio frequency signal (13) to generate a signal of between about 418 MHz and about 425 MHz. The detuned signal can compensate for demodulation of the radio frequency signal (13) due to interaction with the mass of animal (3)...[T]he network frequency match element (118) can be configured to compensate for the signal demodulation due to the unique mass of an animal (3) such that the first radio frequency signal (13) transmitted outside of that unique mass of the animal (3) can be at about 433 MHz (or other selected frequency).”). Furthermore, as discussed above, although Rettedal provides an example of detuning a 433 MHz radio frequency signal to generate a 418-425 MHz signal, Rettedal expressly states that this example is “non-limiting” and that the frequency match element can operate at an “other selected frequency.” *Id.* Since Rettedal repeatedly refers to its bolus operating in the 800-900 MHz band, *id.* [0062]-[0063], Claim 81, a POSA would understand that Rettedal’s frequency match element 118 is also intended for the 800-900 MHz band.

113. Thus, since a POSA would have been motivated to combine Harvey and Rettedal, *supra* § VIII.D.1, and since the combination of Harvey and Rettedal contains all limitations of Claim 7, Claim 7 is obvious over that combination.

E. Ground 5: Claims 9 and 10 are Rendered Obvious by Harvey in view of Kunda

1. A POSA Would have Been Motivated to Combine Harvey and Kunda

114. As discussed in detail *infra* § VIII.E.3, the “generating,” “encoding,” “storing,” “enabling,” and “activating” steps of Claim 9 are taught by Harvey. Claim 9 also includes a step of “transmitting said radio signal with an antenna having a pair of electrically conductive loops disposed a distance apart and further comprising transmitting said radio signal through said antenna.” Claim 10 further specifies that the loops in the antenna “each comprise a loop of conductive sheet material having an inner annular edge and an outer annular edge which join opposed loop faces.” The teachings of Harvey and Kunda provide substantial motivation to add a double loop antenna as disclosed in Kunda to Harvey’s bolus.

115. First, motivation to add Kunda’s antenna to Harvey’s bolus is expressly provided in both references. For example, Harvey sought to produce a bolus that would fit within the digestive tract of a monitored animal and emphasized the importance of compactness. Ex. 1004, 11:10-13 (goal of providing a “miniature transponder”); *see also id.*, 18:15-17 (recognizing importance of “more compact form factor”). Kunda addresses the same size considerations. For example, in discussing the importance of providing a small radio antenna, Kunda points out that “The smaller, the better in the case of portable wireless communication devices[, which] has led to demands for smaller antennas for use in portable wireless

communication devices.” Ex. 1007 [0002]. Thus, a problem that Kunda seeks to solve is “[t]o provide a small antenna with satisfactory characteristics.” *Id.*, Summary; *see also id.*, [0006] (“The present invention...is intended to provide a small antenna with satisfactory characteristics.”), [0008] (invention “makes it possible to reduce the antenna size while maintaining satisfactory characteristics.”), [0020] (similar), [0057] (The antenna “can be made smaller than a regular single-loop antenna, doing so without excessive loss of antenna characteristics.”), [0077]-[0078]. In addition, a POSA would be familiar with the goal of miniaturizing a device that is placed in the body of an animal. Because Kunda’s double-loop antenna saves space—a benefit touted by Kunda—a POSA would consider it well-suited for use in Harvey’s cattle bolus.

116. In addition, a problem identified by the ’644 Patent is interference with transmission—and resulting loss of data—that can be caused by wire-wound antennas that rely on magnetic cores. Ex. 1001, 6:51-61. The ’644 Patent solves that problem by using an antenna comprising a pair of electrically conductive loops separated by an insulating substrate. *Id.*, 6:33-7:33, Figs. 6-13. Kunda recognized and solved that same problem with the same kind of double-loop antenna, with an insulating substrate separating the loops, operating in the same frequency band as the antenna in the ’644 Patent—700 MHz-1 GHz. Ex. 1001, 4:53-61, 21:46-52, Figs. 6-13; Ex. 1007, [0023] (transmitter operating at 900 MHz), [0064]-[0065] (same), Figs. 2-4, 6-9, 11. Since Kunda’s antenna is two loops with PCB substrate

in between, clearly it has no magnetic core. A POSA would have recognized that Kunda's double-loop antenna with an insulating substrate between the loops and no magnetic core achieves the same goal in the same way as the '644 Patent; like the antenna in the '644 Patent, Kunda's antenna avoids the interference that a magnetic core would cause.

117. An additional benefit that the '644 Patent attributes to the double-loop antenna recited in Claims 9 and 10 is increased bandwidth. Ex. 1001, 7:22-33. Kunda touts the same benefits for its own double-loop antenna. For example, in describing the enhanced bandwidth of its antenna, Kunda states that its double-loop configuration "makes it possible to expand the frequency band in which the antenna can transmit and receive signals efficiently." Ex. 1007, [0066]. Thus, Kunda recognized and solved the same problems identified by the '644 Patent.

118. Kunda's antenna improves performance by configuring the loops such that their magnetic fields interact with each other constructively, not destructively. *See, e.g., id.*, [0030] (maintaining antenna performance even when antenna is close to a ground plane, allowing smaller size), [0045]-[0048] (loops configured such that currents at any given point flow in the same direction—thus enhancing each other—due to $\frac{1}{4}$ -wave resonant effects), [0049] ("[A]ntenna 100 can minimize...interference between loop conductor parts, thereby minimizing the extent to which the antenna characteristics are diminished."), [0050]-[0057], [0070], [0075], Figs. 6(a)-7(c). A POSA would understand that, when Kunda refers to (1)

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maintaining antenna performance even when antenna is close to a grounding conductor part, and (2) mitigating “interference” (meaning destructive interference) between loop-shaped members, *see id.*, it is referring to the advantages that Kunda’s antenna confers in maintaining antenna emission efficiency while allowing small size, thus providing additional motivation to combine it with wireless devices such as Harvey’s.

119. Furthermore, Claims 9 and 10—which are met in their entirety by the combination of Harvey and Kunda, *see infra* §§ VIII.E.3, 4—do nothing more than arranging well-known elements with each performing the same function already known to a POSA, and yield no more than one would expect from such an arrangement, thus rendering the combination obvious. Claims 9 and 10 consist of standard, predictable method steps using a bolus and antenna containing well-known, off-the-shelf sensors and simple conductive loops that would be familiar to any POSA. Furthermore, the technology and operation of such components was well-understood in the relevant time period such that the combination of Harvey and Kunda would have had a high likelihood of success.

120. The motivation to combine Harvey and Kunda is further enhanced by the other similarities and common features of their devices, *e.g.*:

- a. Communication device is part of a wireless network. Ex. 1004, 8:23-26, 10:3-11:3, 23:21-29, 36:4-6, 50:4-22, 71:11-17, 77:13-17; Ex. 1007, [0001] (antenna suitable for wireless LANs and

mobile telephone systems), [0002] (portable wireless communication devices), [0023].

- b. Radio communications over Bluetooth, including in the 2-2.5 GHz frequency band. Ex. 1004, 10:7-15 (Bluetooth), 42:36-43:7 (Bluetooth, 2.4 GHz), 43:29-33 (Bluetooth within band of about 2.4-2.5 GHz), 50:9-12 (Bluetooth), 53:31-37, 55:12-14, 63:3-7; Ex. 1007 [0001] (Bluetooth), [0023] (2.4 GHz), [0043] (2.2 GHz), [0056] (2.2 GHz), [0065].
- c. Radio communications in the 850-950 MHz band. Ex. 1004, 43:4-6 (communication band between about 850 MHz and about 950 MHz), 55:1-18 (850-950 MHz frequency band); Ex. 1007, [0023] (900 MHz band), [0064]-[0065] (same); mobile telephony in 900 MHz band.

121. In addition, Kunda lists a broad range of applications for its antenna, including “wireless local area networks (LANs),” mobile telephony, Bluetooth, “and the like,” as well as “portable wireless communications devices” in general. Ex. 1007, [0001]-[0002]. Harvey teaches that all of those applications and communication protocols are suitable for its bolus. *See* Ex. 1004, 4:3-4 (use of bolus as part of wireless LAN (“WLAN”)), 10:3-15 (use of WLAN-based, mobile telephone communication, or Bluetooth protocol), 10:26-30 (WLAN protocol), 10:35-37 (Universal Mobile Telecommunication System (“UMTS”) protocol),

23:34-35 (WLAN), 42:13-19 (WLAN), 42:36-43:4 (Bluetooth), 43:29-35 (Bluetooth or WLAN), 50:4-17.

122. Thus, since Harvey and Kunda share a common motivation of providing a compact device, since the problems identified in the '644 Patent were recognized and solved by Kunda, since the combination of elements in Claims 9 and 10 are nothing more than the predictable use of prior art elements according to their established functions, since the combination of Harvey and Kunda (including using Kunda's antenna in Harvey's bolus) would have had a high likelihood of success, and since Harvey and Kunda share numerous similarities of operation and purpose, a POSA would have been motivated to combine Harvey and Kunda and to try using Kunda's antenna in Harvey's bolus.

2. **The Combination of Harvey and Kunda Meets All Elements of Claims 9 and 10**

123. The Preamble and Elements 9[A]-9[F] of Claim 9 are taught by Harvey, and all other elements of Claims 9 and 10 are taught by Kunda.

3. **Claim 9**

a. **9[Pre]: "A method of monitoring physiological parameters of a ruminant animal, comprising:"**

124. Regardless of whether the preamble of Claim 9—which is identical to that of Claim 5—is limiting, it is taught by Harvey. *See supra* Ground 1, 5[Pre].

- b. **9[A]: “generating a sensor signal from one or more sensors contained in a bolus orally administered to said ruminant animal”**

125. Element 9[A] is identical to Element 5[A]. Both are taught by Harvey.

See supra Ground 1, 5[A].

- c. **9[B]: “said sensor signal varies based on a corresponding change in one or more physiological parameters of said ruminant animal”**

126. Element 9[B] is identical to Element 5[B]. Both are taught by Harvey.

See supra Ground 1, 5[B].

- d. **9[C]: “encoding said sensor signal from said one or more sensors as encoded physiological data corresponding to said one or more physiological parameters of said ruminant animal”**

127. Element 9[C] is identical to Element 5[C]. Both are taught by Harvey.

See supra Ground 1, 5[C].

- e. **9[D]: “storing said encoded physiological data in a non-transitory computer readable media”**

128. Element 9[D] is identical to Element 5[D]. Both are taught by Harvey.

See supra Ground 1, 5[D].

- f. **9[E]: “enabling a radio signal generator located within said bolus”**

129. Element 9[E] is identical to Element 5[E]. Both are taught by Harvey.

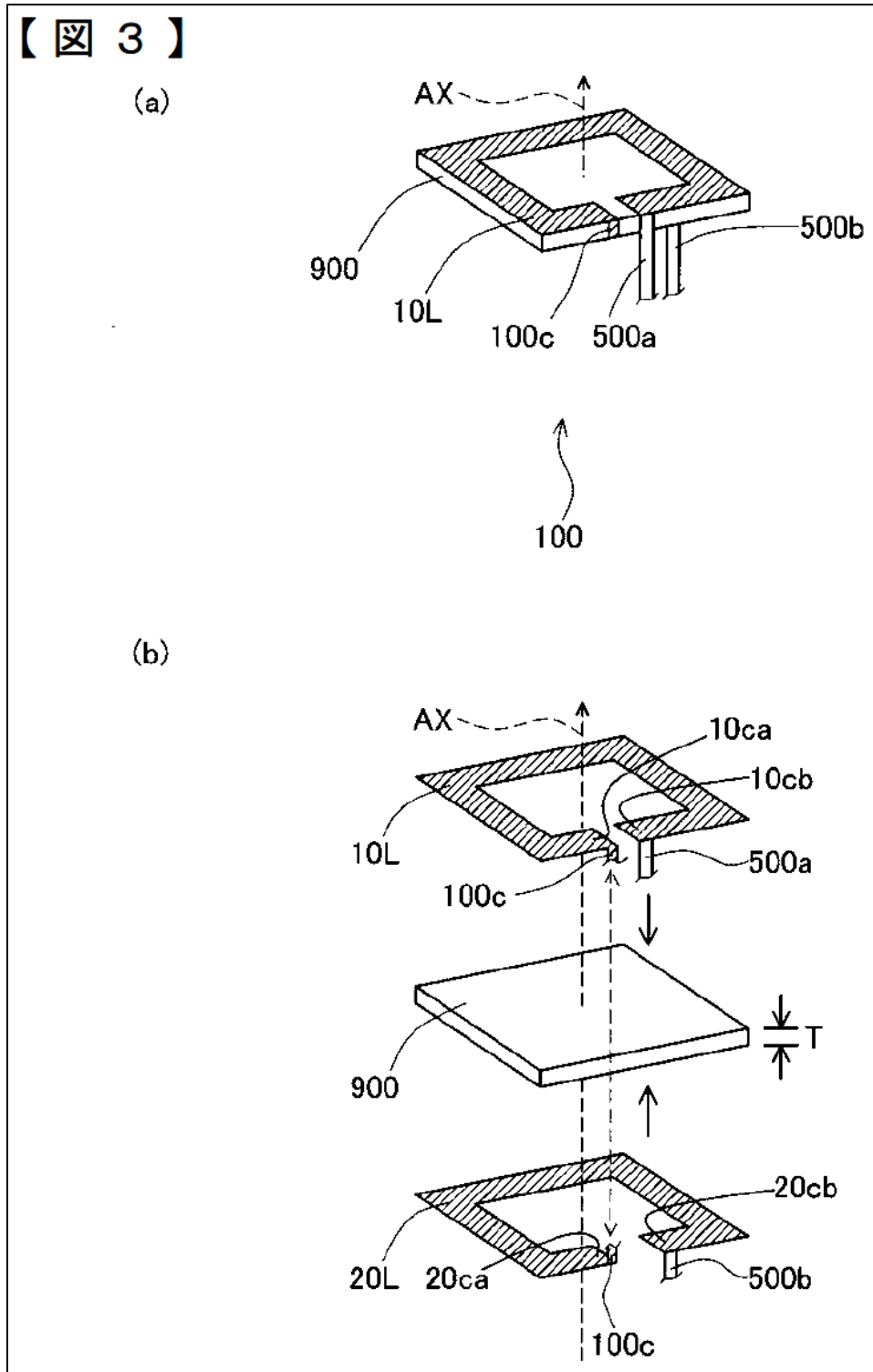
See supra Ground 1, 5[E].

- g. **9[F]: “activating said radio signal generator to generate a radio signal to carry said encoded physiological data”**

130. Harvey teaches activating the radio signal generator to generate a radio signal to carry the encoded physiological data. *See supra* Ground 1, 5[F].

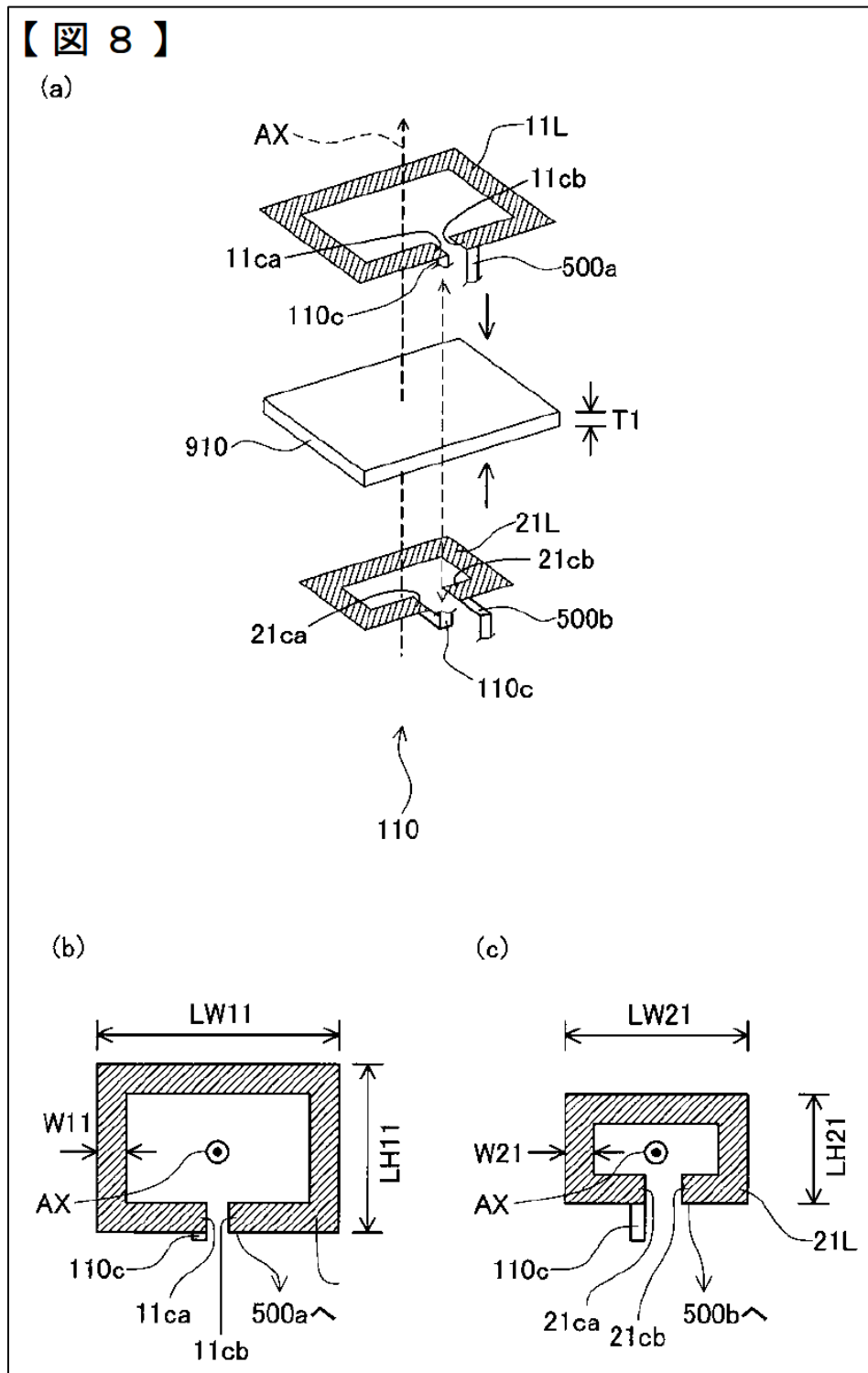
- h. **9[G]: “transmitting said radio signal with an antenna having a pair of electrically conductive loops disposed a distance apart and further comprising transmitting said radio signal through said antenna”**

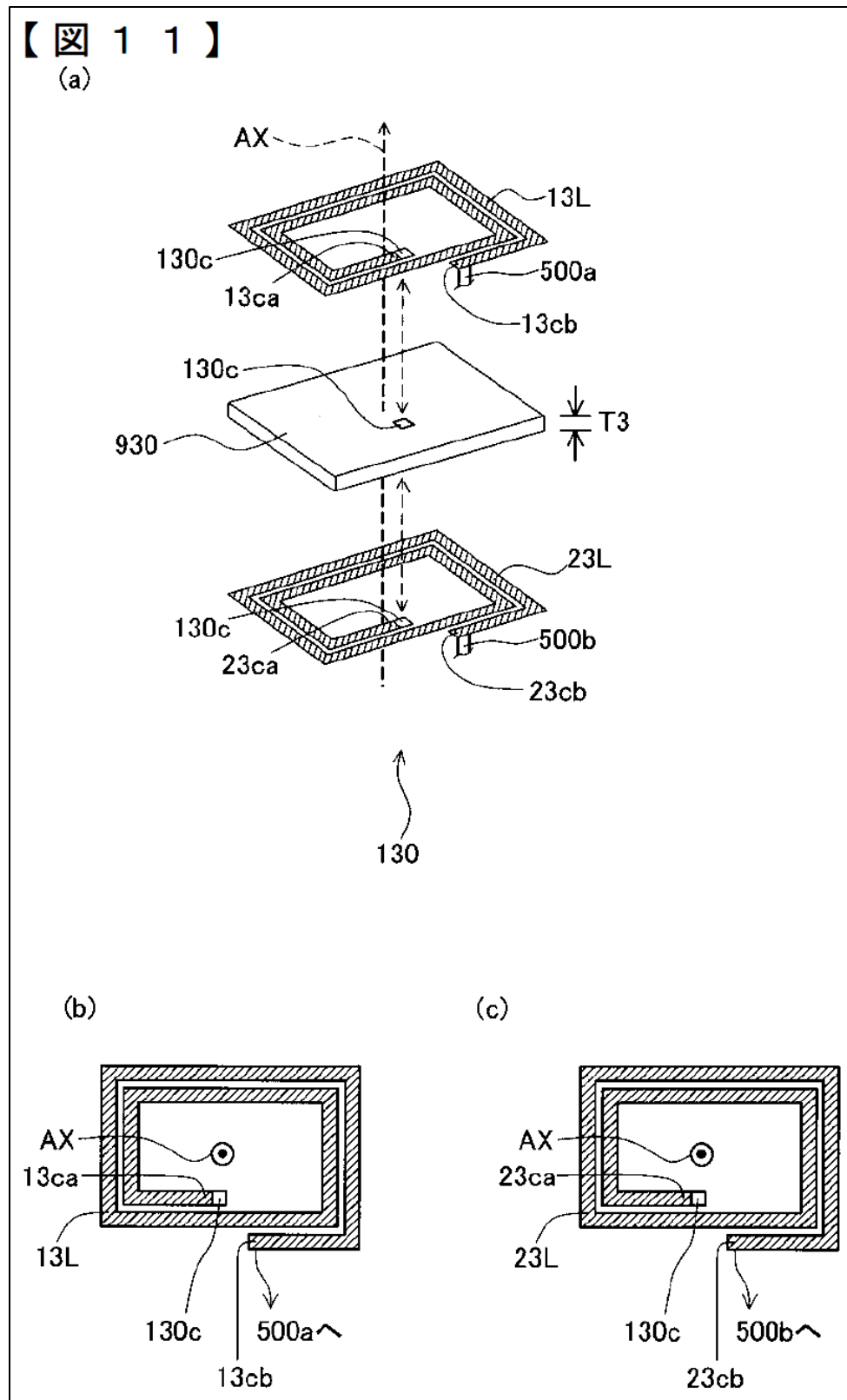
131. Kunda teaches transmitting a radio signal with an antenna having a pair of electrically conductive loops disposed a distance apart and further comprising transmitting said radio signal through said antenna. For example, Kunda discloses a radio communications module which transmits radio signals using an antenna 100 comprising “first loop conductor part 10L and...second loop conductor part 20L, which circle around the same imaginary axis AX.” *See* Ex. 1007, Abstract, Claims 1-7, [0001] (“The present invention pertains to an antenna used to transmit and receive radio frequency signals.”), [0005] (problems solved by antenna include increasing “radiation efficiency”) [0007]-[0021] (describing two-loop antenna used for radio communication), [0023]-[0025] (antenna transmits radio signals), [0028]-[0057] (describing two-loop antenna which transmits radio signals), Figs. 1-7. The configuration of the antenna 100 is illustrated, for example, in Figs. 3(a), (b):



132. The loops 10L and 20L are disposed a distance T apart, where T is the thickness of the dielectric substrate 900 separating the loops. *Id.*, [0033], Figs. 3(a), (b); *see also id.*, Figs. 2, 4, 6(a), 6(c), 6(d), 7(b), 7(c).

133. Kunda describes additional examples of radio-communication antennas, each having a pair of electrically conductive loops disposed a distance apart, in Figs. 8 and 11:





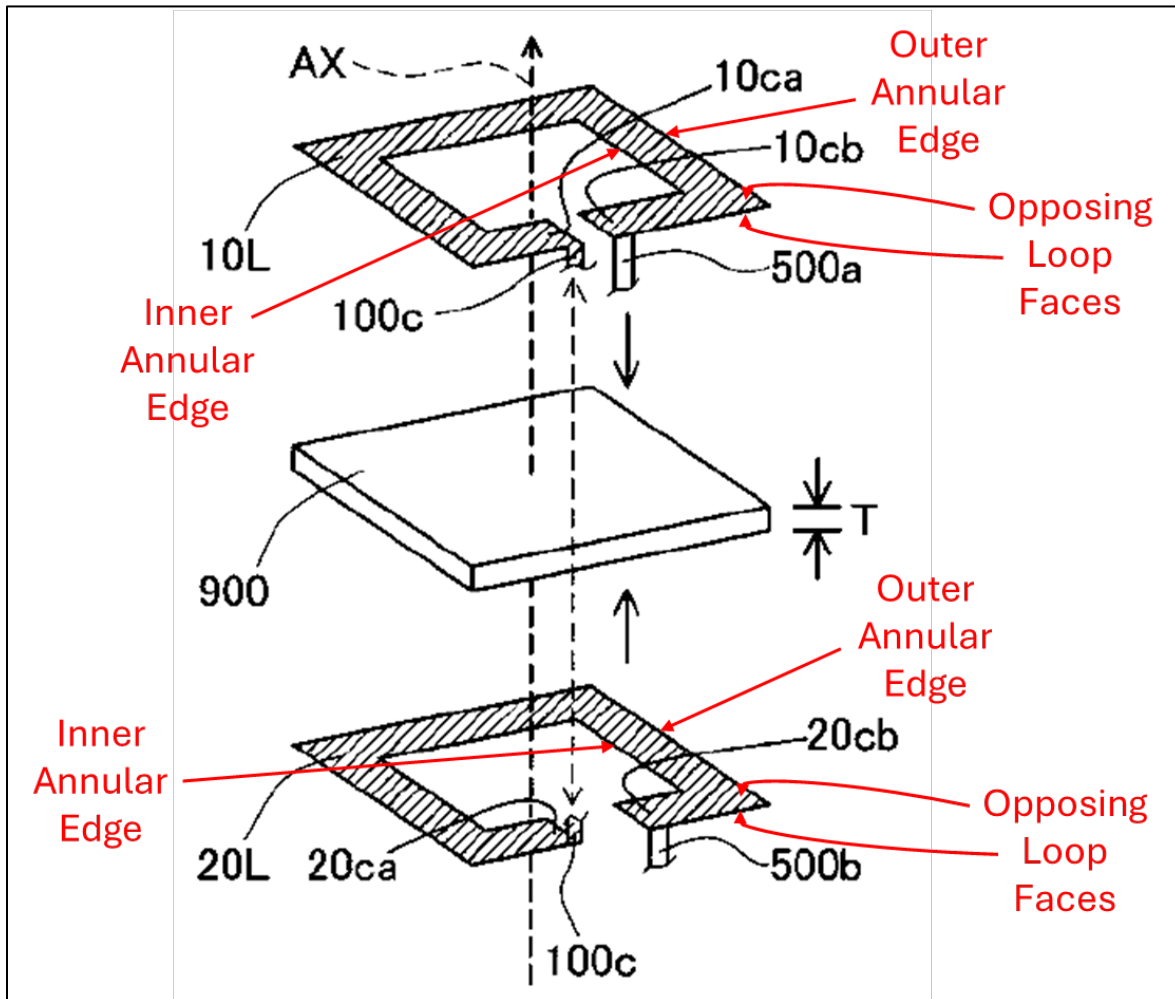
134. The antenna 110 presented in Fig. 8 comprises electrically conductive loops 11L and 21L disposed a distance T1 apart, where T1 is the thickness of the dielectric substrate 910 separating the loops. *Id.*, [0058]-[0062]. Antenna 110 is employed to transmit radio signals. *Id.*, [0063]-[0066]. Similarly, the antenna 130 presented in Fig. 11 comprises electrically conductive loops 13L and 23L disposed a distance T3 apart, where T3 is the thickness of the dielectric substrate 930 separating the loops. *Id.*, [0072]-[0076]. Antenna 130 is employed to transmit radio signals. *Id.*, [0077]-[0078].

4. **Claim 10: “The method of claim 9, wherein said pair of electrically conductive loops each comprise a loop of conductive sheet material having an inner annular edge and an outer annular edge which join opposed loop faces.”**

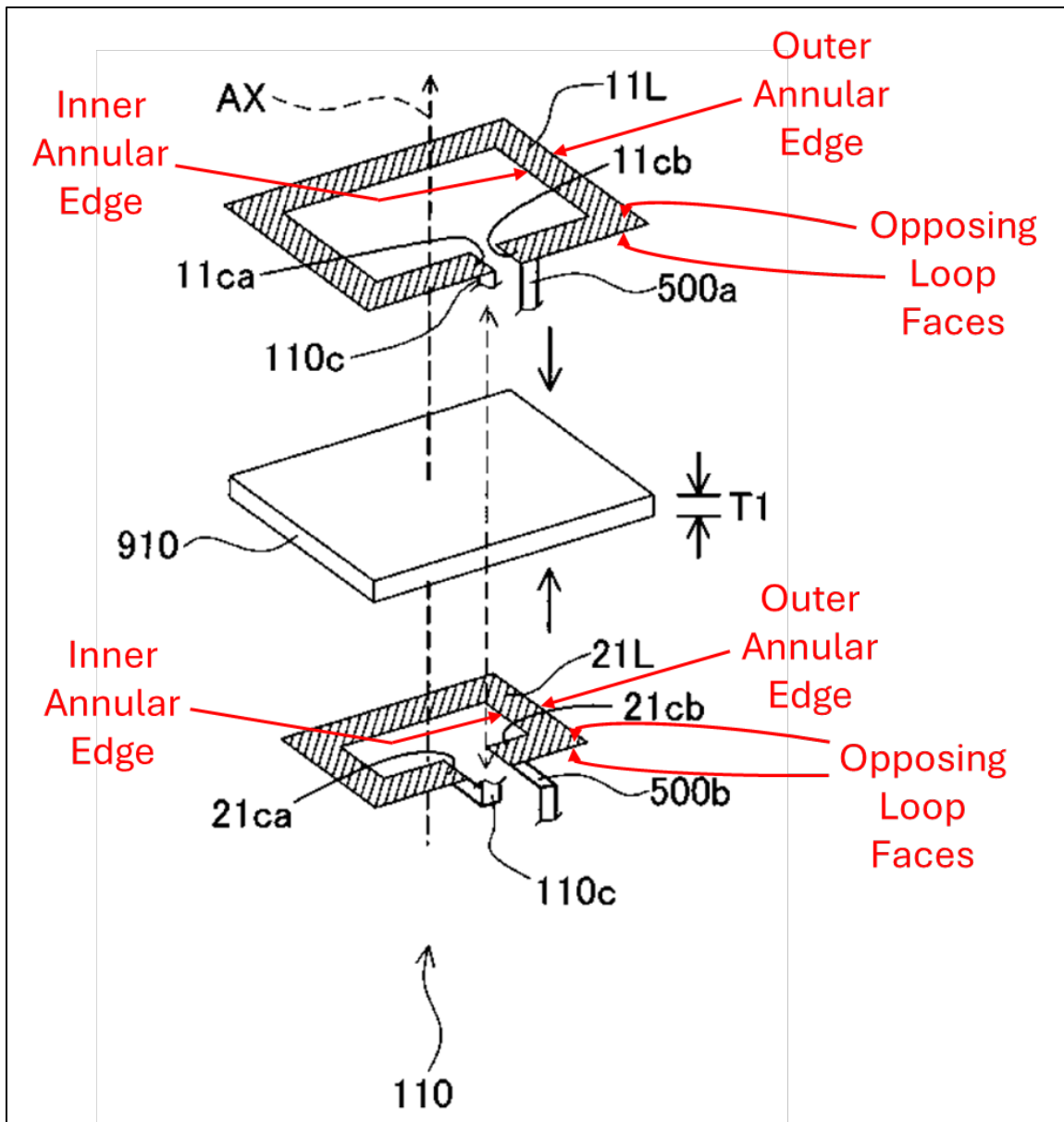
135. All of Kunda’s electrically conductive antenna loops are formed from conductive sheet material—*e.g.*, a layer of copper, silver, or other conductor. Ex. 1007 [0033] (“[F]irst and second loop conductor parts 10L and 20L [are] formed of conductors such as copper and silver.”), [0036] (Conductive loops can be formed, *e.g.*, by (1) “the use of a silver paste to print the forms of conductor parts 10L, 20L, and 100c on the surface of dielectric substrate 900 through screen-printing followed by a baking step at the desired temperature,” (2) masking, with the antenna pattern, a conductive layer formed on a dielectric substrate and then “melting the unnecessary portion of the conductor part,” or (3) “vapor deposition.”). A POSA

would recognize that any and all of those processes would result in a conductive sheet of material as illustrated in Kunda's drawings.

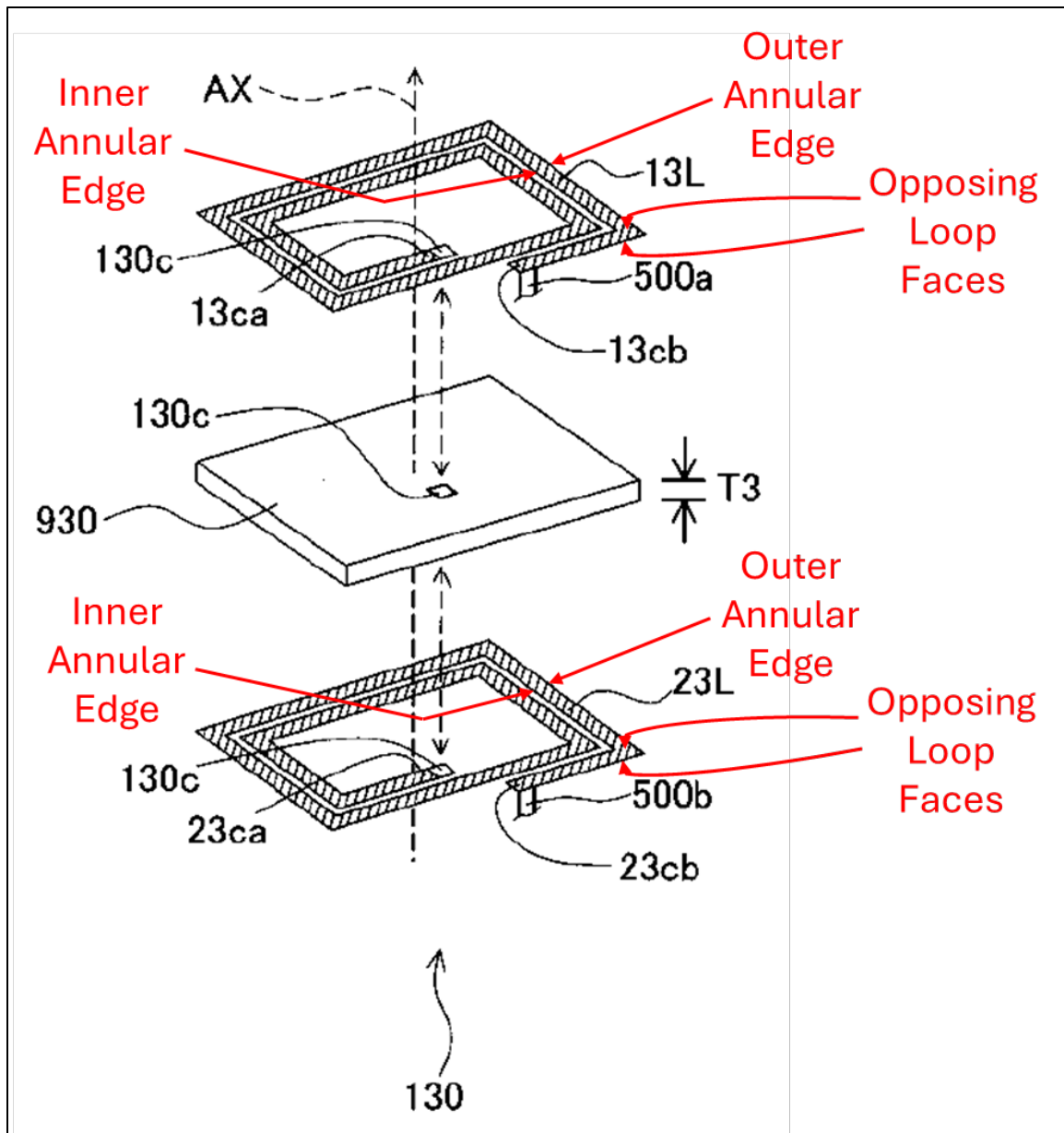
136. Furthermore, each of the loops disclosed in Kunda has an inner annular edge and an outer annular edge which join opposed loop faces:



Id., Fig. 3(b), (annotated).

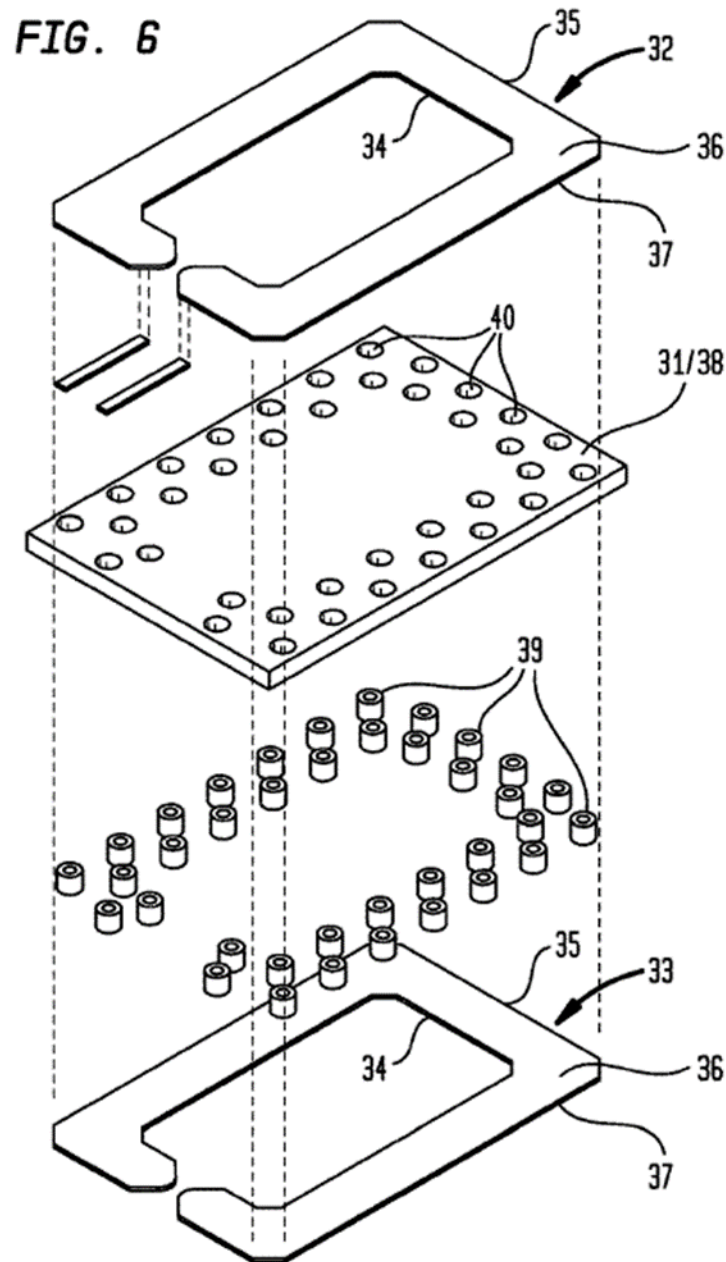


Id., Fig. 8(a) (annotated).



Ex. 1007, Fig. 11(a) (annotated).

137. I further note that the '644 Patent refers to similar inner and outer annular edges 34 and 35 and opposing loop faces 36 and 37 in Fig. 6:



See Ex. 1001, 7:2-7 (“As to particular embodiments, the first or the second or the pair of electrically conductive loops (32)(33) can each include a conductive sheet material (or a laid down conductive path or conductive layer) having an inner annular edge (34) and an outer annular edge (35) which join opposed loop faces (36)(37).”).

138. Thus, since a POSA would have been motivated to combine Harvey and Kunda, *supra* § VIII.E.1, and since the combination of Harvey and Kunda contains all limitations of Claims 9 and 10, Claims 9 and 10 are obvious over that combination

F. Ground 6: Claim 13 is Anticipated by Risky

1. Claim 13

a. 13[pre]: “A method of monitoring physiological parameters of a ruminant animal, comprising:”

139. Regardless of whether the preamble of Claim 13 is limiting, it is taught by Risky. *See supra*, Ground 2, 5[Pre].

b. 13[A]: “administering a bolus to said ruminant animal”

140. This element is taught by Risky. *See supra*, Ground 2, 5[A].

c. 13[B]: “enabling or disabling one or more sensors in said bolus by execution of a computer code contained in a non-transitory computer readable media communicatively coupled to a processor”

141. Risky teaches enabling and disabling the sensors in the bolus by executing computer code contained in a non-transitory computer readable media communicatively coupled to a processor. First, Risky teaches that the bolus contains a number of sensors. *See supra* Ground 2, 5[A]. In addition, as discussed above in Ground 2, Element 5[D], Risky’s bolus has a memory unit 250 comprising read-only storage 254, which may be EEPROM. Ex. 1005 [0052]. A POSA would

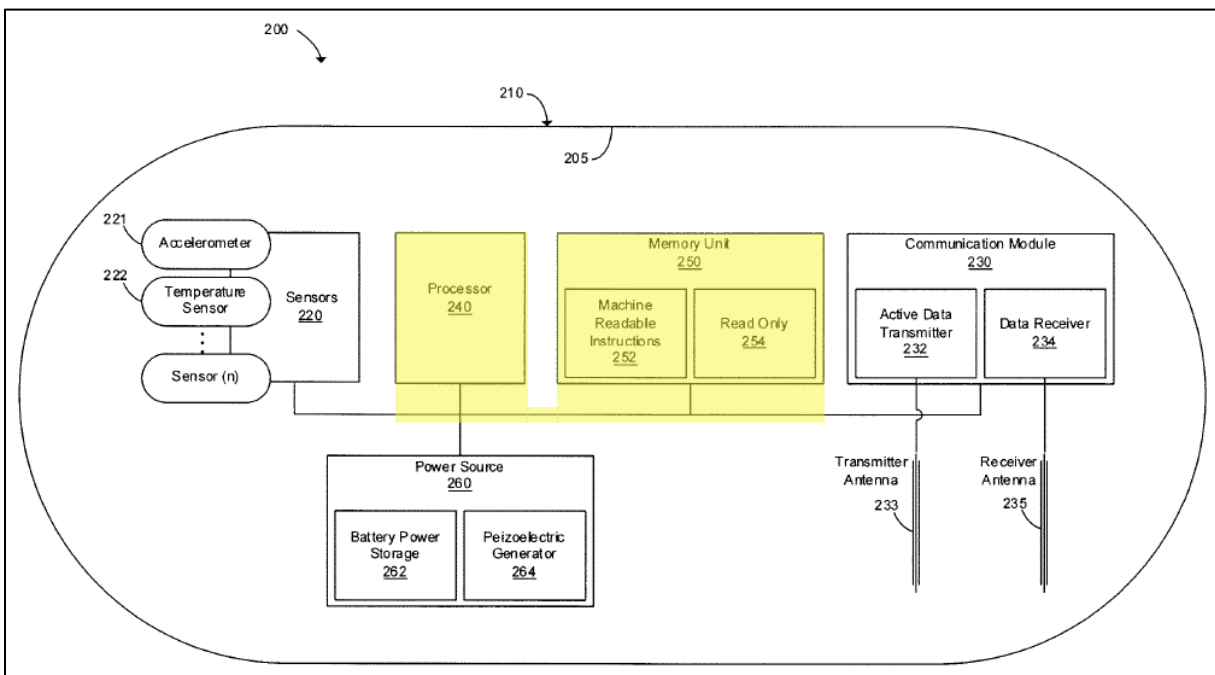
know that an EEPROM is a non-transitory computer readable media. *See, e.g.*, Ex. 1021, 30:32-35 (identifying EEPROM as a type of non-volatile memory).

142. The computer code that operates Risky's bolus—machine readable instructions 525—is contained in memory unit 250. *Id.*, [0038] (“[M]emory unit 250 may comprise machine readable instructions 252 stored thereon.”), [0039] (referring to “[m]achine readable instructions 252 stored on memory unit 250”), [0043]. A POSA would understand that, when Risky describes storing the computer code in memory unit 250, *id.*, [0038], [0039], [0043], it is referring to non-transitory memory such as the EEPROM, because Risky's memory unit 250 does not contain any transitory memory. *Id.*, Fig. 2.

143. Furthermore, a POSA would also recognize that transitory computer readable media requires uninterrupted power to maintain any data or code stored within it, such that if the power is interrupted or lost, all data and code are erased. *See, e.g.*, Ex. 1016, [0174]-[0175] (“Examples of non-volatile memory are flash memory (used as secondary memory) and ROM, PROM, EPROM and EEPROM memory (used for storing firmware such as BIOS) [whereas] [v]olatile memory...requires power to maintain the stored information.”), [0182] (without electrical power backup, “data is lost [from transitory memory] in the event of a power failure”)). Thus, a POSA in the relevant time period would have considered it essential to store the machine readable instructions 525 in non-transitory computer readable media such as the EEPROM within the memory unit 250, because if it were

stored in transitory media, then it would be erased if the battery voltage or charge dropped too low, permanently disabling the bolus. Risky contemplates such power drops when it refers to impending battery expiration and methods for recharging the battery. *Id.*, [0045] (referring to “a possible problem with the bolus 210 (e.g., power source 260 about to expire, etc.)”), [0058] (referring to recharging battery by generating power from animal movement, vibration, or body heat). Therefore, since storage of computer code in a non-transitory computer readable media is necessarily present in Risky’s bolus, it is inherent in Risky.

144. The memory storing the code is communicatively coupled to processor 240, which executes the code:



Ex. 1005, Fig. 2 (annotated); *see also id.*, [0038] (“Bolus 210 may comprise a processor 240 communicatively coupled to a memory unit 250. In one embodiment,

memory unit 250 may comprise machine readable instructions 252 stored thereon. In this embodiment, processor 240 may read and execute machine readable instructions 252 stored on memory unit 250.”), [0053] (“Machine readable instructions 252 may include instructions to be executed by processor 240”).

145. The instructions 252, when executed, cause the processor to “deactivate” or “re-activate”—*i.e.*, disable or enable—one of more of the sensors in order to conserve power. *Id.*, [0042] (“Machine readable instructions 252 may specify that one or more sensors 220 should be deactivated in order to reduce the power consumed by bolus 210. Processor 240 may be communicatively coupled to sensors 220 and may be capable of configuring and/or controlling one or more of sensors 220. Machine readable instructions 252 may specify that one or more sensors 220 should be re-activated.”), [0056] (“[W]hile in ‘off-line’ mode, machine readable instructions 252 may direct processor 240 to deactivate certain sensors 220 in order to conserve power.”), [0145] (“[T]he message of step 885 may activate and/or deactivate one or more bolus sensors....”).

- d. **13[C]: “generating a sensor signal from said one or more sensors which varies based on a corresponding change in one or more physiological parameters of said ruminant animal”**

146. Risky teaches this element. *See supra* Ground 2, Element 5[B].

e. **13[D]: “receiving a radio signal containing programming data”**

147. Risky’s bolus receives from the base station 40 a radio signal containing programming data, including, *e.g.*, updates and revisions to the bolus’s computer code—machine readable instructions 252. Ex. 1005, [0057] (“In one embodiment, bolus 210 may receive new and/or modified machine readable instructions 252 via data receiver 234 of wireless communications unit 230. Such received instructions may include changes to the operation of sensors 220 and/or processor 240 including: sensor sampling frequency; sensor reading duration; sensor activation status; sensor calibration data; processor polling frequency; processor operational mode (i.e., ‘instantaneous’ or ‘burst[’]); and the like.”), [0059] (“[T]he computing device 42 [in the base station] may modify the configuration of the bolus 10, 20 (*e.g.*, modify the bolus 10, 20 polling frequency, sample time, transmission time or the like)....”); *see also id.*, [0053]-[0054] (bolus receives radio signal).

f. **13[E]: “re-programming said computer code contained within said non-transitory computer readable medium based on the radio signal containing programming data”**

148. On receiving programming data comprising an update or revision of the bolus’s computer code (machine readable instructions 252) via a radio signal from the base station, Risky’s bolus uses the received programming data to re-program those instructions within the non-transitory memory in memory unit 250. Ex. 1005, [0057] (“In one embodiment, bolus 210 may receive new and/or modified machine

readable instructions 252 via data receiver 234 of wireless communications unit 230. Such received instructions may include changes to the operation of sensors 220 and/or processor 240 including: sensor sampling frequency; sensor reading duration; sensor activation status; sensor calibration data; processor polling frequency; processor operational mode (i.e., ‘instantaneous’ or ‘burst[’]); and the like.”), [0059] (“the computing device 42 [in the base station] may modify the configuration of the bolus 10, 20 (e.g., modify the bolus 10, 20 polling frequency, sample time, transmission time or the like).”).

G. Ground 7: Claim 13 is Rendered Obvious by Risky

1. A POSA Would have Been Motivated to Store Risky’s Computer Code in Risky’s Non-Transitory Computer Readable Media

149. To the extent that Patent Owner argues that Risky does not expressly teach storing computer code in a non-transitory computer readable media (which it does, *see supra* Ground 6), or the extent that Patent Owner argues that storing computer code in a non-transitory computer readable media is not inherent in Risky (which it is, *see id.*), that limitation would be obvious in view of Risky. As discussed *supra* in Ground 2, Element 5[D], Risky teaches a bolus having a memory unit 250 comprising read-only storage 254, which may be, *e.g.*, an Electrically Erasable Programmable Read-Only Memory (EEPROM). Ex. 1005 [0052]. A POSA would know that an EEPROM Is a non-transitory computer readable media. A POSA would also recognize that transitory computer readable media requires

uninterrupted power to maintain any stored data and code, such that if the power is interrupted, all stored data and code are erased. *See, e.g.*, Ex. 1016, [0174]-[0175] (non-transitory memory such as flash and EEPROM memory are used to store code because transitory memory requires power to maintain stored information), [0182] (without backup, transitory memory loses data in the event of a power failure). Thus, a POSA in the relevant time period would have considered it standard practice—indeed, essential—to store the computer code that operates the bolus in non-transitory computer readable media, because if the code were stored only in transitory media, then it would be erased if the battery voltage or battery charge drops too low, thus losing the stored computer code, permanently disabling the bolus. For example, as the energy stored in a battery is depleted, its ability to maintain its voltage, especially under load, is diminished.

150. The importance of storing the bolus's computer code in non-transitory media to prevent loss of the code is further supported by Risky's teachings. For example, Risky contemplates power drops and other problems with the battery, because it (1) refers to impending battery expiration, and (2) describes various methods for recharging the battery, including generating power from the animal's movement or body heat. Ex. 1005 [0045] (referring to "a possible problem with the bolus 210 (e.g., power source 260 about to expire, etc.)"), [0058] ("[P]ower source 260 may comprise...a generator 264[, e.g.,] a piezoelectric generator or mass/alternator generator to generate power from the movement or vibration of

bolus 210 within a host animal[, or] a heat-activated generator to generate electrical energy from the body heat of a host animal....[P]ower generated by power generator 264 may be stored in battery power storage 262.”). A POSA would recognize that, if the battery voltage or charge were to drop too low to maintain the computer code in RAM, for example, then recharging the battery while the bolus remains in the animal would be futile because the stored computer code would be permanently lost, thus disabling the bolus’s operation. In contrast, if the code is stored in non-transitory media, *e.g.*, EEPROM, it would not be lost. Therefore, the bolus would resume operation once the on-board generator adequately recharges the battery.

151. Thus, a POSA would have been motivated to store the computer code that operates the bolus, including enabling and disabling the sensors, in the EEPROM within Risky’s memory unit 250.

152. Risky also refers to flash memory—a non-transitory computer readable media—as generally applicable to its disclosed embodiments, stating: “One skilled in the art would recognize any data storage and/or retrieval mechanism known in the art could be under the teachings of this disclosure. As such, this disclosure should not be read as limited to any particular data storage and/or retrieval system.” Ex. 1005, [0098]. Thus, in addition to Risky’s EEPROM, discussed above, a POSA would have been motivated to use flash memory in the bolus to store the computer code that operates the bolus.

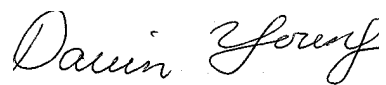
153. In addition, storing computer code in a non-transitory computer readable media was a well-known, predictable, and established technique which would have been familiar to any POSA in 2015. As one non-limiting example, it has been a common practice for many decades—since long before the filing date of the '644 Patent—to store computer BIOS code in an EEPROM. Using non-transitory computer readable media to store computer code was well-understood in the relevant time period such that it would have had a high likelihood of success.

154. Thus, since a POSA would have recognized that it would have been crucial to store the computer code that operates Risky's bolus in a non-transitory computer readable media such as EEPROM or flash memory, and since storing computer code in non-transitory media was well-known and predictable in the relevant time period and would have had a high likelihood of success, a POSA would have been motivated in view of Risky's teachings to use a non-transitory computer readable media to store the computer code that operates Risky's bolus, including enabling and disabling the sensors.

2. **Risky Meets All Elements of Claim 13**

155. The preamble and every element of Claim 13 are taught by Risky. Thus, since a POSA would have been motivated to store Risky's computer code (*e.g.*, machine readable instructions 252) in Risky's non-transitory computer readable media (*e.g.*, the disclosed EEPROM or flash memory), Claim 13 would have been obvious over Risky.

Declaration of Professor Darrin J. Young

A handwritten signature in black ink that reads "Darrin Young". The signature is written in a cursive, flowing style.

Dated: June 25, 2024

Darrin J. Young