IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the application of: Nicholas P. Rettedal, Stephen M. Weilnau, Scott R. Cockroft, and Joseph Janus IV	**Confirmation No.:**
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Filed:	**Examiner:**
For: Calf Bolus	
Attorney Docket No.: bellaUScalf (280-10)	

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

PRELIMINARY AMENDMENT

Before examining the above-referenced application and calculating the fee due, please amend the application as follows:

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 1 of 607

CLAIM AMENDMENT

It is respectfully requested that the claims be amended without prejudice, without admission, without surrender of subject matter, and without intention of creating any estoppel as to equivalents, as follows. This listing of claims will replace all prior versions, and listings, of claims in the application.

Listing of Claims:

1-36 (canceled).

37 (original). A method of monitoring the physiological parameters of an animal, comprising:

obtaining a bolus configured for oral administration to a ruminant animal, said bolus including:

one or more sensors each capable of generating a sensor signal which varies based on a corresponding change in one or more physiological parameters of a ruminant animal;

a memory element;

a processor in communication with said memory element;

a computer code contained in said memory element, said computer code containing a power management module executable by said processor to enable and disable one or more of said plurality of sensors; and

a housing providing an outer most external surface of said bolus; and

orally administering said bolus to said ruminant animal to dispose said bolus in a reticulorumen of said ruminant animal.

38 (original). The method of claim 37, further comprising enabling or disabling said one or more sensors based upon elapsed duration of time from activation of said bolus.

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 2 of 607

39 (original). The method of claim 37, further comprising enabling or disabling said one or more sensors based upon a pre-determined set of said one or more physiological parameters to be sensed during a stage in a life cycle of said ruminant animal.

40 (canceled).

41 (currently amended). The method of claim [[40]] 37, further comprising:

monitoring said sensor signal from said one or more sensors;

comparing said sensor signal from said one or more sensors to a first pre-selected activation code; and

activating said bolus upon generation of said sensor signal from said one or more sensors which by comparison to said first pre-selected activation code exceeds a first pre-selected activation match threshold.

42 (original). The method of claim 41, further comprising:

comparing said sensor signal from said one or more sensors to a second pre-selected activation code; and

activating said bolus upon generation of said sensor signal from said one or more sensors which by comparison to said first and said second pre-selected activation codes exceeds said first and a second pre-selected activation match threshold.

43 (original). The method of claim 42, further comprising:

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; and

storing said encoded physiological data in said memory element.

44 (original). The method of claim 43, wherein said bolus further comprises a radio signal generator capable of generating a radio signal to carry said encoded physiological data, and further comprising:

enabling said radio signal generator; and

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 3 of 607

activating said radio signal generator at pre-determined intervals to generate said radio signal to carry said encoded physiological data.

45 (original). The method of claim 44, wherein said bolus further comprises an energy source which supplies energy to operate said bolus, and further comprising:

determining a remaining amount of energy stored in said energy source;

determining an amount of energy required by said bolus to operate through a pre-determined period of time based on current programming of said computer code;

comparing said amount of energy required by said bolus to operate through said pre-determined period of time to said remaining amount of energy stored in said energy source; and

calculating a difference in said amount of energy remaining in the power source and said amount of energy required by said bolus to operate through said pre-determined period of time.

46 (original). The method of claim 45, further comprising performing one or more power regulation events to offset said difference in said amount of energy remaining in the power source and said amount of energy required by said bolus to operate through said pre-determined period of time.

47 (canceled).

48 (currently amended). The method of claim [[47]] 46, further comprising generating a radio signal having a frequency of between about 700MHz to about 1GHz.

49 (original). The method of claim 48, wherein said frequency is selected from the group consisting of: between about 700 MHz to about 800MHz, 750 MHz to about 850MHz, about 800 MHz to about 900MHz, 850 MHz to about 950MHz, 900 MHz to about 1GHz.

50 (original). The method of claim 49, wherein said bolus further comprises matching elements configured to adjust said frequency of said radio signal, and further comprising

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 4 of 607

adjusting said frequency to compensate for change in said frequency upon passing through a mass of said ruminant animal.

51 (original). The method of claim 50, wherein said radio signal generator generates said radio signal having only one frequency.

52 (original). The method of claim 51, wherein said bolus further comprises an antenna having a pair of electrically conductive loops disposed a distance apart and further comprising transmitting said radio signal through said antenna.

53 (original). The method of claim 52, 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.

54 (original). The method of claim 53, wherein said antenna further comprises one or more vias interconnecting said pair of electrically conductive loops.

55 (original). The method of claim 54, wherein said antenna further comprises a non-conductive sheet material disposed between said pair of electrically conductive loops.

56-63 (canceled).

64 (original). The method of claim 46, wherein said bolus further comprises a radio signal receiver and further comprising:

receiving radio signal containing programming data; and

re-programming said computer code contained within said memory element.

65 (original). The method of claim 64, further comprising re-programming said computer code based upon based upon said pre-determined set of said plurality of physiological parameters to be sensed during said stage in said life cycle of said ruminant animal.

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 5 of 607

66 (original). The method of claim 65, further comprising re-programming said computer code to offset said difference in said amount of energy remaining in the power source and said amount of energy required by said bolus to operate through said pre-determined period of time.

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 6 of 607

REMARKS

1. Applicant has without prejudice canceled claims 1-36, 40, 47 and 56-63 of the original application. Applicant does not waive any right to have the canceled claims 1-36, 40, 47 and 56-63 examined in a subsequent continuation, divisional, continuation-in-part, or other type of continuing application, without reduction of the scope or breadth of the claims, or to present other claims supported by the description which may have greater breadth than the claims originally filed, or to rejoin certain claims as allowed under the rules.

2. Claims Amendment. Applicant amends claims 41 and 48 as to form only.

Applicant respectfully requests entry of these amendments to the file and examination of claims 37-39, 41-46, 48-55 and 64-66.

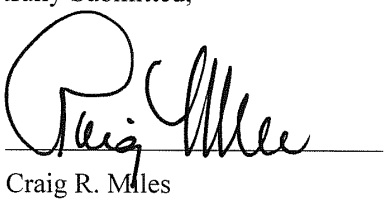
Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 7 of 607

CONCLUSION

Applicant submits this Preliminary Amendment to without prejudice cancel claims 1-36, 40, 47 and 56-63 of the original application and to request examination of claims 37-39, 41-46, 48-55 and 64-66.

Dated this 12 day of June, 2015

Respectfully Submitted,

By: 

Craig R. Miles
ATTORNEY FOR APPLICANT
USPTO Reg. No. 45,954
CR MILES, P.C.
405 Mason Court, Suite 119
Fort Collins, CO 80524
(970) 492-0000 telephone
(970) 492-0003 facsimile

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 8 of 607

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(71) Applicant: **Nederlandse Organisatie voor Toegepast -Natuurwetenschappelijk Onderzoek TNO**
2628 VK Delft (NL)

(72) Inventors:
- **Sewalt, Karl Everhardus**
  3119 BT Schiedam (NL)
- **van Tilburg, Mark Wilhelmus Theresia**
  5691 ZC Son (NL)

(74) Representative: **Hatzmann, Martin**
Vereenigde
Johan de Wittlaan 7
2517 JR Den Haag (NL)

(54) Bolus System

(57) Method for installing a bolus system into a stomach or other organ of an animal, comprising the steps of (a) providing at least two boluses (1, 5) comprising magnetic attraction means (4, 6) for mutual attracting each other when present in each other's proximity, (b) administering at least one of the boluses (1) to the animal at a first moment and (c) administering always at least one of the boluses (5) to the animal at later moments. At least one of the boluses administered to the animal at the first moment may include data exchange means (3) and possibly data collection means related to the health of the animal.

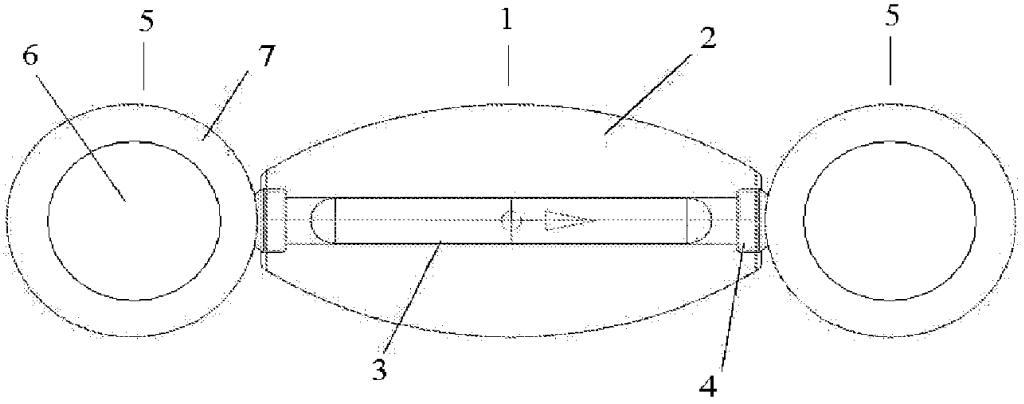


FIG. 1

EP 2 314 154 A1

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Description

[0001] The identity and physiological condition of livestock is of paramount importance to owners, buyers, and processors of livestock. It is known to visually identify livestock using brands or ear tags. It is also known to identify livestock using radio frequency identification (RFID) tags, e.g., in the form of an ear tag, an injectable tag, or an ingestible bolus which is intended to be received in a stomach, e.g. the reticulum (second pre-stomach) of a ruminant. By including a sensor with the RFID tag, it is possible to collect indications of physiological characteristics, e.g., temperature etc. Besides for animal identification, monitoring etc., boluses may be used for internal delivery of nutrients, vitamins, medicines etc.

[0002] Known boluses, which may include RFID chips etc. for animal identification and/or monitoring, are too large to administer to newborn ruminant calves (0 - 3 days). The bolus may be stuck in and/or harm the oesophagus; newborn calves, besides, have a limited peristalsis. Known are "miniboluses" for e.g. lams and goats. Such miniboluses, however, are too small to be used for cows, as they, due to their small volume and/or low density, may be lost during ruminating, end up in another stomach or be lost via the excrements.

[0003] One aim of the present invention is to provide a bolus system which is adaptable in size and/or density (weight), in order to be suitable to be used for newborn bovine animals (e.g. calves) as well as for mature bovine animals.

[0004] Another aim of the invention is to provide a bolus system comprising single boluses having limited dimensions, which can administered individually at subsequent points of time, thus enabling enhanced and more secure administration and installation in the (small) animal's reticulum, and enabling that, by delayed administration of additional boluses and "magnetic coagulation" within the stomach of the (growing) animal the bolus system, having then more interconnected boluses, has sufficient volume and density to prevent that the bolus system unintentionally disappears from the reticulum.

[0005] According to the invention, a bolus system, intended for installing into a stomach or other organ of an animal, is provided, which system preferably comprises at least one bolus having magnetic attraction means for attracting one or more other boluses when present in each other's proximity. The magnetic attraction means may comprise a permanent magnet in at least one bolus. At least one (other) bolus may comprise a magnetic (e.g. a ferromagnetic) attraction member or may be formed by another permanent magnet. Small neodymium magnets may be used, which may be coated by a plastic or ceramic outside layer which is inert for the biochemical compounds and processes within the animal's stomach.

[0006] Known as such, from US2004/0155782 and US2006/0132317, is that at least one bolus may include data exchange means and possibly data collection means, sensors, detectors etc.

[0007] A method for installing a bolus system into a stomach or other organ of an animal, preferably comprises the steps of:

- providing at least two boluses comprising magnetic attraction means for mutual attracting each other when present in each other's proximity;
- administering at least one of said boluses to said animal at a first moment;
- administering always at least one of said boluses to said animal at later moments.

[0008] Preferably at least one of the boluses administered to the animal at the first administration moment (e.g. administered to a newborn calf) includes data exchange means, e.g. an RFID tag for animal identification, and, possibly, data collection means, e.g. for animal health monitoring. Moreover, such bolus may be used for internal delivery of nutrients, vitamins, medicines etc.

[0009] Hereinafter, the invention will be elucidated further with reference to some figures, wherein:

Figure 1 shows, in cross sectional view, an exemplary embodiment of the bolus system according to the invention, including a central bolus and two satellite boluses;

Figure 2 shows, in perspective view, a central bolus to be administered solely to a newborn animal;

Figure 3 shows the central bolus shown in figure 2, provided with one satellite bolus, interconnected by mutual magnetic attraction force;

Figure 4 shows the bolus system shown in figure 3, provided with a second satellite bolus, administered to the animal when growing up.

[0010] Figure 1 shows a central bolus 1, having a body 2 made from e.g. a ceramic material, which covers an RFID chip 3 or another data transmission chip, possibly including capabilities for data collection related to the animal's health etc., as e.g. suggested in US2004/0155782 and US2006/0132317. The bolus, moreover, includes two magnets 4. This central bolus 1, may be administered to a newborn calf, within 1 - 3 days after its birth, in order to be remotely identifiable.

[0011] After a certain time the calf will have become larger. To avoid that the central bolus might be disappear from the reticulum of the calf, one satellite bolus 5 will be administered to the calf. Such a satellite bolus 5 includes a body 6 which is covered by e.g. a ceramic layer 7. The "magnetic attraction" body 6 is made of a permanent magnetic material like neodymium, or is made of a ferromagnetic material like iron, nickel or ferrite. After the satellite bolus 5 has been arrived in the reticulum of the calf, the satellite bolus 5 will be connected, by their mu-

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 10 of 607

tually attracting magnetic forces, to the central bolus 1 which was administered to the calf within 3 days after its birth. By this magnetic connection of the boluses 1 and 5 the total volume and density of the total bolus system 1-5 may be sufficient to prevent ejection of the bolus system from the animal's reticulum.

[0012] Still some time later, when the calf has become a young cow, a second satellite bolus 5 may be administered to the animal, which, again, is attracted by the central bolus 1, after which the volume and density of the bolus system 5-1-5, has been increased such that the whole can not leave the reticulum.

[0013] It is also possible to feed individually all separate parts, i.e. the central bolus 1 and the satellite boluses 5, within 1 - 3 days after the calf is born, instead of waiting until the calf has grown.

[0014] It is noted further that more (than two) satellite boluses may be fed to the animal. More satellite boluses 5 may be attracted one another by the magnetic field or fields generated in the central bolus 1 and possible in one or more satellite boluses.

[0015] Figure 2 shows again the central bolus 1, to be administered to a newborn animal, including magnets 4 extending to its outer surface (however preferably covered by a suitable coating of cover).

[0016] Figure 3 shows the central satellite bolus 1, shown in figure 1, administered to the animal when newly born, and one satellite bolus 5 coagulated, after being administering after some months to the animal, and coagulating with the central bolus 1 by their mutual magnetic attraction force of one of the permanent magnets 4.

[0017] Figure 4 shows the bolus system, completed with a second satellite bolus 5, administered to the animal when it has become more or less mature, and thus forming a bolus system which has sufficient volume and density to prevent that it can be lost from the reticulum.

[0018] It is noted that, in particular when the satellite boluses include magnetic bodies having permanent magnetic characteristics, e.g. when they are made of neodymium, it is possible, when desired to add more (than two) satellite boluses to the bolus(es) already in the reticulum.

[0019] It is noted that in US2004/0155782 and US2006/0132317 applying a permanent magnet, included in a bolus, is known as such. However, the aim of that permanent magnet, mounted in the bolus at a location separated from the transponder electronics, is to reduce the risk of hardware disease in the bolus host by attracting metal objects.

Claims

1. Bolus system, intended for installing into a stomach or other organ of an animal, comprising at least one bolus (1, 5) having magnetic attraction means (4, 6) for attracting one or more other boluses (5) when present in each other's proximity.

2. Bolus system according to claim 1, comprising at least two boluses (1, 5) having magnetic attraction means (4, 6) for attracting one another when present in each other's proximity.

3. Bolus system according to claim 1 or 2, at least one bolus (1) comprising at least one permanent magnet (4).

4. Bolus system according to claim 3, at least one bolus (5) comprising a magnetic attraction member (6).

5. Bolus system according to any preceding claim, at least one of said boluses (1, 5) including data exchange means (3).

6. Bolus system according to any preceding claim, at least one of said boluses (1, 5) including data collection means.

7. Bolus system according to any preceding claim, at least one of said boluses (1, 5) being arranged for internal delivery of nutrients, vitamins, medicines etc.

8. Method for installing a bolus system into a stomach or other organ of an animal, comprising the steps of:

   - providing at least two boluses (1, 5) comprising magnetic attraction means (4, 6) for mutual attracting each other when present in each other's proximity;
   - administering at least one of said boluses (1) to said animal at a first moment;
   - administering always at least one of said boluses (5) to said animal at later moments.

9. Method according to claim 8, at least one of the boluses administered to the animal at said first moment includes data exchange means (3).

10. Method according to claim 9, at least one of the boluses administered to the animal at said first moment includes data collection means.

11. Method according to claim 8, at least one of said boluses being arranged for internal delivery of nutrients, vitamins, medicines etc.

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 11 of 607

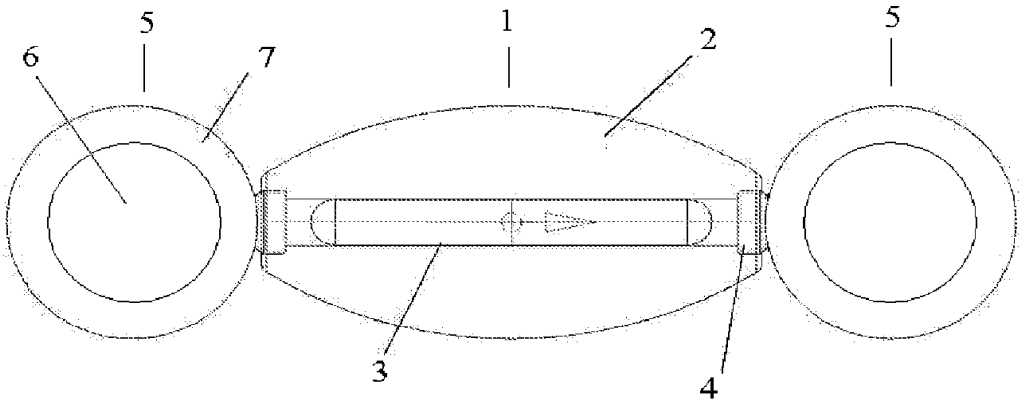


FIG. 1

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 12 of 607

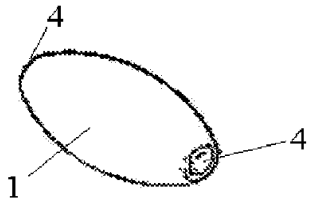


FIG. 2

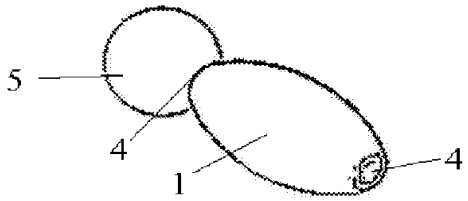


FIG. 3

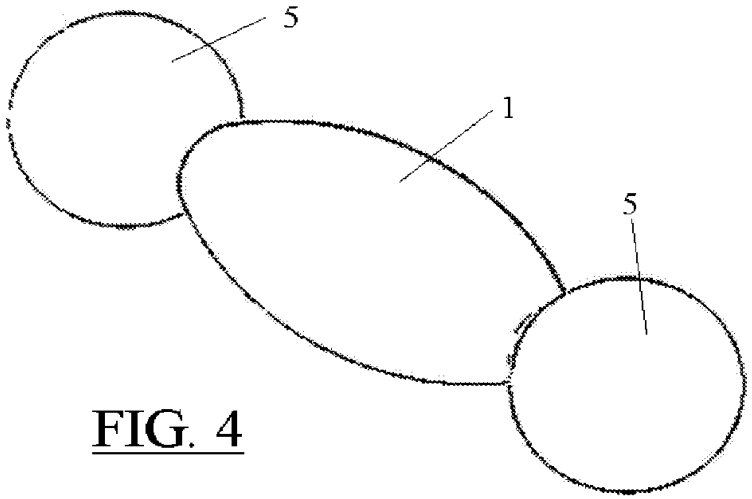


FIG. 4

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 13 of 607

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European Patent Office
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EUROPEAN SEARCH REPORT

Application Number
EP 09 17 4031

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	WO 98/47351 A1 (AVID IDENTIFICATION SYST INC [US]; HAYES NORMAN J [US]; TROESCH PETER) 29 October 1998 (1998-10-29) * page 1, lines 6-21 * * page 3, line 23 - page 7, line 13 * * page 9, line 15 - page 11, line 16 * * page 13, line 5 - page 15, line 22 * * claims 1-8,14,21-22; figures 4-6, 18-20 * -----	1-7	INV. A01K11/00 A61K9/00
X	US 2004/133131 A1 (KUHN DAVID L [US] ET AL) 8 July 2004 (2004-07-08) * paragraphs [0005], [0010] - [0015], [0033] * * claim 1; figure 1 * -----	1-7	
X	US 2007/008155 A1 (TROST STEVEN M [US] TROST STEVEN MICHAEL [US]) 11 January 2007 (2007-01-11) * paragraphs [0006] - [0009], [0032] - [0038], [0043] - [0046], [0 51] * * claim 1; figures 1-5 * -----	1-7	TECHNICAL FIELDS SEARCHED (IPC) A01K A61K

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	26 April 2010	Batres Arnal, Lucía

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 14 of 607

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 09 17 4031

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26-04-2010

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 9847351 A1	29-10-1998	AU 7250998 A	13-11-1998
		CA 2329906 A1	29-10-1998
		EP 0977478 A1	09-02-2000
US 2004133131 A1	08-07-2004	NONE	
US 2007008155 A1	11-01-2007	NONE	

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 15 of 607

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- US 20040155782 A **[0006] [0010] [0019]**
- US 20060132317 A **[0006] [0010] [0019]**

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 16 of 607

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(71) Applicant *(for all designated States except US)*: **smaXtec animal care sales GmbH** [AT/AT]; Wastiangasse 4, A-8010 Graz (AT).

(72) Inventors; and
(75) Inventors/Applicants *(for US only)*: **ROSENKRANZ, Stefan** [AT/AT]; Schillerstrasse 58, A-8010 Graz (AT). **FALLAST, Mario** [AT/AT]; Kurzeggerweg 5N, A-8044 Graz (AT).

(74) Agent: **PATENTANWALTSKANZLEI MATSCHNIG & FORSTHUBER**; Siebensterngasse 54, A-1071 Wien (AT).

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Published:

— *without international search report and to be republished upon receipt of that report (Rule 48.2(g))*

(54) **Title**: DEVICE FOR THE MEASUREMENT OF INDIVIDUAL FARM ANIMAL DATA

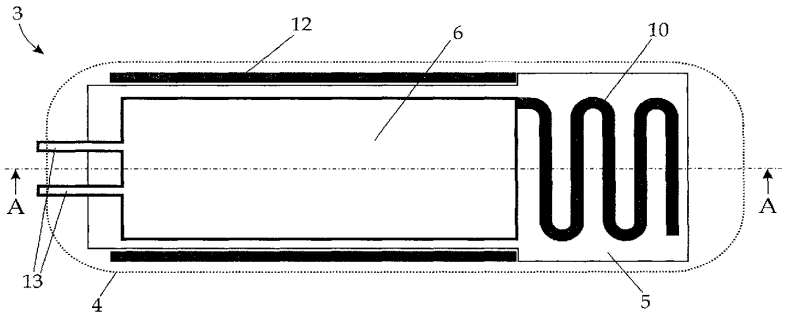


Fig. 2

(57) **Abstract**: The invention relates to a measuring device (3) for the measurement of at least one physiological parameter of a farm animal's organism, whereby the measuring device (3) is placeable in the gastro-intestinal tract of livestock and comprises the following components arranged in a casing (4): at least one sensor (8, 8') for the measurement of at least one physiological parameter of a farm animal, at least one transmitter (9) with antenna (10) for the wireless transmission of information, at least one control unit (7) for controlling the measuring device (3), and at least one power supply device (11) for the measuring device (3), whereby a hollow protective guard (12, 12') is provided inside the casing (4) which covers at least the power supply unit in order to protect it from mechanical impact.

WO 2011/079338 A2

DEVICE FOR THE MEASUREMENT OF INDIVIDUAL FARM ANIMAL DATA

The invention concerns a device for measuring at least one physiological parameter of a farm animal's organism, whereby such device can be placed in the gastro-intestinal tract of the farm animal and contains at least one sensor for measuring at least one physiological parameter of the farm animal's organism, at least one transmitter with antenna for the wireless transmission of information, at least one control unit for controlling the device, and at least one power supply device for supplying the device with power.

The invention further relates to a system, comprising at least one of the aforementioned devices and a base station, the base station and the device communicating with each other via a wireless procedure. A base station may for example be a data processing unit which communicates with one or several devices by means of antennas and processes and stores the transmitted information.

Livestock farming, in particular of dairy cattle, is currently subject to structural changes, especially in Europe with a tendency to large-scale farming. In this context, herd management turns out to be increasingly difficult, e.g. when it comes to controlling the health of individual animals or to allocating feeds. With increasingly large herds, symptoms of illness in individual animals are frequently not detected in time, and customized feeding is hardly possible. In order to ensure both appropriate feed and care for the animals and to make farming economically viable, it is enormously important for farmers to keep themselves precisely informed about their animals' state of health.

Let us take the example of cattle farming: especially in high-yield dairy cattle herds, e.g. Subacute Ruminal Acidosis (SARA) is a widespread problem, and mostly cumulative in a herd. The negative effects of SARA on the livestock's health are multifarious and represent a central factor that reduces production figures in cattle farming. For various reasons, SARA is a pathological and disease-causing state that is not always diagnosed accurately. The lack of simple and specific diagnostic methods, and/or the proneness of applicable diagnostic methods to mistakes have led to a situation where the diagnosis so far is usually made indirectly and retrospectively (e.g. via the fat content of the milk, fat protein ratio) and/or based on secondary clinical symptoms (e.g. thin, mushy excrement containing an increased percentage of undigested elements).

In order to solve these problems, devices were developed that can be placed directly in the gastro-intestinal tract of livestock in order to measure physiological data. For example DE 199 01 124 A1 describes such a device, consisting of a probe in bolus form, which is

inserted into the gastro-intestinal tract of cattle, and of a controllable monitoring device, which communicates with the probe via a wireless procedure. A bolus form is commonly understood to be a pill form, thus essentially an object with an oval cross-section along its longitudinal axis. The probe contains sensors for the measurement of one or several different physiological parameters, such as pressure, temperature, conductivity, pH value, or ammonia content in the gastro-intestinal tract.

Similar solutions are described in US 2004/0133131 A1, WO 01/13712 A1, US 5,984,875, WO 2006/046057, and GB 2455700. US 6,694,161 B1 additionally shows an illustrative embodiment, in which the pH sensor and a transmitter located outside the animal are connected via a cannula needle.

The said devices are mostly fragile devices that are only insufficiently protected from heavy mechanical influence. Damage during their utilization caused by sharp-edged individual parts or harmful substances may thus jeopardize the health of the farm animal in question.

It is thus an aim of the invention to come up with a device that overcomes the said disadvantages of prior art.

According to the invention this problem is solved by a device of the initially-mentioned kind, wherein a hollow protective guard, covering at least the power supply device to protect it from mechanical impact, is arranged inside the casing.

Thanks to the invention it is possible to ensure real time livestock monitoring. Due to the wireless transmission of the information registered by the device cost-effective integration into similar or existing feeding systems which are also based on wireless procedures is possible. In such a case transmission is ensured by the transmitter, however, a transceiver device may also be provided for, which has the advantage of both transmitting and receiving data.

On the one hand, the protective guard protects the sensitive parts of the device from mechanical impact, for example from bites in case the device lands in the mouth or between the teeth of livestock. At least the power supply device, which frequently contains harmful substances, should be covered by the protective guard, in order to protect the animal from injury, e.g. from poisoning, in case of excessive mechanical strain to the device.

On the other hand, the protective guard allows for increase and/or customization of the weight – i.e. the specific weight – of the device, in order to ensure optimal positioning of the

device in the gastro-intestinal tract of the farm animal. This enables proper data acquisition by the at least one sensor.

In addition, if the protective guard is manufactured from a conductive material, it is possible to improve the electromagnetic conditions for the device (or the antenna of the transmitter, respectively), in order to positively influence the radiation pattern of the antenna.

Advantageously, the protective guard does not entirely cover the elements to be protected, but is executed in such a way that they may be inserted into the protective guard and removed if necessary. The protective guard thus ideally has cylinder form, with a circular or polygonal cross-section. Ideally, the bottom and cover surfaces are left open. In the following description, the term polygonal cross-section is intended to mean a polygonal cross-section which may be triangular, quadrangle, hexagonal, octagonal or designed to have more angles. Due to the regular design, an improved reception and distribution of mechanical impacts is achieved and damage to the elements covered by the protective guard is avoided.

In one variant of the invention, the protective guard is made of metal. Possible materials are for example steel or brass, which are easy to process and available at low price, thus permitting a time- and cost-saving production of the device according to the invention. A condition for its utilization is the aforementioned requirement of resistance against mechanical impact. For the above-mentioned reasons, the choice of the material also depends upon the specific weight of the material used and upon its effect on the total weight of the device.

In another variant of the invention, the protective guard covers not only the power supply device, but also the transmitter and the control unit, and thus protects further sensitive parts of the device from damage. At the same time, the enlarged surface of the protective guard may lead to an increased weight of the device. As mentioned above, the protective guard is preferably designed in such a way as to enable easy insertion and, if necessary, removal of the parts to be protected. If the protective guard is executed in cylinder form, this may be achieved by leaving open the bottom and cover surfaces.

Basically different antenna types may be used – for example the antenna may be executed as dipole or directional antenna. Also the dimensioning is more or less left to discretion and may be $\lambda/2$, for instance. However, it is important to consider the limited space in the casing of the device. The length of the transmitter antenna should preferably be dimensioned to $\lambda/4$ of the used frequency.

The transmitter transmits information via frequencies in the range of 20 MHz to 1 GHz. In a variant of the invention the transmitter transmits information via frequencies ranging from 300 MHz to 450 MHz. In Europe a frequency of 433 MHz is used, for instance. For applications in the USA a frequency of 315 MHz may be used. Furthermore the use of ISM-radio bands (Industrial-, Scientific- and Medical band) in the range of 868 MHz or 915 MHz is possible.

Good results are achieved with antennas in meander form with at least one loop. Meander form is intended to mean a form consisting of one or more interconnected loops in serial arrangement. The term meander derives from the bends in a sinuous watercourse. The loops of the meandered antenna may in this case be angular or circular. The antenna is dimensioned according to the frequency used. The meander form enables the use of long antennas in a small space. The meandered antenna has the omnidirectional radiation pattern that is required for the proper functioning of the device and is easy to tune, a property which is for example necessary for protective guards made of metal which, together with the power supply unit, influence the radiation pattern.

In one variant of the invention, the device is equipped with at least one switch which is connected to the control unit and may be actuated from outside the device. The switch serves for example for activating and/or deactivating the device. Basically the switch may be of any kind, as long as it withstands the conditions under which the device is used. In the present case, this would be the acid environment of the gastro-intestinal tract of a farm animal, such as a cow.

The switch may be configured as a magnetic switch (eg. a Reed-switch) which is located inside the measuring device 3. Here, the term magnetic switch denotes a switch that can be switched by a magnetic field. In the present case the measuring device 3 may be activated (or deactivated) by applying a magnetic field at a certain position of the measuring device. A Reed-switch basically consists of two contacts which are arranged in vacuum or inert gas; when a magnetic field (permanent magnet or electromagnet) is applied the contacts are brought into contact and, hence, close a circuit.

In another variant of the invention, the switch is executed in form of at least two contacts connected to the control unit, which protrude from the device through openings in the casing, whereby the control unit activates the device by short-circuiting the contacts. This means that the control unit activates the measuring device when the contacts are short-circuited. This may be achieved by providing a start-up circuit with two MOSFETS. The first MOSFET is connected to the contacts, and by short-circuiting the contacts the second MOSFET is actuated so that the battery load is switched over to the control unit and from

there to the areas necessary for the functioning of the measuring device. The short-circuiting of contacts can be achieved, for example, by providing a support for inserting the device, whereby its insertion would cause the short-circuiting of the contacts.

In addition, the device comprises at least one storage unit for data storage. This storage unit advantageously is a conventional storage chip (EEPROM - electrically erasable programmable read-only memory); however other storage devices such as SD cards, flash memories or the like are also possible. When the device is provided with a RFID transponder, a storage unit of the RFID transponder may be used for data storage.

The goal of the invention is furthermore achieved by using a system as initially mentioned, which comprises at least one of the above-cited devices and at least one base station.

In the following, the present invention is described in more detail with reference to the drawings, which show:

Fig. 1 a cow with a device according to the invention placed in its gastro-intestinal tract,

Fig. 2 a plan view of a sectional view of the device according to the invention,

Fig. 3 a side view of a sectional view along the line A-A in Fig. 2,

Fig. 4 a front view of a sectional view along the line B-B in Fig. 3,

Fig. 5 an exploded view showing the individual parts of the device according to the invention, and

Fig. 6 a schematic drawing of the components of the device.

It should be appreciated that the invention is not restricted to the following embodiments which merely represent one of the possible implementations of the invention. Furthermore, it is noted that the representations in the figures are only schematic for the sake of simplicity.

Fig. 1 shows the sectional view of a cow 1, whereby the cow 1 in this case only serves as an example of a farm animal in whose gastro-intestinal tract the device can be inserted. Examples for other suitable livestock are e.g. sheep, goats, and wild ruminants, such as red deer.

The feed ingested and masticated by the cow 1 ends up in the stomach of the cow 1, e.g. in the rumen or reticulum 2. The reticulum 2 is part of the cow's 1 stomach, located before the rumen. From the reticulum 2, the ingested feeds either move forward into the rumen, or backward into the mouth of the cow 1 for rumination.

The feeds in the stomach of the cow 1 roughly can be divided into three phases: at the top is the gaseous phase containing CO_2 and methane (CH_4). In between is a solid phase, the so-called "fiber mat", containing pre-digested hay, silage grass etc. In the lower portion is the rumen fluid, consisting of liquids, such as acids, microbes, saliva, water, and masticated material. Measuring the physiological parameters of the stomach contents allows one to draw conclusions about possible effects and/or conclusions as to the animal's state of health - whenever the pH is low, e.g. rumen acidosis may occur. The measuring device 3 according to the invention is thus placed within the gastro-intestinal tract of the animal - i.e. in the present example in the area of the reticulum 2 of the cow 1 in order to capture physiological data of the stomach.

Figs. 2, 3 and 4 show the measuring device 3 according to the invention in different sectional views. The measuring device 3 is inserted into the gastro-intestinal tract of a ruminating farm animal by appropriate means and remains there. To introduce the measuring device 3, e.g. a balling gun common in livestock farming is used.

Fig. 2 shows a plan view of a section along the longitudinal axis of the inventive measuring device 3, hereinafter also referred to as bolus, whereby the same reference sign is used as for the measuring device 3.

The casing 4 of the bolus 3 has a cylinder form with rounded edges of large radiuses, whereby external burrs should be avoided in order to minimize the risk of injury for the animal. The materials for the casing 4 are preferably acid-proof, impact-strong plastics, which ideally comply with the rules of the American Food and Drug Administration (FDA). The casing 4 should not break irregularly below a certain load threshold. When choosing the plastic to be used the acid environment of the animal's gastro-intestinal tract should be taken into account.

The casing 4 is lockable and can, for this purpose, be composed of several parts, for example of two or three interlockable parts (see Fig. 5). The casing 4 contains the devices necessary for the measuring of physiological parameters. These devices are arranged on a printed circuit board 5 (PCB). The exact arrangement is not illustrated in Fig. 2, since a number of arrangements are possible which are well known to the person skilled in the art. Reference is

made to only one area 6 of the printed circuit board 5 in which the individual components are located.

Fig. 6 shows a schematic drawing with the components of the inventive device 3 and their connections. The components are located in a casing 4. The casing comprises a control unit 7 for controlling the measuring device 3. This may for example be achieved using an adequately programmed micro-processor. The control unit 7 controls and processes data from the sensors 8, 8'. A storage unit 16, for example a storage chip or an SD card, may be provided for data storage. At least one sensor 8, 8' is to be provided, however, more than two sensors may also be used. The sensors 8, 8' measure parameters of their surroundings such as pH and temperature. However, also sensors for measuring glucose, volatile fatty acids (especially mixed fatty acids), acetate, propionate, butyrate, and lactate may be suitably provided for. The sensors 8, 8' are mounted in such a way as to be able to get in contact with the environment of the measuring device 3, for example through openings (not illustrated in the figures).

The data are processed by the control unit 7. Via a transmitter device 9, equipped with an antenna 10, the data are transmitted wirelessly, for example to a base station located outside the animal. Preferably, the transmitter 9 is designed as transceiver device 9 which is able to both transmit and receive data. Hence, the term transceiver 9 will be used in the following.

Via the antenna 10 and the transceiver 9 it is possible to influence the control unit 7 from the outside, for example in order to modify the internal programming. The antenna 10 may be executed in various ways, for example as helical antenna or corkscrew antenna, or as ceramic and/or patch antenna.

The transceiver 9 operates in the frequency range 20 MHz to 1 GHz. Frequency bands that are frequently used in similar applications range from 300 MHz to 450 MHz. The frequency 433 MHz is used in Europe, for instance. For an application in the USA the frequency 315 MHz may be used. However, other useable ISM-radio bands (Industrial, Scientific and Medical band) lie in the range of 868 MHz or 915 MHz. Also the frequency 27 MHz may be used.

The transceiver 9 may be realized as RFID transponder is also possible. In this case, depending on its design variant the RFID transponder, may be contain an antenna, a switching circuit for the transmitting (and receiving) of data, a circuit for controlling the transponder as well as a memory, for example in form of a tag. The switching circuit for transponder control writes data into the memory (e.g. the tag). In a special design, this switching circuit may be located outside the RFID transponder, in the present case for

example as part of the control unit 7 on the printed board 5. The RFID transponder is then read out via a stimulation by means of a high-frequency alternating field. In such a case the RFID transponder is to be adequately arranged on the printed circuit board 5.

When using an RFID transponder, data are transmitted within a frequency range of 128 kHz (long-wave range) up to 13,56 MHz (short-wave range), or within a range of 865-869 MHz (European range) up to 950 MHz (US American and Asian frequency ranges). Frequency may vary from one region to the other.

As far as construction size and other specifications are concerned it is possible to choose from a number of well-known solutions.

The power supply device may be a battery 11 or an accumulator.

The antenna 10 in Fig. 2 is executed as meandered antenna. It consists of several loops of an appropriate carrier material, which are arranged on the level of the printed circuit board 5. Antenna 10 in the mentioned design enables an optimal compromise between the radiation pattern in the vertical and horizontal planes of polarization, the necessary adaptation and cost-effective production. The meandered antenna can be optimized for a direct connection of the antenna base to the printed circuit board 5 so that no additional adaptation is necessary, which further reduces production costs.

Fig. 3 shows a lateral cross-section of the measuring device 3 along the line A-A in Fig. 2. It shows that the battery 11 is arranged below the printed circuit board 5 within the casing 4. The illustration of battery 11 and its arrangement is, however, only given as example; it may also be arranged in any other form according to the commonly available battery or accumulator forms.

The power supply units used, for example lithium batteries, generally contain substances that are potentially harmful for livestock. Therefore the inventive device 3 is designed to contain a hollow protective guard 12 covering at least the battery 11 in order to protect it from mechanical impact. Such impact may for example occur when the cow 1 regurgitates the measuring device 3 back up into its mouth together with the feed to be ruminated and then bites into the measuring device 3.

Preferably, the guard 12 is executed in cylindrical form. In the pictured embodiment the cylinder has a circular cross-section (see fig. 4), however the cross-section may also have a polygonal form. Ideally, both the top and bottom planes are open so that the appliances to be protected are easily inserted into the device. The protective guard 12 may be made from any

material that resists high mechanical impact, for example from plastics such as Kevlar™, or metals, such as brass or similar metals.

In the illustrated embodiment, the protective guard 12 surrounds not only the power supply unit 11 but also most of the printed circuit board 5 with the aforementioned components (for example also the aforementioned RFID transponder). Preferably, the antenna 10 is arranged outside the protective guard 12 – in order to minimize the impairing of the radiation pattern, which is considerable, especially where a metallic material is used for the protective guard 12. Fig. 4 shows a variant of the invention in a dotted outline, in which a protective guard 12' surrounds only the battery 11. In such a case, the protective guard 12 of a higher diameter may be omitted – it is however possible to provide for a combination of a protective guard 12' for the battery and another bigger protective guard 12 surrounding it.

The protective guard 12 serves both as protection from mechanical influence ("bite protection") and as additional weight, providing the device 3 with sufficient density to ensure that it remains in a location within the gastro-intestinal tract which is favorable for data reception by the sensors 8, 8'. If the protective guard 12 is made of metal, it may improve the radiation pattern of antenna 10 by altering the electromagnetic near field of the antenna 10.

In addition to its "bite protection" function, the protective guard 12 contributes to the weight of device 3. The weight, i.e. the specific gravity (density) of the measuring device 3 is highly important for the proper positioning of device 3 within the gastro-intestinal tract of the farm animal in question. Thus the weight of the entire measuring device 3 may be influenced by the material selected for and the thickness of the protective guard 12. For example it is also possible to vary the thickness of the protective guard 12 lengthwise.

In order to further increase the weight of the measuring device 3, it is possible to fill the inside of the casing 4 with a thermosetting material, such as synthetic resin. When filling in the material, the antenna 10 is ideally left out in order to ensure proper data transmission.

In the depicted embodiment of the invention the device 3 is equipped with a switch. The switch may basically be executed in any form – here the switch consists of two metal contacts 13, for example in stainless steel, which are connected to the control unit 7. These contacts protrude from device 3 through openings 14 in the casing 4 (see Figs. 2 and 5). The measuring device 3 is activated by short-circuiting the contacts 13 for a certain period of time, ranging from a few milliseconds to several seconds.

The circuiting of the contacts 13 within the control unit 7 which is necessary for this is state of prior art. For example, the contacts 13 may be connected to a start-up circuit in the control unit 7 which comprises two MOSFETs (metal oxide semiconductor field-effect transistors), whereby one of the MOSFETs is connected to the contacts 13. By short-circuiting the contacts 13, the second MOSFET switches the battery voltage onto the circuitry within the control unit 7, which thereby activates the measuring device 3.

In order to facilitate the short-circuiting process for the user, a rack may be provided into which the measuring device 3 can be placed, thus activating the measuring device 3 by short-circuiting the contacts.

The switch of the above-described design only ensures activation of the measuring device 3, which continues to function until the end of the battery run time, and/or until a pre-definable switch-off time point. Basically any other kind of switches may be provided for, in order to activate and deactivate the measuring device 3. A wide range of switches for this purpose are prior art.

In a variant of the invention a magnetic switch 13' is used which is arranged inside the measuring device 3 (see dashed object in Fig. 6). A magnetic switch 13' here denotes a switch that can be switched by a magnetic field. An example of such a magnetic switch 13' is a Reed-switch. Basically, a magnetic switch 13' has two contacts which are arranged in a protective atmosphere and do not touch each other. However, if a magnetic field is applied the two contact tongues attract and touch each other, consequently closing a circuit.

The magnetic switch 13' may be combined with a second MOSFET as described above so that a switching of the magnetic switch 13' puts the battery voltage through to the rest of the circuit in the control unit 7, thereby activating the measuring device 3.

The switching of the magnetic switch 13' may be effected by applying a magnetic filed to a specific position of the measuring device 3, by attaching a permanent magnet or an electromagnet, for instance.

Fig. 5 shows the individual components of the inventive measuring device 3 in an exploded view. In this case the casing consists of three parts, a casing front part 41 (which may for example be designed to contain openings for the sensors 8, 8'), a casing central part 42 housing the printed circuit board 5, and a casing rear part 43, the parts being interconnectable. The three-part structure of the casing with parts 41, 42, 43 in this case only serves as example - the design may provide for more or less casing parts. In order to facilitate the insertion of the measuring device 3 into the animal, the rear part of the casing 43

may have a flat end, which cooperates with the movable end of the balling gun that is used for inserting the device so that the measuring device 3 is properly moved into the rumen and does not get stuck.

In addition to the above-described components (which are not shown in the figures), the printed circuit board 5 includes the meandered antenna 10 and the contacts 13. The printed circuit board 5 is held in place by means of a rack 15 and supplied with power by means of a battery 11. The protective guard 12 may be placed around these components.

The rear part of the casing 43 comprises openings for the contacts 13.

Upon activation and insertion into the gastro-intestinal tract of the animal, the measuring device 3 performs measurements in certain time intervals. These intervals may range from 1 sec to several hours or even days. The measured data are stored on a storage unit 16, for example an EEPROM storage chip, an SD memory, or a flash memory. If the device 3 contains an RFID transponder, the data may be stored in the memory of the transponder. It is also possible to directly transmit the data wirelessly to the exterior.

If the measuring device 3 is used as part of a system together with at least one base station, such base station regularly searches for measuring devices within its reach with an inventory command. The distance between the measuring device and the base station in this case is for example 5 to 6 m or less. As soon as a measuring device 3 is within reach, it identifies itself by means of an identifier (serial number, bolus number or similar). Thereafter the base station checks whether the measuring device 3 contains any newly measured data. In this the case, the measured data are read out, stored in the base station (e.g. in a database), and then deleted from the measuring device 3. The base station then processes the measured data by means of appropriate routines so as to enable quick assessment of the data. Such an assessment may for example lead to a change in the feed ration administered.

CLAIMS

1. Measuring device (3) for the measurement of at least one physiological parameter of a farm animal's organism, wherein the measuring device (3) is placeable in the gastro-intestinal tract of the farm animal and comprises the following components arranged within a casing (4):

- at least one sensor (8, 8') for the measurement of at least one physiological parameter of the farm animal's organism;

- at least one transmitter (9) with antenna (10) for the wireless transmission of information,

- at least one control unit (7) for the control of the measuring device (3), and

- at least one power supply device (11) for the measuring device (3),

characterized in that the casing comprises a hollow protective guard (12, 12') covering at least the power supply device (11) in order to ensure protection from mechanical impact.

2. Measuring device according to Claim 1, **characterized in that** the protective guard (12, 12') has a cylinder form with circular or polygonal cross-section.

3. Measuring device according to Claims 1 or 2, **characterized in that** the protective guard (12, 12') is made of metal.

4. Measuring device according to one of the Claims 1 to 3, **characterized in that** the protective guard (12, 12') covers the transmitter (9) and the control unit (7) in addition to the power supply device (11).

5. Measuring device according to one of the Claims 1 to 4, **characterized in that** the length of the antenna (10) of the transmitter is dimensioned to $\lambda/4$ of the frequency used.

6. Measuring device according to one of the Claims 1 to 5, **characterized in that** the transmitter (9) uses frequencies ranging from 20 MHz to 1 GHz for the wireless transmission of information.

7. Measuring device according to one of the Claims 1 to 6, **characterized in that** the transmitter (9) uses frequencies ranging from 300 MHz to 450 MHz for the wireless transmission of information.

8. Measuring device according to one of the Claims 1 to 6, **characterized in that** the antenna (10) is designed in meander form with at least one loop.

9. Measuring device according to one of the Claims 1 to 8, **characterized in that** the measuring device (3) additionally has at least one switch connected to the control unit (7), which is actuable from outside the device.

10. Measuring device according to claim 9, **characterized in that** the switch is a magnetic switch like a Reed-switch, the magnetic switch being located inside the measuring device (3).

11. Measuring device according to Claim 9, **characterized in that** the switch is executed in form of at least two contacts (13) that are connected to the control unit (7) and stand out from the measuring device (3) through openings (14) in the casing (4), whereby the control unit (7) activates the measuring device (3) when the contacts (13) are short-circuited.

12. Measuring device according to one of the Claims 1 to 11, **characterized in that** at least one storage unit (16) is provided for the purpose of data storage.

13. System for the measuring of physiological parameters of a farm animal's organism, comprising at least one measuring device (3) according to one of the Claims 1 to 12, as well as at least one base station, whereby the base station and the measuring device (3) communicate with each other via a wireless procedure.

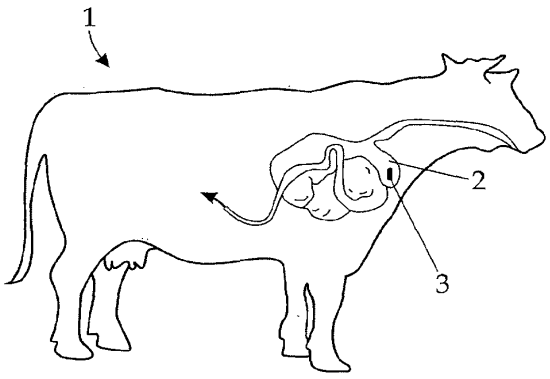


Fig. 1

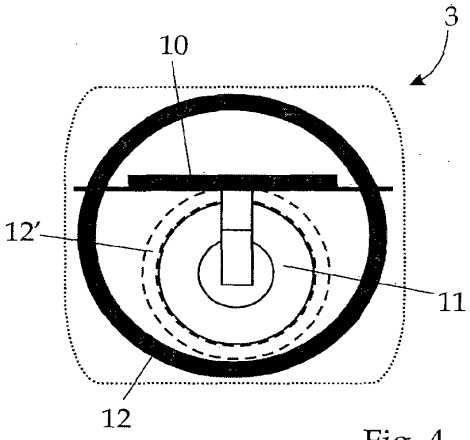


Fig. 4

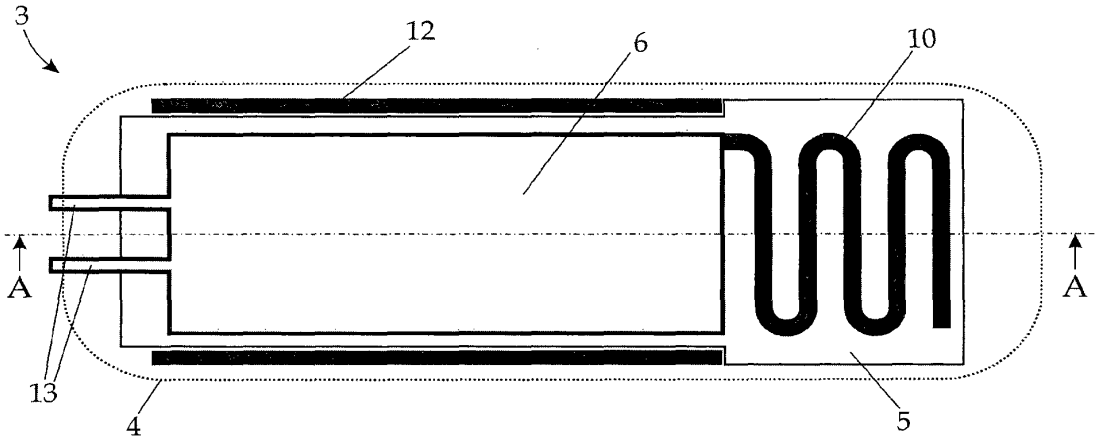


Fig. 2

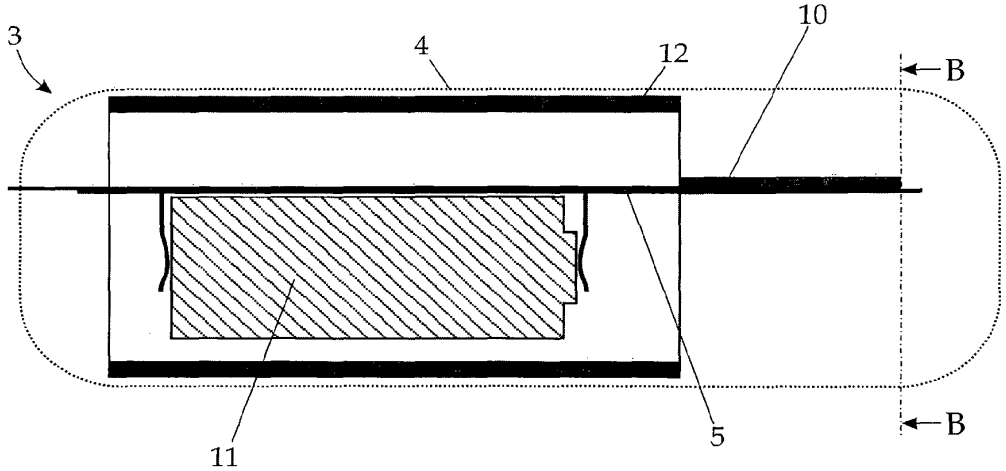


Fig. 3

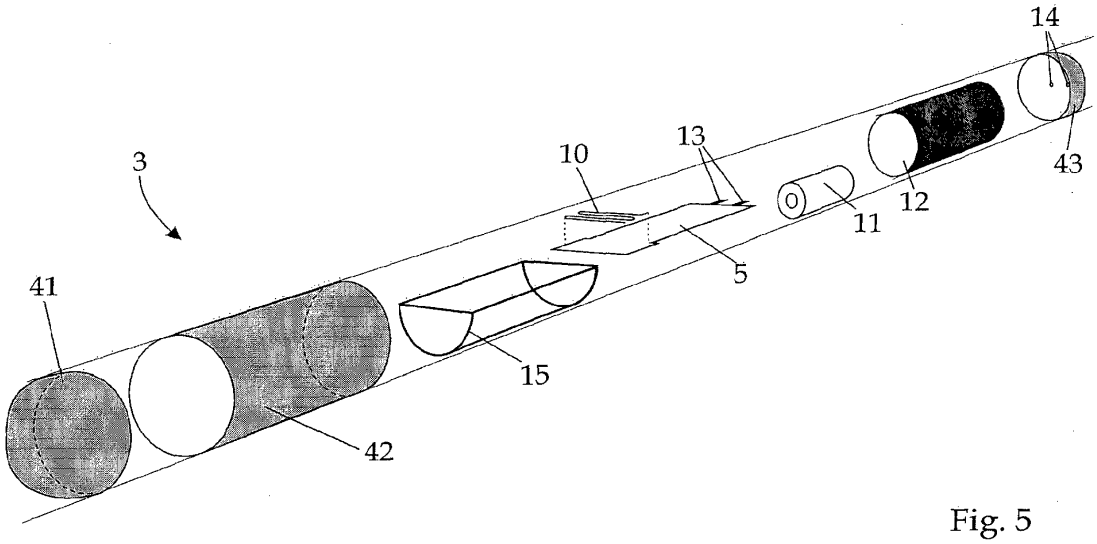


Fig. 5

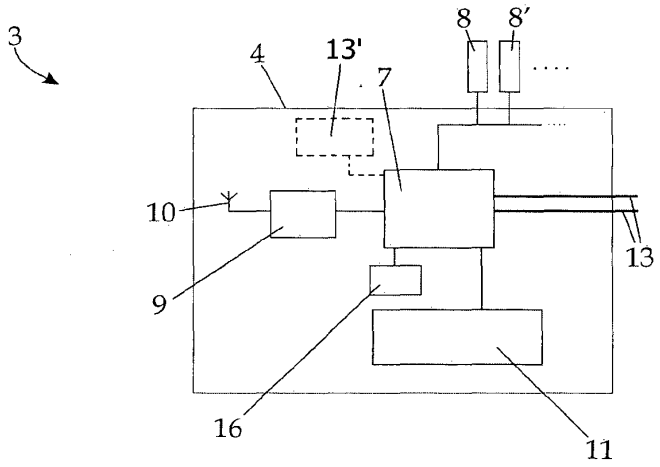


Fig. 6

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(71) Applicant *(for all designated States except US)*: **KAHNE LIMITED** [NZ/NZ]; Level 8, Forsyth Barr Tower, 55 Shortland Street, Auckland, 1010 (NZ).

(72) Inventor; and
(71) Applicant : **MALLINSON, Paul Benjamin** [NZ/NZ]; 2 William Denny Avenue, Westmere, Auckland, 1022 (NZ).

(72) Inventor; and
(75) Inventor/Applicant *(for US only)*: **LAPORTE-URIBE, Jose Alberto** [CL/NZ]; 3 Filgate Street, Hillsborough, Auckland, 1042 (NZ).

(74) Agents: **WEST-WALKER, Greg J.** et al.; A J Park, PO Box 949, Wellington, 6140 (NZ).

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(54) **Title**: SYSTEM AND METHOD FOR IN-RUMEN MONITORING

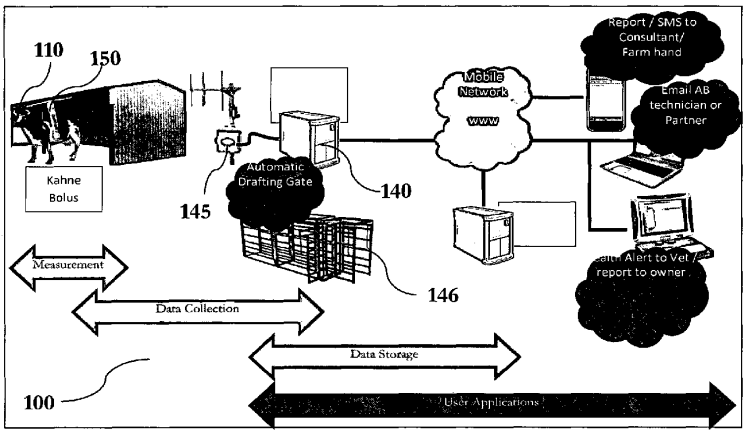


Figure 1

(57) **Abstract**: A system for monitoring digestive efficiency within the rumen of one or more ruminant animals comprises rumen boluses shaped and sized to be retained within the rumen dorsal sac and each comprising temperature, pH sensor, and redox sensors, and a wireless transmitter. A processor is arranged to derive from the sensor data one or more parameters indicative of animal digestive efficiency including any combination of one or more of hydrogen scale (rH), partial pressure of hydrogen ($pp[H_2]$), oxygen fugacity ($f(O_2)$) and free energy of the system (ΔG). A method and bolus are also claimed.

WO 2012/173502 A1

SYSTEM AND METHOD FOR IN-RUMEN MONITORING

FIELD OF INVENTION

The invention relates to a device, system, and method for monitoring the physiological condition of a ruminant, and in particular to a rumen bolus for cattle and to methods of utilising the bolus data to provide information relevant to a one or more application.

BACKGROUND

A rumen bolus is a device that is ingested into the rumen (stomach) of an animal, such as a cow or sheep for example, for monitoring the physiological state of the animal.

Kahne Ltd has developed a wireless rumen bolus that monitors in-rumen Ph, temperature, and pressure (see www.kahneanimalhealth.com). The bolus can transmit data in real time or at a specific time of day, which is received by the end user in raw format. The bolus is mainly used as a scientific instrument for those involved in rumen research. It assists scientists by providing a continuous and real-time flow of in vivo measurements from cattle living under realistic commercial conditions. However, it is currently still left up to the scientist to analyse the raw data from the bolus and make sense of what it represents.

SUMMARY OF THE INVENTION

The invention provides an improved or at least alternative system, method, and/or bolus for in-rumen monitoring.

In one aspect the invention may broadly be said to consist of a system for monitoring digestive efficiency within the rumen of one or more ruminant animals comprising:

one or more rumen boluses each shaped and sized to be retained within, or residing within, the dorsal sac of the rumen of the associated animal and each comprising:

a temperature sensor to provide data indicative of temperature within the rumen,

a pH sensor to provide data indicative of pH within the rumen,

a redox sensor to provide data indicative of the oxidation-reduction potential within the rumen, and

a wireless transmitter to transmit data or derived parameter(s) to a remote station, and

in the or each bolus or at a remote station a processor arranged to derive from the sensor data one or more parameters indicative of animal digestive efficiency.

Preferably the system comprises a bolus for or residing in the rumen of a sub population of a group of animals. The group of animals may be any animal management grouping such as a mob or herd, and may comprise a herd of twenty or fifty or more animals. The sub population may be any number of animals within the group from a single animal to all of the animals. The system may comprise a bolus for or residing in the rumen of many or a majority or all of a multiple number of animals of such a group of animals. Each bolus may comprise stored in memory in the bolus an identification code unique to the individual bolus.

Preferably the system is arranged to transmit data at least once, or twice , or more times per week or day for at least one, two, or four weeks, or one, three, or six months, or indefinitely.

Preferably the processor is associated with memory storing one or more thermodynamic and/or physiological equations, the processor arranged to input the sensor array data into one or more or all of the equations to obtain as outputs the one or more parameters indicative of animal digestive efficiency.

The processor may be located within a remote station and the sensor data transmitted to the remote station. Alternatively the processor may be located within the or each bolus and the data transmitted to the remote station is the one or more parameters indicative of animal digestive efficiency.

In a second aspect the invention may broadly be said to consist of a method for monitoring digestive efficiency of the rumen of one or more ruminant animals comprising the steps of:

providing a bolus within the dorsal sac of the rumen of the or each animal,

sensing a combination of temperature, pH, and oxidation-reduction potential within the dorsal sac of the or each rumen,

wirelessly transmitting the sensed data to a remote receiver, and

in a processor in the or each bolus or at a remote station deriving from the sensor data one or more parameters indicative of animal digestive efficiency.

Preferably the method comprises providing a bolus within the dorsal sac of the rumen of many or a majority or all of a multiple number of animals such as a herd of fifty or more

animals. Each bolus may comprise stored in memory in the bolus an identification code unique to the individual bolus.

Preferably the method comprises uploading or transmitting data at least once, or twice , or more times per week or day for at least one, two, or four weeks, or one, three, or six months, or indefinitely.

Preferably the one or more parameters indicative of animal digestive efficiency includes any combination of one or more of hydrogen scale (rH), partial pressure of hydrogen ($pp[H_2]$), oxygen fugacity ($f(O_2)$), and free energy of the system (ΔG).

Preferably the equation stored in memory for obtaining rH is:

$$rH=(E_h*2*F/(2.303*R*T)) + 2*pH$$

where:

E_h = Hydrogen potential (V) derived from the redox sensor data

F = Faraday's constant (96.485 $kJ.V^{-1}.mol^{-1}$)

R = gas constant (0.008314472 $kJ.mol^{-1}.K^{-1}$)

T = temperature (K) derived from the temperature sensor data,

rH = - log (H_2), and

pH = -log (H^+) derived from the pH sensor data.

Preferably rH is indicative of the reductive or oxidative intensity of the rumen environment and the processor is arranged to output a value ranging from 0 to 42, wherein 0 represents a saturated atmosphere of hydrogen.

Preferably the equation stored memory for obtaining $pp[H_2]$ is:

$$pp[H_2] = 10^{-rH} \text{ (atm)}$$

where:

$pp[H_2]$ = partial pressure of hydrogen (atmospheres), and

rH = hydrogen scale.

Preferably the equation stored in memory for obtaining $f(O_2)$ is:

$$\text{Log } f(O_2) = [((E_h-0.818)*4*F/(2.303*R*T))+4*pH)]$$

where:

$f(O_2)$ = fugacity of oxygen gas ($p[O_2]$)

E_h = hydrogen potential (V) derived from the redox sensor data

F = faraday's constant (96.485 $kJ.V^{-1}.mol^{-1}$)

R = gas constant (0.008314472 $kJ.mol^{-1}.K^{-1}$)

T = temperature (K) derived from the temperature sensor data, and
pH = -log (H^+) derived from the pH sensor data.

Preferably the equation stored in memory for obtaining ΔG is:

$$\Delta G = 2.303*R*T*rH$$

where:
ΔG = the free energy of the system (kJ/mol^{-1})
R = gas constant (0.008314472 $kJ.mol^{-1}.K^{-1}$)
T = temperature (K) derived from the temperature sensor data, and
rH = the hydrogen scale.

In a third aspect the invention may broadly be said to consist of a rumen bolus for a ruminant animal, comprising:

a body shaped and sized to be retained within the dorsal sac of the rumen of the animal,

housed within the body of the bolus:

a temperature sensor to provide data indicative of the temperature within the rumen,

a pH sensor to provide data indicative of the pH within the rumen,

a redox sensor to provide data indicative of the oxidation-reduction potential within the rumen,

a wireless transmitter to transmit the read sensor array data or one or more parameters derived by processing the data, or both, to a remote station.

In some embodiments the bolus also comprises a processor and memory associated with the processor storing one or more thermodynamic and/or physiological equations, the processor arranged to input the sensor array data into one or more or all of the equations to obtain as an output one or more parameters indicative of animal digestive efficiency.

The term "comprising" as used in this specification means "consisting at least in part of". When interpreting each statement in this specification that includes the term comprising", features other than that or those prefaced by the term may also be present. Related terms such as "comprise" and "comprises" are to be interpreted in the same manner.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention is further described, by way of example only, and with reference to the drawings, in which:

Figure 1 shows a system of the invention for monitoring the rumen environment in a plurality of animals,

Figure 2 is a perspective view of a rumen bolus of the system of figure 1

Figure 3a is a graph obtained from the experimental work showing circadian rhythms of temperature from the ventral and dorsal sac of the rumen,

Figure 3b is a graph obtained from the experimental work showing circadian rhythms of pH from the ventral and dorsal sac of the rumen,

Figure 3c is a graph obtained from the experimental work showing circadian rhythms of redox (E_h) from the ventral and dorsal sac of the rumen,

Figure 4a is a graph obtained from the experimental work showing the circadian distribution of values of hydrogen scale (rH) obtained from the bolus of figure 2,

Figure 4b is a graph obtained from the experimental work showing the circadian distribution of values of partial pressure of hydrogen and fugacity of oxygen, expressed in a logarithmic scale, obtained from the bolus of figure 2,

Figure 4c is a graph obtained from the experimental work showing the circadian distribution of values of the Gibbs free energy of the system (ΔG, kJ) obtained from the bolus of figure 2, and

Figure 5 is a graph obtained from the experimental work showing the relationship of the circadian rhythms of pH and free energy of the rumen (ΔG, kJ) in dry dairy cattle.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

Referring to figure 1, a preferred embodiment system 100 for monitoring the rumen environment of one or more ruminant animals such as cows and in particular in-rumen digestive efficiency comprises a bolus 150 residing in the rumen of an animal 110 (one only shown) or of many or a majority of or all of a multiple number of animals such as a herd of twenty or fifty or more animals, and a remote server comprising a computer processor 140 for receiving and processing data sent from the or each bolus 150. The data is analysed for each animal to determine the efficiency of feed conversion and/or bacterial

activity. The system 100 is described with reference to cattle 110 but may also be used with other ruminant animals however.

Each bolus 150 is swallowed/ingested by a cow 110 into the stomach where it resides in the dorsal sac of the rumen of the cow 110. The rumen environment is monitored by the bolus 150 which senses the temperature, pH and, oxidation-reduction (redox) state/potential in the rumen. The bolus 150 may send the data in raw format to remote server 140 which performs the processing and analysis to derive one or more parameters indicative of digestive efficiency, and/or an on-board processor in the bolus 150 may carry out such processing and transmit the derived parameters, or alternatively again the on-board processor may carry out some pre-processing before sending data to the server 140 for further processing. The bolus 150 communicates to the server 140 through wireless telemetry.

Referring now to figure 2, a preferred embodiment bolus 150 comprises a hollow body or housing 151 for retaining the various components of the bolus 150 and is shaped/sized to be retained within the dorsal sac of the rumen of the animal. The bolus comprises an elongate body of for cattle length in the range 135 to 160mm and circular cross-section of diameter in the range 25 to 35mm. At or towards one end the bolus comprises opposed lateral extensions or tabs 153, which are flexible towards the body of the bolus but have memory towards a position extending outwardly of the bolus body and slightly rearwardly (as shown), so that the tabs 153 may be forced against their memory towards the body of the bolus, manually or by a purpose administration tool, while the bolus is inserted down the throat of an animal with the outer ends of the tabs 153 trailing, but will restore to their outwardly extending position when the bolus reaches the dorsal sac of the rumen to hold the bolus in the dorsal sac. The bolus has light weight, preferably less than 100 grams, which along with buoyancy further assists it to be retained within the dorsal sac and not to fall through to the bottom of the rumen.

Fermentation in the rumen produces gas that is trapped within the mat, resulting in retention of large particles of grass and feed (greater than 2 mm) within in the dorsal sac. Liquid and smaller particles are deposited in the bottom of the rumen (ventral sac). Contained within the housing 151 are sensors exposed in use through the sensor head 152 to the rumen environment, including at least temperature, pH, and redox sensors. In the preferred embodiment a processor 154 within the bolus is connected to the sensors and periodically or continuously reads the sensor outputs and either processes the data to derive parameters indicative of digestive efficiency for the animal and sends same to the computer 140 or sends raw or pre-processed data to the computer 140, via a wireless

transmitter also in the bolus. A battery is also provided onboard the bolus for supplying power to the sensors, microprocessor, and transmitter. The processor 154 may relay the information onto the transmitter immediately upon reading of the sensor outputs or in the preferred embodiment log the data for a certain period (i.e. between milking) and then send multiple sensor output readings in one transmission for the computer to then separate and process. Additionally, the information may be averaged and the values of the average and standard deviation stored to be transmitted. Any other suitable statistical or averaging scheme may be used before storing averaged sensor data however. It is from these obtained parameters that end applications can make use of the system 100 to improve the overall efficiency of the animal.

As stated data analysis may be carried out remotely or within the bolus itself and preferably comprises at least a processor for running the algorithms, memory for storing algorithms and data, and interface circuitry. The processor may be any form of programmable hardware device, whether a CPU, Digital Signal Processor, Field-Programmable Gate Array, Microcontroller, Application-Specific Integrated Circuit, or the like.

As stated and referring again to figure 1, the computer 140 in the preferred embodiment is arranged to receive and process data from a number of boluses 150 in a collection of livestock in a farm for example. Each bolus has stored in memory associated with the on board processor an identification code unique to the particular bolus 150. The unique ID is sent to the computer 140 with the sensor data or parameters to associate the information with the particular animal.

Each bolus 150 may also be arranged to transmit data or parameters to more than one computer 140, each computer arranged to process the bolus data or parameters in a particular way for a particular application or applications. Data analysis may be implemented on any suitable computer hardware system, platform or architecture.

In the preferred embodiment the sensor output readings and optionally the thermodynamic parameters are stored locally on the bolus device and uploaded (for the avoidance of doubt, in this specification and claims transmitting includes uploading) to the computer 140 automatically when the animal comes into proximity of a receiver device 145 installed in an appropriate location such as a milking shed, watering trough, crush, race or similar animal handling facility (animal milking, watering or handling station) for example.

Uploading or transmission of data or parameters may occur at least once, or twice , or more times per week or day for at least one, two, or four weeks, or one, three, or six months, or indefinitely. As shown in Figure 1, animals may pass through the milking shed twice daily and the information from each bolus is collected and uploaded to computer or server 140.

The data is analysed for each animal to determine the efficiency of feed conversion and/or bacterial activity. Data analysis is described in further detail below. Information may be stored in a database associated with computer 140 or in any other type of digital storage medium (i.e. cloud based systems). Field applications can be developed to use this information to aid farmers to enhance animal performance, improve animal welfare, and/or reduce waste products or digestive efficiency. In turn productivity and health dynamics from within the rumen, where fermentation occurs, converting feedstuff to energy needed for milk production or muscle mass development, may be monitored and managed. Monitoring may occur over an extended period such as at least one, two, or four weeks, or one, three, or six months, or indefinitely until the animal carrying a bolus dies.

Animals beginning to suffer health issues will undergo changes to their physiology well before they exhibit external symptoms, which can be detected. Temperature is a basic indicator of animal health and can be used to diagnose sub clinical and clinical disease, heat stress, mastitis, metabolic disorders, reproductive cycles and even the impending birth of calves. With better rumen function management, farmers can expect to see a reduction in afflictions such as laminitis and high somatic cell counts which also adversely affect animal productivity.

Rumen function and efficiency are reflected in temperature as well as in pH changes throughout the digestive process of rumination. During digestion, rumen pH can vary from about 7.0 (neutral) to less than 5.0 (acidic), ideally maintaining a healthy neutral balance as much of the time as possible. Rumen microbes work best between pH 6-7. Efficiency of rumen fermentation is compromised when pH drops for a prolonged period. When diets contain excessive levels of rapidly degradable starch or sugars and not enough slow fermenting fibre, an overly acidic environment develops and pH can fall to around pH 5.5 and remain there. This has detrimental implications for both productivity and animal health and is a major challenge for both the dairy and feedlot industries around the world. Dairy herds experiencing this condition, often referred to as sub-acute ruminal acidosis (SARA), will have a decreased efficiency of milk production, increased waste (effluent, methane etc.), impaired cow health and high rates of involuntary culling. In addition up to 20% of dairy cows develop acidosis after calving. SARA can lead to more serious health issues, and if left untreated can progress to acute ruminal acidosis, defined as pH < 5.0, which often

results in death. It also predisposes the cow to more serious diseases such as lameness, mastitis and sub-fertility which can cost hundreds of dollars per affected animal.

Server 140 may be arranged to monitor pH continuously and produce alerts to a farmer when pH drops to an unhealthy level, allowing the farmer to make small changes in animal diet to stabilise pH and create a better rumen environment for more hours of the day, thus having a healthier, higher producing animal.

Server 140 may be wire or wirelessly linked to a controller of an automatic drafting gate 146 whereby animals with abnormal profiles may be automatically drafted to a holding pen, and optionally also an email alert sent by server 140 to the vet, farmer, technician or other advisor such as an animal nutritional consultant. Optionally again functionality may be provided enabling the vet, farmer, technician or nutritional consultant to log on to server 140 via the internet and review the data, and for example assess if an on-site visit is required. At the end of each milking operation a summary report of the herd may be sent to the vet, farmer, technician or nutritional consultant identifying any individual outliers and animals of concern.

The ability of the system to provide long term 24/7 monitoring of the sensed data and calculated thermodynamic parameters provides the animal manager with a detailed picture of diurnal patterns and the effects changes in feed composition and feed management practice on the rumen environment. This enables the rumen environment to be actively managed on either a herd of individual animal basis thereby improving the efficiency of the animal at converting feed input to useful output (for example milk or meat). Maintaining ruminal pH, redox, ΔG etc. at optimal levels favours the growth of the beneficial microbes which synthesise VFAs and ATP which are absorbed by the ruminant through the rumen wall and are used in the creation of milk and muscle tissue. Outside optimal conditions production of less desirable microbes which are linked to the production of methane and other waste products increases. The consumption of feed by these undesirable microbes represents a direct loss of energy available to the beneficial microbes and, through their production of VFAs and ATP therefore, a direct loss of production of milk and meat.

Animal feeds are not homogenous and their different compositions in terms of protein, fibre, carbohydrates and sugars along with variations in particle size all influence the speed at which fermentation in the rumen may occur and therefore the degree and duration of changes in pH, temperature, redox and subsequent calculated thermodynamic parameters. The ability to measure these parameters combined with controlled feeding regimes provides the animal manager with a mechanism to influence the efficiency of the fermentation process in the rumen and the overall efficiency of the animal or animals.

The bolus may optionally also comprise pressure, conductivity, sodium, potassium, chloride and ammonium sensors. The data may optionally be analysed for each animal to determine one or more of the flow rate of digesta, rumen volume, methane production, mineral profile and volatile fatty acid profiles.

Data analysis

The laws of thermodynamics (preferably alongside physiological equations) are applied to the data from the sensors to generate one or more parameters that can be used to interpret the efficiency of feed conversion/bacterial activity of the rumen. Physiological data read directly from the sensors or after processing physiological/thermodynamic equation outputs may give important information of the wellbeing of the animal and help to understand or predict diseases or metabolic syndromes. As stated the bolus 150 comprises a pH sensor, a redox sensor, and a temperature sensor, and is positioned in the dorsal sac of the rumen. Thermodynamic law may be applied to the sensor outputs to derive rH, pp[H_2], $f(O_2)$ and ΔG as shown below. These parameters are derived to monitor the bacterial activity within the rumen.

The hydrogen scale

The hydrogen scale, rH, gives a good indication of the reductive or oxidative intensity or potential of the rumen environment, analogous to the pH measurement of acidity or alkalinity. The rH scale integrates the pH and E_h measurements giving a better description of the anaerobic microbial metabolism. For the same reason, it can be used in *in vivo* conditions to provide a direct indication of the oxidation/reduction state or potential of the rumen contents.

Given

$$E_h = E_0 + 2.303*R*T/n*F *(rH-2*pH)$$

rH is equal to:

$$rH = (E_h*2*F/2.303*R*T) + 2*pH$$

where:

E_h = hydrogen potential (V) derived from the redox sensor output

E_o = the potential of the reaction, in this case 0 (hydrogen potential)

n = number of electron in the reaction, in this case 2

F = faraday's constant (96.485 $kJ.V^{-1}.mol^{-1}$)

R = gas constant (0.008314472 $kJ.mol^{-1}.K^{-1}$)

T = temperature (K) derived from the temperature sensor output

rH = - log (H_2), and

pH = -log (H^+) derived from the pH sensor output.

The scale spans from 42 to 0, where 0 represents a saturate atmosphere of hydrogen (1 atmosphere). Values of different oxidation-reduction reaction can be stated in that scale and for every two species of reactants a certain value of ΔrH applies. This may be used to observe reaction couples (reactant: product) to a specific redox capacity and predict the efficiency of that particular reaction.

Partial pressure of H_2

There is a close relationship between changes in hydrogen gas (H_2) concentration in the gas phase and rH scale in the rumen liquor. Indeed, rH scale also represents the hydrogen gas partial pressure by the formula already discussed. H_2 not only is a key intermediary in the degradation of organic matter in the rumen, but hydrogen partial pressure ($pp[H_2]$) in the rumen gas cap can be directly linked to the methane production in *in vitro* conditions. Interspecies H_2 transfer drives biochemical reaction such as the production of short chain fatty acids (SCFA) and energy formation (ATP). Furthermore, monitoring $pp[H_2]$ in real-time enhances knowledge of the carbohydrate fermentation processes (SCFA, ATP and methane formation) and interspecies H_2 transfer leading to the optimisation of fermentative processes and reducing methane losses.

The hydrogen scale (rH) is the negative logarithm in base 10 of the hydrogen partial pressure, therefore:

$$rH = - \log pp[H_2]$$

then,

$$pp[H_2] = 10^{\wedge -rH} \text{ (atm)}$$

where:

$pp[H_2]$ = partial pressure of hydrogen (atmospheres), and,

rH = Hydrogen scale.

At a value of 0 rH the partial pressure of hydrogen is 1 atmosphere

Oxygen fugacity ($f(O_2)$)

Increasing oxygen pressure ($f(O_2)$) in the rumen liquor has been related to reduction in methane emissions and causes free H_2 to accumulate in the fluid. Conversely, low $f(O_2)$ tension, observed after feeding increases methane production. It has been shown that rumen protozoa are important scavengers of dissolved oxygen (Ellis et al. 1989). Then, the fate of $f(O_2)$ observed after feeding could be a good indicator of protozoa activity. Protozoa activity in the rumen has been linked to the rate of nitrogen turnover, therefore dietary

changes will enhance protozoa activity increasing nitrogen turnover. Similarly, the symbiosis between protozoa and methanogens could protect methanogens from high ruminal oxygen concentrations. In essence, monitoring $f(O_2)$ helps in the interpretation of variation in methane emissions due to the protozoa activity.

On the other hand, monitoring $f(O_2)$ is associated to conversion of lactate into propionate through the acrylate pathway. Below the equilibrium (-50.16 of the log $f(O_2)$) the formation of propionate will be favoured and above that equilibrium lactate will accumulate. In essence, $f(O_2)$ could help to optimise rumen fermentation by reducing the incidence of lactic acidosis or monitor the conversion of lactate to propionate.

The fugacity of the rumen is the log of the oxygen partial pressure and it is related to the potential of the hydrogen electrode by:

$$E_h = E_o + 2.303*R*T/n*F*\text{Log}([\text{product}]/[\text{reactants}]).$$

and,

$$E_h = E_o + 2.303*R*T/4*F*\text{Log}([O_2]*[H^+]^4/[H_2O]^2)$$

In the rumen water $[H_2O]$ is not limited in the reaction and the term could be obviated from the equation.

Therefore:

$$\text{Log } f(O_2) = [((E_h-0.818)*4*F/(2.303*R*T))+4*pH)]$$

Where:

$f(O_2)$ = fugacity of oxygen gas ($p[O_2]$)
E_h = hydrogen potential (V) derived from the redox sensor output
E_o = the potential of the reaction (0.818 V)
n = number of electron in the reaction, in this case 4
F = faraday's constant (96.485 $kJ.V^{-1}.mol^{-1}$)
R = gas constant (0.008314472 $kJ.mol^{-1}.K^{-1}$)
T = temperature (K) derived from the temperature sensor output, and
pH = -log (H^+) derived from the pH sensor output.

The fugacity of the oxygen gas in the rumen ($f(O_2)$) is represented in a logarithmic scale.

Gibbs free energy (ΔG)

The systems energy is related to the rH scale by the following formula

$$\Delta G = 2.303*R*T*rH$$

where:

ΔG = the free energy of the system (kJ)

R = gas constant (0.008314472 $kJ.mol^{-1}.K^{-1}$)

T = temperature (K) derived from the temperature sensor output, and

rH = the hydrogen scale

This formula is applied to systems involving 2 electrons $H_2 = 2H^+ + 2e$, as $rH = -\log [H_2]$. Because most of the reactions of interests in the rumen agree with that premise, the bolus 150 displays the ΔG of the system using that formula. However if the system where the free energy is related to the work required to expand half mole of hydrogen from steady state conditions to the required state, hence n = 1, the value of rH needs to be replaced by rH/2.

By estimating the stoichiometry of carbohydrate fermentation values of ATP and SCFA formation can be estimated. SCFA is by ruminants the main source of energy for maintenance, growth and production. The conserved energy (ATP) is used mainly in the biosynthesis of cellular component, bacterial growth and multiplication. Although the efficiency of bacterial growth will depend on several mechanisms of energy dissipation, there seems to be an inverse relationship between the production of SCFA and microbial cell synthesis.

However, the limitations of these models are related to the minimal *in vivo* information about fluctuation in pH and E_h. The real time measurement of the thermodynamic parameters from the bolus will enhance our understanding of the rumen environment and give information of bacterial growth and nutrient formation.

The value Gibbs free energy of the rumen (ΔG) represents the net or total energy of all reactions in the rumen:

$$\Delta G_{system} = \Sigma \Delta G_{reactions}$$

Additionally, ΔG of the system is the product of the enthalpy energy (ΔH) realised during work (chemical reactions) and the entropy (ΔS) of the system.

$$\Delta G_{system} = \Sigma \Delta H - \Sigma T \Delta S,$$

If $\Delta G = 0$, then

$$\Sigma \Delta H = \Sigma T \Delta S$$

As the ΔG tends to equilibrium ($\Delta G = 0$) the enthalpy (ΔH) and the entropy (ΔS) of the system will tend to be equal and the reaction will not occur spontaneously.

A decline in rumen pH also reflects the production and accumulation of SCFA. Therefore, as the rumen pH declines the ΔG should tend to equilibrium (ΔG=0). In Figure 5 it can be see that after feeding around 8 am the rumen ΔG decline up to a maximum that maximum energy is related to the maximal potential work that the system can produce, the more negative the value the more potential work that the system can produce.

In similar way, the highest value of ΔG is reached 4-5 hours after this represent the maximal work that it can be done, this higher value of AG is correlated to the lowest pH, as we discussed the lowest the pH the higher the amount of SCFA produce.

With this technique it can be observed how food is digested and how much potential work can be done. Fermentation can be optimised by looking what feeding management or feed supplements provide animals with the best performance.

The following description of trials work further illustrates the invention.

TRIAL 1

Method: Two dry fistulated cattle were used in a Latin square design to test the reliability and accuracy of the bolus 150. Management of these animals include free access to drinking water and around 8 kg of dry matter intake per day. The daily pasture allowance was offered at around 8 AM daily. No attempts were made to change the dietary allowance or modify the daily managements.

Two boluses 150 were placed into the rumen through cannulae: one bolus in the dorsal sac and another attached to a 1.5kg stainless steel weight to obtain data from the ventral sac. The boluses were set to log data every one minute for a 7 day period (one week).

After a period of one week the boluses were extracted, and placed in calibration solution (4, 7 and 10 and E_h Zobell's solution) to test the drift of the pH and E_h sensors. After this procedure the boluses were reallocated into the animals in a random fashion, and the process repeated at the end of each period (week) for 4 weeks. All the boluses recorded data at least once from both sites (dorsal or ventral) and from two animals (cow 1 and 2). Drift of the pH and E_h sensor over a period of a month was assessed by testing the calibration recordings at the beginning of the experiment and at the end (week 4).

A full set of 6 days of recordings were used for the analysis. The data logged at the beginning of the week (set up) and at the of the week end (calibration) was discarded to

avoid any disturbance of normal circadian rhythms during the days of manipulation, or E_h changes due to cannula removal.

Measurements were compared using the following methodology: A general linear model was constructed (using JMP 8, SAS), and the main factors were described as the circadian rhythm, the week of recording and the site of recording with animals being treated as a random factor. As the drift was linear over time, the bolus was used as autoregressive (AR_1) covariance. Using this model a circadian rhythm (time of the days in hours) was constructed for each variable and displayed in a graphical way using the mean value every 10 minutes and 95% confidence intervals (Figure 3 and 4). Linear regression analysis between sites (dorsal and ventral sac) was deduced from those models and the correlation between sites was described. Paired-T test analyses were performed for the drift analysis together with descriptive statistics. Figure 3a shows circadian rhythms of temperature from the ventral (bottom) or dorsal (top) sac of the rumen; Figure 3b shows circadian rhythms of pH from the ventral (top) or dorsal (bottom) sac of the rumen; and. Figure 3c shows **c**ircadian rhythms of redox (E_h) from the ventral (bottom) or dorsal (top) sac of the rumen. In Figures 3a-c values represent the mean and the 95% confidence intervals for a 10 minute interval during a daytime.

Figure 4a shows the circadian distribution of values of hydrogen scale (rH), obtained with the bolus; Figure 4b shows the circadian distribution of values of partial pressure of hydrogen (pp[H2] in atmosphere, black) and fugacity of oxygen (Log $f(O_2)$, white), expressed in a logarithmic scale, obtained with the bolus; and Figure 4c shows the circadian distribution of values of the Gibbs free energy of the system (ΔG, kJ) obtained with the bolus. In Figures 4a-c values represent the mean plus or minus the 95% confidence intervals.

Results: The drift of the pH sensors during the month of experimental work although significant was very small (0.1 pH point). Similarly the E_h sensors remained very accurate during all the experiment.

The comparison between sites, dorsal and ventral sac, showed that the circadian rhythms of temperature and pH were closely related (Table 1, and Figures 3a and 3b). Although, differences can be seen between sites within a daily pattern, the sites tend to follow one another. The largest differences between sites were observed on the E_h capacity of the ventral and dorsal sac, both compartments clearly having different E_h capacities (Figure 3c).

Differences between sites of sampling were more striking comparing the models for the parameters with a linear regression analysis between sites. This analysis clearly shows pH and temperature are highly correlated between sites (Table 1) and values obtained from the dorsal sac measurement are a good indicator of the overall pH and temperature of the rumen. However, Redox (E_h) of the ventral sac was only slightly correlated to the dorsal sac measurements sac (R^2=0.282).

Factor	Slope	intercept	Adj R^2
Temperature (°C)	12.105 ± 0.744	0.683 ± 0.019	0.898
pH	1.474 ± 0.071	0.794 ± 0.011	0.973
E_h (V)	-0.215 ± 0.008	0.279 ± 0.037	0.282

Table 1: Equations (slope and intercept) for the relationships between dorsal (x) and ventral (y) measurements of pH, temperature and redox (E_h).

Using the sensors onboard the bolus 150, one can calculate other valuable information from the rumen (in real-time) including hydrogen scale (rH), partial pressure of hydrogen (pp[H_2]), fugacity of oxygen ($f(O_2)$) and Gibbs free energy of the system (ΔG). Table 2 and figures 4a-c also show the circadian distribution of these values.

Variable	Descriptive statistics				
	Mean	Standard Error (SE)	Standard Deviation (SD)	Minimum	Maximum
rH scale	5.54	0.009	2.176	1.23	18.36
pp[H_2] (atm x10^{-3})	0.358	0.0058	1.486	0.000	58.987
f(O2)	-68.4	0.02	4.31	-78.3	-42.9
ΔG(kJ)	-33.1	0.05	12.98	-109.4	-7.3

Table 2. Mean values for hydrogen scale (rH), partial pressure of hydrogen (pp[H_2]), fugacity of oxygen ($f(O_2)$) and Gibbs free energy of the system (ΔG) obtained with the bolus for the rumen environment.

These secondary parameters are largely affected by feeding (around 8:00). The rumen environment becomes more reduced (lower rH values) as the digestion of the food progresses (Figure 4a). Similarly, feeding increases the amount of oxygen present in the digesta (log $f(O_2)$ increase), but the oxygen is quickly disposed reaching the lowest values around 4 hours post feeding (Figure 4b). Partial pressure of hydrogen (pp[H_2]), on the other hand, reached highest values after the nadir of oxygen (Figure 4b). Finally, the free Gibbs energy of the rumen (ΔG) decreased with feeding. Lowest values are reached within a few minutes after feeding; the highest ΔG is reached 4 hours after feeding (Figure 4c).

Ventral sac measurements were only slightly correlated to the E_h recordings from the dorsal sac (Table 1). The circadian rhythms of E_h from the dorsal sac were more dynamic and variable, especially around feeding (Figure 3c). Together, the higher temperature, E_h and lower pH of the dorsal sac could be a direct consequence of higher nutrient distribution and indicative of greater metabolic activity in this compartment than in the ventral sac.

The experiment demonstrates the feasibility of using the bolus to derive thermodynamics to explain circadian changes within the rumen. Figure 5 shows the relationship between pH and ΔG, and by including the time (daily hours) it can be shown that by feeding the animals the system gets energised and ΔG falls after feeding (8:00). As fermentation progresses and bacterial activity increases, the pH drops, SCFA accumulate and the ΔG increases towards equilibrium. In other words, as the system gets energised (feeding, 8 am) the activity of the bacteria will produce work reflected in the accumulation of acid in the rumen (i.e. lower pH). As the ΔG of the rumen environment tends to equilibrium (ΔG=0), bacteria activity will reach a steady state.

With the bolus 150 deployed in the correct site, the dorsal sac monitors the activity of the rumen microbiota. Consequently, the secondary parameters obtained with this bolus could give direct insight into the efficiency of fermentative processes such as SCFA and ATP formation, bacterial growth (protein formation), the optimization of fermentation by improving feeding practices (timing and supplementation), or reducing waste product such as methane and ammonia. This technology could aid in the direct and real time determination of protein and carbohydrate metabolism, predicting methane emissions and nitrogen losses, and overall improving the conversion efficiency of ruminants.

TRIAL 2

Method: Ten milking fistulated cattle were fitted with bolus devices as described previously in relation to and as shown in figure 2 to assess the performance of the automated uploading of data from the system. The cattle were milked twice daily declining

to once daily prior to being dried off. The specific purpose of the trial was to assess whether data could be gathered from the rumen without need to modify any of the animal's daily routine or management or disruption of normal production practices, which if required represents an additional cost to the producer.

One bolus was placed into the rumen of each animal through cannulae. The boluses were set to log data every five minutes and data was to be uploaded automatically by a system as described previously in relation to and as shown in figure 1, as each animal entered the dairy shed. Progress of the trial was monitored daily from a remote location over the internet. Data was gathered over a period of 23 days.

Results: 111,000 records were captured over a total of 338 bolus days in-vivo. 100% of the data was successfully automatically uploaded from the animals without the need for any human intervention. The trial demonstrates the feasibility of automatically gathering data from the dorsal sac of the rumen of production cattle over an extended period.

CLAIMS:

1. A system for monitoring diagnostic efficiency within the rumen of one or more ruminant animals comprising:

one or more rumen boluses each shaped and sized to be retained within, or residing within, the dorsal sac of the rumen of the associated animal and each comprising:

a temperature sensor to provide data indicative of temperature within the rumen,

a pH sensor to provide data indicative of pH within the rumen, and

a redox sensor to provide data indicative of the oxidation-reduction potential within the rumen, and

a wireless transmitter for transmitting data or derived parameters to a remote station, and

in the or each bolus or at a remote station a processor arranged to derive from the sensor data one or more parameters indicative of animal digestive efficiency.

2. A system according to claim 1 comprising boluses for or residing in the rumens of a minority of fifty or more animals.

3. A system according to claim 1 comprising boluses for or residing in the rumens of a majority or all of fifty or more animals.

4. A system according to claim 1 comprising boluses for or residing in the rumens of twenty or more animals.

5. A system according to any one of claims 1 to 4 wherein each bolus comprises stored in memory in the bolus an identification code unique to the individual bolus.

6. A system according to any one of claims 1 to 5 arranged to transmit data at least once per week.

7. A system according to any one of claims 1 to 5 arranged to transmit data at least once per day.

8. A system according to any one of claims 1 to 5 arranged to transmit data at least twice per day.

9. A system according to any one of claims 6 to 8 arranged to transmit data for at least one week.

10. A system according to any one of claims 6 to 8 arranged to transmit data for at least four weeks.

11. A system according to any one of claims 6 to 8 arranged to transmit data for at least three months.

12. A system according to any one of claims 6 to 8 arranged to transmit data indefinitely.

13. A system according to any one of claims 1 to 12 wherein the processor is located within the remote station.

14. A system according any one of claims 1 to 12 wherein the processor is located within the bolus.

15. A system according any one of claims 1 to 14 arranged to store locally in the bolus the sensor data and/or derived parameters and transmit same to the remote station when the animal comes into proximity of a receiver.

16. A system according to claim 15 wherein the receiver is located proximal to an animal milking, watering or handling station.

17. A system according any one of claims 1 to 16 wherein each bolus comprises a body comprising the sensors and wireless transmitter, and at or towards one end of the body opposed lateral extensions or tabs which are flexible towards the body of the bolus but have memory towards a position extending outwardly of the body of the bolus.

18. A system according to any one of claims 1 to 17 wherein the one or more parameters includes any combination of one or more of hydrogen scale (rH), partial pressure of hydrogen ($pp[H_2]$), oxygen fugacity ($f(O_2)$) and free energy of the system (ΔG).

19. A system according to claim 18 wherein the equation stored in memory for obtaining rH is:

$$rH=(E_h*2*F/(2.303*R*T)) + 2*pH$$

where:

E_h = hydrogen potential (V) derived from the redox sensor data

F = faraday's constant (96.485 $kJ.V^{-1}.mol^{-1}$)

R = gas constant (0.008314472 $kJ.mol^{-1}.K^{-1}$)

T = temperature (K) derived from the temperature sensor data,

rH = - log (H_2), and

pH = -log (H^+) derived from the pH sensor data.

20. A system according to claim 19 wherein rH is indicative of the reductive or oxidative intensity of the rumen environment and the processor is arranged to output a value ranging from 0 to 42, wherein 0 represents a saturate atmosphere of hydrogen.

21. A system according to any one of claims 1 to 20 wherein the equation stored memory for obtaining $pp[H_2]$ is:

$$pp[H_2] = 10^{-rH} \text{ (atm)}$$

where:

$pp[H_2]$ = partial pressure of hydrogen (atmospheres), and

rH = hydrogen scale.

22. A system according to any one of claims 1 to 21 wherein the equation stored in memory for obtaining $f(O_2)$ is:

$$\text{Log } f(O_2) = [((E_h-0.818)*4*F/(2.303*R*T))+4*pH)]$$

where:

$f(O_2)$ = fugacity of oxygen gas ($p[O_2]$)

E_h = hydrogen potential (V) derived from the redox sensor data

F = faraday's constant (96.485 $kJ.V^{-1}.mol^{-1}$)

R = gas constant (0.008314472 $kJ.mol^{-1}.K^{-1}$)

T = temperature (K) derived from the temperature sensor data, and

pH = -log (H^+) derived from the pH sensor data.

23. A system according to any one of claims 1 to 22 wherein the equation stored in memory for obtaining ΔG is:

$$\Delta G = 2.303*R*T*rH$$

where:

ΔG = the free energy of the system (kJ/mol^{-1})

R = gas constant (0.008314472 $kJ.mol^{-1}.K^{-1}$)

T = temperature (K) derived from the temperature sensor data, and

rH = the hydrogen scale.

24. A system according to any one of claims 1 to 23 wherein the rumen bolus(es) also comprise any one or more of:

a pressure sensor for providing data indicative of the pressure within the rumen,

a conductivity sensor for providing data indicative of the conductivity within the rumen,

a potassium sensor for providing data indicative of the concentration of potassium within the rumen,

a chloride sensor for providing data indicative of the concentration of chloride within the rumen

a sodium sensor for providing data indicative of the concentration of sodium within the rumen, and

an ammonium sensor for providing data indicative of the concentration of ammonia within the rumen.

25. A method for monitoring digestive efficiency of the rumen of one or more ruminant animals comprising the steps of:

providing a bolus within the dorsal sac of the rumen of the or each animal,

sensing a combination of temperature, pH, and oxidation-reduction potential within the dorsal sac of the or each rumen,

wirelessly transmitting the sensed data or derived parameters to a remote receiver, and

in a processor in the or each bolus or at a remote station deriving from the sensor data one or more parameters indicative of animal digestive efficiency.

26. A method according to claim 25 including providing boluses for or residing in the rumens of a minority of fifty or more animals.

27. A method according to claim 25 including providing boluses within the rumen of a majority or all of fifty or more animals.

28. A method according to claim 25 comprising boluses for or residing in the rumens of twenty or more animals.

29. A method according to any one of claims 25 to 28 wherein each bolus comprises stored in memory in the bolus an identification code unique to the individual bolus.

30. A method according to any one of claims 25 to 29 including transmitting data at least once per week.

31. A method according to any one of claims 25 to 29 including transmitting data at least once per day.

32. A method according to any one of claims 25 to 29 including transmitting data at least twice per day.

33. A method according to any one of claims 25 to 29 including transmitting data for at least one week.

34. A method according to any one of claims 25 to 33 including transmitting data for at least four weeks.

35. A method according to any one of claims 25 to 33 including transmitting data for at least three months.

36. A method according to any one of claims 25 to 33 including transmitting data indefinitely.

37. A method according to any one of claims 25 to 36 wherein the processor is located within the remote station.

38. A method according any one of claims 27 to 36 wherein the processor is located within the bolus.

39. A method according any one of claims 25 to 38 including storing locally in the bolus the sensor data and/or derived parameters and transmitting same to the remote station when the animal comes into proximity of a receiver.

40. A method according to claim 39 wherein the receiver is located proximal to an animal milking, watering or handling station.

41. A method according any one of claims 25 to 40 wherein each bolus comprises a body comprising the sensors and wireless transmitter, and opposed lateral extensions or tabs which are flexible towards the body of the bolus but have memory towards a position extending outwardly of the body of the bolus.

42. A method according to any one of claims 25 to 41 wherein the one or more parameters includes any combination of one or more of hydrogen scale (rH), partial pressure of hydrogen ($pp[H_2]$), oxygen fugacity ($f(O_2)$) and free energy of the method (ΔG).

43. A method according to claim 42 wherein the equation stored in memory for obtaining rH is:

$$rH=(E_h*2*F/(2.303*R*T)) + 2*pH$$

where:

E_h = hydrogen potential (V) derived from the redox sensor data

F = faraday's constant (96.485 $kJ.V^{-1}.mol^{-1}$)

R = gas constant (0.008314472 $kJ.mol^{-1}.K^{-1}$)

T = temperature (K) derived from the temperature sensor data,

rH = - log (H_2), and

pH = -log (H^+) derived from the pH sensor data.

44. A method according to claim 43 wherein rH is indicative of the reductive or oxidative intensity of the rumen environment and the processor is arranged to output a value ranging from 0 to 42, wherein 0 represents a saturate atmosphere of hydrogen.

45. A method according to any one of claims 25 to 44 wherein the equation stored memory for obtaining $pp[H_2]$ is:

$$pp[H_2] = 10^{-rH} \text{ (atm)}$$

where:

$pp[H_2]$ = partial pressure of hydrogen (atmospheres), and

rH = hydrogen scale.

46. A method according to any one of claims 25 to 45 wherein the equation stored in memory for obtaining $f(O_2)$ is:

$$\text{Log } f(O_2) = [((E_h-0.818)*4*F/(2.303*R*T))+4*pH)]$$

where:

$f(O_2)$ = fugacity of oxygen gas ($p[O_2]$)

E_h = hydrogen potential (V) derived from the redox sensor data

F = faraday's constant (96.485 $kJ.V^{-1}.mol^{-1}$)
R = gas constant (0.008314472 $kJ.mol^{-1}.K^{-1}$)
T = temperature (K) derived from the temperature sensor data, and
pH = -log (H^+) derived from the pH sensor data.

47. A method according to any one of claims 25 to 46 wherein the equation stored in memory for obtaining ΔG is:

$$\Delta G = 2.303*R*T*rH$$

where:
ΔG = the free energy of the method (kJ/mol^{-1})
R = gas constant (0.008314472 $kJ.mol^{-1}.K^{-1}$)
T = temperature (K) derived from the temperature sensor data, and
rH = the hydrogen scale.

48. A rumen bolus for a ruminant animal, comprising:

a body shaped and sized to be retained within the dorsal sac of the rumen of the animal,

housed within the body of the bolus:

a temperature sensor to provide data indicative of the temperature within the rumen,

a pH sensor to provide data indicative of the pH within the rumen,

a redox sensor to provide data indicative of the oxidation-reduction potential within the rumen, and

a wireless transmitter to transmit the read sensor array data or one or more parameters derived by processing the data, or both, to a remote station.

49. A bolus according claim 47 wherein the processor is located within the bolus.

50. A bolus according to either claim 48 or claim 49 arranged to store locally in the bolus the sensor data and/or derived parameters and transmit same to the remote station when the animal comes into proximity of a receiver.

51. A bolus according any one of claims 47 to 50 comprising a body comprising the sensors and wireless transmitter, and opposed lateral extensions or tabs which are flexible towards the body of the bolus but have memory towards a position extending outwardly of the body of the bolus.

52. A bolus according to any one of claims 47 to 51 wherein the one or more parameters includes any combination of one or more of hydrogen scale (rH), partial pressure of hydrogen ($pp[H_2]$), oxygen fugacity ($f(O_2)$) and free energy of the system (ΔG).

53. A bolus according to any one of claims 47 to 52 wherein the rumen bolus(es) also comprise any one or more of:

a pressure sensor for providing data indicative of the pressure within the rumen,

a conductivity sensor for providing data indicative of the conductivity within the rumen,

a potassium sensor for providing data indicative of the concentration of potassium within the rumen,

a chloride sensor for providing data indicative of the concentration of chloride within the rumen

a sodium sensor for providing data indicative of the concentration of sodium within the rumen, and

an ammonium sensor for providing data indicative of the concentration of ammonia within the rumen.

54. A system for monitoring digestive efficiency within the rumen of one or more ruminant animals comprising:

multiple rumen boluses each shaped and sized to be retained within, or residing within, the dorsal sac of the rumen of a group of animals and each comprising:

a temperature sensor to provide data indicative of temperature within the rumen,

a pH sensor to provide data indicative of pH within the rumen, and

a redox sensor to provide data indicative of the oxidation-reduction potential within the rumen,

stored in memory in the bolus an identification code unique to the individual bolus, and

a wireless transmitter for transmitting data or derived parameters to a remote station arranged to transmit data at least once per day or once per week for at least four weeks or at least three months, and

in the or each bolus or at a remote station a processor arranged to derive from the sensor data one or more parameters indicative of animal digestive efficiency including any combination of one or more of hydrogen scale (rH), partial pressure of hydrogen ($pp[H_2]$), oxygen fugacity ($f(O_2)$) and free energy of the system (ΔG).

55. A system according claim 54 arranged to store locally in the bolus the sensor data and/or derived parameters and transmit same to the remote station when the animal comes into proximity of a receiver.

56. A system according to claim 55 wherein the receiver is located proximal to an animal milking, watering or handling station.

57. A system according any one of claims 54 to 56 wherein each bolus comprises a body comprising the sensors and wireless transmitter, and at or towards one end of the body opposed lateral extensions or tabs which are flexible towards the body of the bolus but have memory towards a position extending outwardly of the body of the bolus.

58. A rumen bolus for monitoring digestive efficiency within the rumen of an ruminant animal, comprising:

lateral extensions or tabs which are flexible towards a body of the bolus but have memory towards a position extending outwardly of the body of the bolus, to assist the bolus to be retained within, or the bolus residing within, the dorsal sac of the rumen of an animals,

a temperature sensor to provide data indicative of temperature within the rumen,

a pH sensor to provide data indicative of pH within the rumen, and

a redox sensor to provide data indicative of the oxidation-reduction potential within the rumen,

a processor arranged to derive from the sensor data one or more parameters indicative of animal digestive, with associated memory to store or storing a bolus identification code, and

a wireless transmitter arranged to periodically transmit the one or more derived parameters to a remote station over at least three months.

1/6

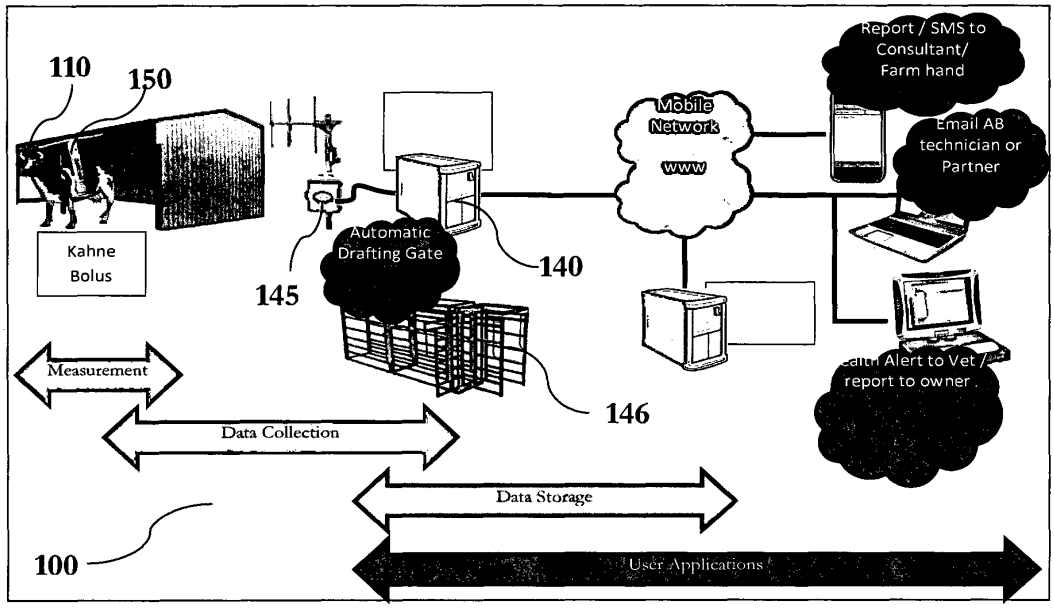

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Partner
Measurement
Data Collection
146
Data Storage
100
User Applications

Figure 1

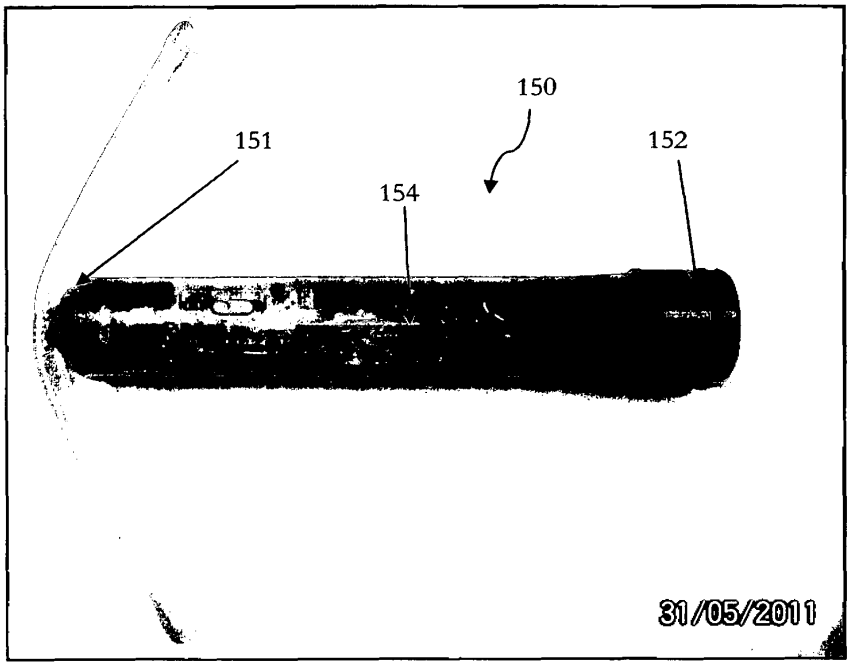


Figure 2

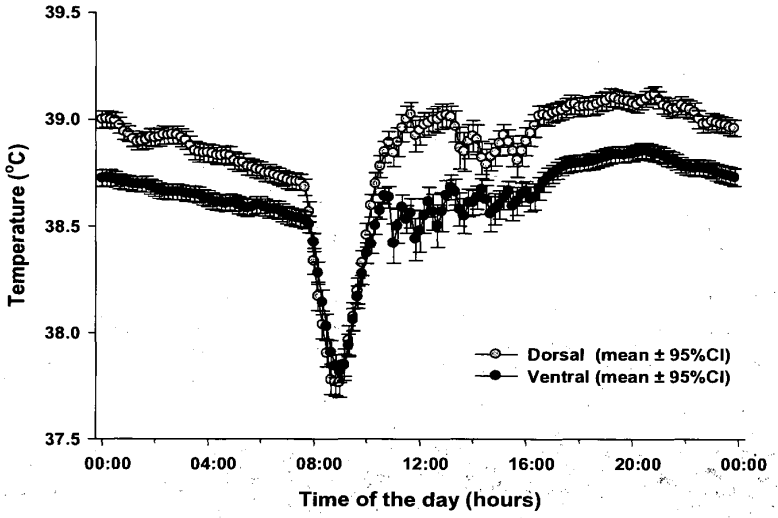


Figure 3a

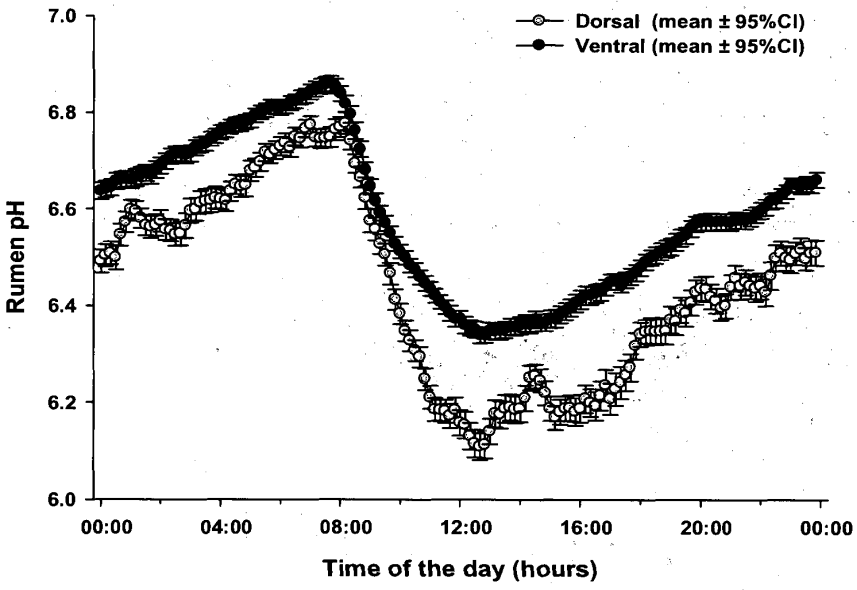


Figure 3b

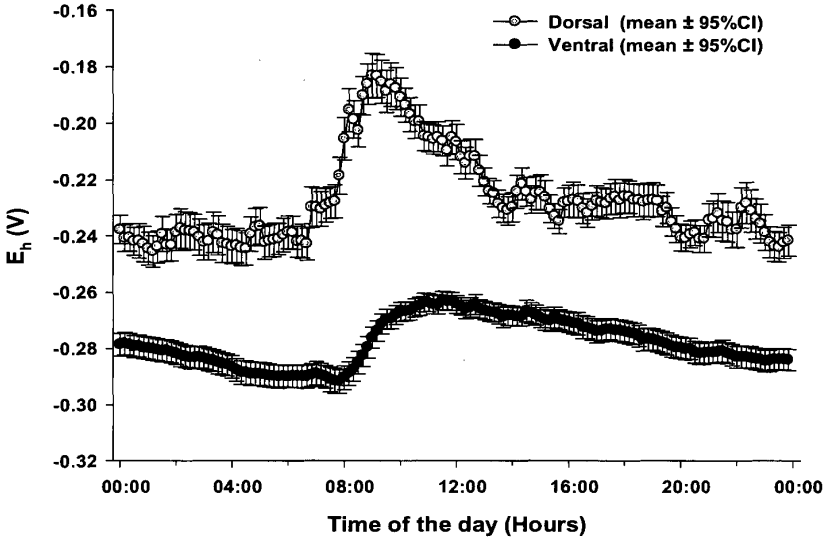


Figure 3c

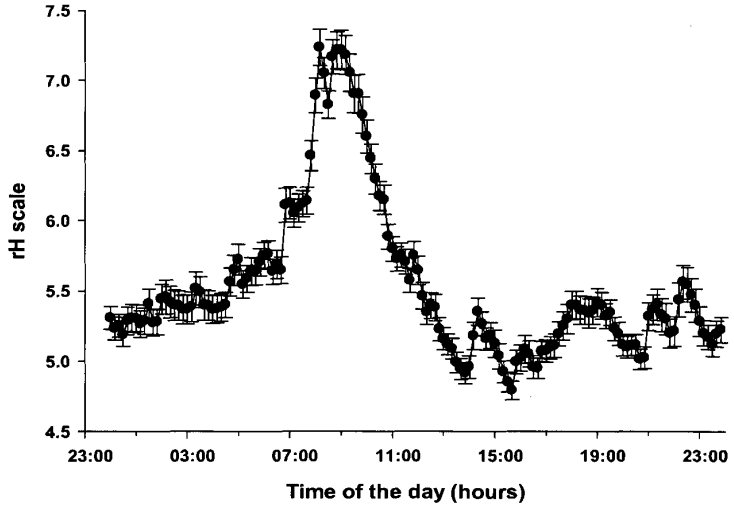


Figure 4a

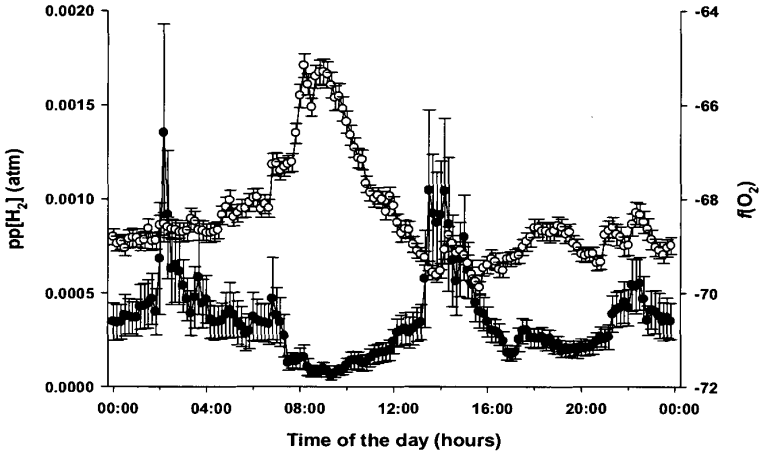


Figure 4b

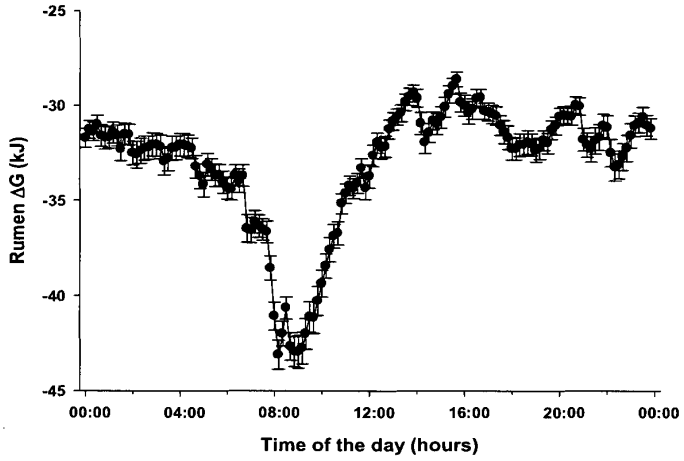


Figure 4c

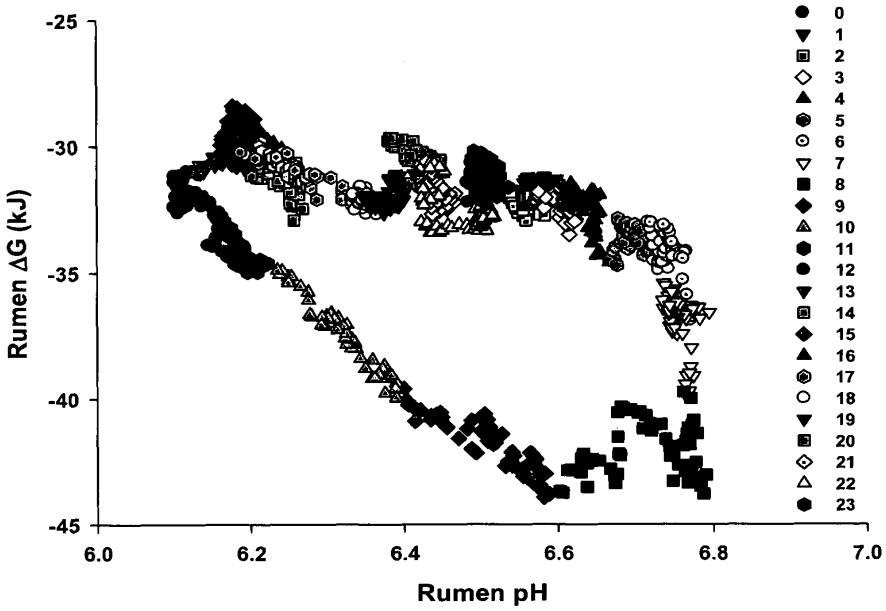

-25
-30
-35
-40
-45
Rumen ΔG (kJ)
6.0
6.2
6.4
6.6
6.8
7.0
Rumen pH
0
1
2
3
4
5
6
7
8
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Figure 5

INTERNATIONAL SEARCH REPORT

International application No.
PCT/NZ2012/000100

A. CLASSIFICATION OF SUBJECT MATTER

A01K 11/00 (2006.01) A61B 5/00 (2006.01)

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPODOC, WPI: A61B5/00, A01K11/00 & Keywords (Rumen, Bolus, pH, Temperature, Redox, Wireless) and like terms.

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
	Documents are listed in the continuation of Box C	

[X] Further documents are listed in the continuation of Box C [X] See patent family annex

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
13 August 2012	13 September 2012

Name and mailing address of the ISA/AU

AUSTRALIAN PATENT OFFICE
PO BOX 200, WODEN ACT 2606, AUSTRALIA
Email address: pct@ipaustralia.gov.au
Facsimile No.: +61 2 6283 7999

Authorised officer

Timothy Williams
AUSTRALIAN PATENT OFFICE
(ISO 9001 Quality Certified Service)
Telephone No. 0262832067

Form PCT/ISA/210 (fifth sheet) (July 2009)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/NZ2012/000100

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☐ Claims Nos:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a)

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

See Supplemental Box for Details

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☒ As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.

☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.

☐ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		International application No. **PCT/NZ2012/000100**
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2009/0182207 A1 (RISKEY et al) 16 July 2009 Paragraphs 13-14, 16, 22, 30, 32-36, 45, 47-50.	1-16, 18-40, 42-50, 52-56
X	US 6099482 A (BRUNE et al) 08 August 2008 Figure 1, 12, Column 3 Line 1-5, Column 4 Line 44-59, Column 5 Line 1-9 Line 28-37 Line 48-52, Column 6 Line 4-8.	1-16, 18-40, 42-50, 52-56
X	US 2008/0236500 A1 (HODGES et al) 02 October 2008 Figure 1, 6, Para 6, 12-13, 15-17, 20	1-16, 18-40, 42-50, 52-56
A	US 2002/0128542 A1 (VAN OVER) 12 September 2002 Whole Document	1-58

Supplemental Box

Continuation of: **Box III**

This International Application does not comply with the requirements of unity of invention because it does not relate to one invention or to a group of inventions so linked as to form a single general inventive concept.

This Authority has found that there are different inventions based on the following features that separate the claims into distinct groups:

- Claims 1 to 53 are directed to a system, method and device for monitoring digestive efficiency within the rumen of one or more ruminant animals. The feature of 'each bolus or remote station having a processor arranged to derive from the sensor data one or more parameters indicative of animal digestive efficiency' is specific to this group of claims.

- Claims 54 to 57 are directed to a system for monitoring digestive efficiency within the rumen of one or more ruminant animals. The feature of 'each bolus or remote station having a processor arranged to derive from the sensor data one or more parameters indicative of animal digestive efficiency including any combination of hydrogen scale, partial pressure of hydrogen, oxygen fugacity and free energy of the system' is specific to this group of claims.

- Claim 58 which is directed to a rumen bolus for monitoring digestive efficiency within the rumen of a ruminant animal. The feature of 'lateral extensions or tabs which are flexible towards a body of the bolus but have memory towards a position extending outwardly of the body of the bolus, to assist the bolus to be retained within, or the bolus residing within, the dorsal sack of the rumen of an animal' is specific to this group of claims.

PCT Rule 13.2, first sentence, states that unity of invention is only fulfilled when there is a technical relationship among the claimed inventions involving one or more of the same or corresponding special technical features. PCT Rule 13.2, second sentence, defines a special technical feature as a feature which makes a contribution over the prior art.

When there is no special technical feature common to all the claimed inventions there is no unity of invention.

In the above groups of claims, the identified features may have the potential to make a contribution over the prior art but are not common to all the claimed inventions and therefore cannot provide the required technical relationship. The only feature common to all of the claimed inventions and which provides a technical relationship among them is **'one or more rumen boluses each shaped and sized to be retained within, or residing within, the dorsal sac of the rumen of the associated animal and each comprising: a temperature sensor to provide data indicative of temperature within the rumen, a pH sensor to provide data indicative of pH within the rumen, and a redox sensor to provide data indicative of the oxidation-reduction potential within the rumen, and a wireless transmitter for transmitting data or derived parameters to a remote station, and in each bolus or remote station a processor arranged to derive from the senor data one or more parameters indicative of animal digestive efficiency'.**

However this feature does not make a contribution over the prior art because it is disclosed in:
Prior art documents D1-D3

Therefore in the light of this document this common feature cannot be a special technical feature. Therefore there is no special technical feature common to all the claimed inventions and the requirements for unity of invention are consequently not satisfied *a posteriori*.

INTERNATIONAL SEARCH REPORT Information on patent family members	International application No. **PCT/NZ2012/000100**

This Annex lists known patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document/s Cited in Search Report		**Patent Family Member/s**	
Publication Number	**Publication Date**	**Publication Number**	**Publication Date**
US 2009/0182207 A1	16 Jul 2009	US 2009182207 A1	16 Jul 2009
US 6099482 A	08 Aug 2008	EP 0897662 A1	24 Feb 1999
		EP 0897662 B1	07 May 2003
		EP 0898882 A1	03 Mar 1999
		EP 0898882 B1	30 Jul 2003
		US 5984875 A	16 Nov 1999
		US 6059733 A	09 May 2000
		US 6099482 A	08 Aug 2000
		US 6371927 B1	16 Apr 2002
US 2008/0236500 A1	02 Oct 2008	US 2008236500 A1	02 Oct 2008
US 2002/0128542 A1	12 Sep 2002	AU 2002252225 A1	24 Sep 2002
		US 2002128542 A1	12 Sep 2002
		WO 02073194 A2	19 Sep 2002

End of Annex

Due to data integration issues this family listing may not include 10 digit Australian applications filed since May 2001.

Electronic Patent Application Fee Transmittal

Application Number:	
Filing Date:	
Title of Invention:	Calf Bolus
First Named Inventor/Applicant Name:	Nicholas P. Rettedal
Filer:	Craig R. Miles/Lioudmila Townsend
Attorney Docket Number:	bellaUScalf (280-10)

Filed as Small Entity

Filing Fees for Utility under 35 USC 111(a)

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Utility filing Fee (Electronic filing)	4011	1	70	70
Utility Search Fee	2111	1	300	300
Utility Examination Fee	2311	1	360	360
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				
Miscellaneous:				
		Total in USD ($)		**730**

Electronic Acknowledgement Receipt	
EFS ID:	22624036
Application Number:	14738789
International Application Number:	
Confirmation Number:	8986
Title of Invention:	Calf Bolus
First Named Inventor/Applicant Name:	Nicholas P. Rettedal
Customer Number:	39208
Filer:	Craig R. Miles/Lioudmila Townsend
Filer Authorized By:	Craig R. Miles
Attorney Docket Number:	bellaUScalf (280-10)
Receipt Date:	12-JUN-2015
Filing Date:	
Time Stamp:	21:45:50
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Credit Card
Payment was successfully received in RAM	$730
RAM confirmation Number	6478
Deposit Account	
Authorized User	
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:	

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Transmittal Letter	Transmittal_Letter.pdf	61436 f559ae67bf03c1037b46c65a6add09346e6f31fe	no	2
Warnings:					
Information:					
2	Application Data Sheet	ADS.pdf	121132 41d3e4469ca97da451cfc2ed3c0fff0a1a0216f4	no	6
Warnings:					
Information:					
This is not an USPTO supplied ADS fillable form					
3	Oath or Declaration filed	Declaration_NR.pdf	74429 083a4fddf2f4c58cd165dad8df63de3abeb3b23a	no	3
Warnings:					
Information:					
4	Oath or Declaration filed	Declaration_SW.pdf	93036 0b175ecd222bdce799b25422600072 0c4848faf5	no	3
Warnings:					
Information:					
5	Oath or Declaration filed	Declaration_SC.pdf	82198 0bde9882ad087983bc9110a7c2125c9a507a0c61	no	3
Warnings:					
Information:					
6	Oath or Declaration filed	Declaration_JJ.pdf	80535 e622a474651bfe314644463b15bf134dfcc63b3f	no	3
Warnings:					
Information:					
7	Power of Attorney	POA_Assignee.pdf	38124 b7d3529c056597e589852410fb834864aebf828b	no	1
Warnings:					
Information:					

8	Assignee showing of ownership per 37 CFR 3.73	Statement.pdf	365064 4c9728399329b9bf6913a6914a5b861d70d95edd	no	9
Warnings:					
Information:					
9	Assertion of entitlement to small entity status	Small_Entity_Statement_Business.pdf	60142 f7b714e41c7581cf3b7be2755794bf7a191eb220	no	2
Warnings:					
Information:					
10	Specification	Specification.pdf	1995459 76fb68c230cd597838a329ba26b355a5d28b7eb3	no	43
Warnings:					
Information:					
11	Drawings-only black and white line drawings	Drawings.pdf	149851 6eb6d4681496e31cbd80c56b4ca71c427a578ef2	no	7
Warnings:					
Information:					
12	Information Disclosure Statement (IDS) Form (SB08)	IDS.pdf	288222 47ed43330d7ef0902bd73834bd6b3d36c86d347b	no	4
Warnings:					
Information:					
This is not an USPTO supplied IDS fillable form					
13	Preliminary Amendment	Prelim_Amendment.pdf	193952 4a8e4621c1c6e7c7cf706f06dd71858026671168	no	8
Warnings:					
Information:					
14	Foreign Reference	EP2314154.pdf	200172 d70b84710c45cbcd3087d7e4ace687a6a78f844b	no	8
Warnings:					
Information:					
15	Foreign Reference	WO2011079338.pdf	846645 30560e2fc736c82f16ce508423d34c58b13b34d5	no	16
Warnings:					
Information:					
16	Foreign Reference	WO2012173502.pdf	1510289 810fd13e1e93270b783e6e5375c63dc09dea275f	no	39

Warnings:					
Information:					
17	Non Patent Literature	Boehmer.pdf	50225 0dd1b5b9cd2da2c3372969c2ae2a5868968e95f6	no	4
Warnings:					
Information:					
18	Non Patent Literature	Caja.pdf	387083 5d05885498173c08a44e4dcb6d56d0b768f60ed8	no	19
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Information:					
19	Non Patent Literature	Cooper.pdf	226469 c3add36b007a001838a100f43c51c56dbb52cb88	no	33
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Information:					
20	Non Patent Literature	Fallon.pdf	1533149 b3c5e7b512323921979cf899172f4732af9f5d21	no	28
Warnings:					
Information:					
21	Non Patent Literature	Ghirardi.pdf	315640 9a03b77e51ddb3a19c7e5e1b65c423e331de7d22	no	11
Warnings:					
Information:					
22	Non Patent Literature	Ghirardi_2.pdf	311504 6e643a135ea8cc7335dec1ff098600a5a918e363	no	10
Warnings:					
Information:					
23	Non Patent Literature	Hach.pdf	29335 76c9764033d1074cb92836128ad008bce040fafe	no	2
Warnings:					
Information:					
24	Non Patent Literature	Scanga.pdf	71664 6e1026db36ddce40a88326abfaafa18fb4f3fa0f	no	2
Warnings:					
Information:					
25	Non Patent Literature	SmartStock.pdf	3507078 22883cb812f2414ae8ba38125658e2abcc1c78ef	no	12

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Information:					
26	Non Patent Literature	AU_OA.pdf	46437 fe05fb03c27425fa0f0955ab86d7e506bc9e5642	no	3
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Information:					
27	Non Patent Literature	NZ_OA_1.pdf	27153 e6d955703ff90a2734ab16f66c69935a569f1496	no	1
Warnings:					
Information:					
28	Non Patent Literature	NZ_OA_2.pdf	24596 ebd94d4bcc08d536966de49ee1968b512660bb94	no	1
Warnings:					
Information:					
29	Non Patent Literature	NZ_OA_3.pdf	18558 db5784fb888874c7260486fd987dee45231de0c4	no	1
Warnings:					
Information:					
30	Non Patent Literature	NZ_OA_4.pdf	31891 2b5d47cf89a36e785423809104f4ab4c74958824	no	3
Warnings:					
Information:					
31	Non Patent Literature	NZ_OA_5.pdf	31933 e96fad689a0b557819f683557615ec842093e8ff	no	3
Warnings:					
Information:					
32	Fee Worksheet (SB06)	fee-info.pdf	34778 be0bff1cfcbe34f98fdf1b5ee7ae16346e65f801	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	12808179		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the application of: Nicholas P. Rettedal, Stephen M. Weilnau, Scott R. Cockroft, and Joseph Janus IV	**Confirmation No.:**
Application No.:	**Group Art Unit:**
Filed:	**Examiner:**
For: Calf Bolus	
Attorney Docket No.: bellaUScalf (280-10)	

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

LETTER OF TRANSMITTAL

Dear Sir/Madam:

Please find enclosed, for filing, a United States non-provisional patent application entitled "Calf Bolus", including the following documents:

1. an Application Data Sheet (6 page(s));
2. a Declaration For Patent Application by Nicholas P. Rettedal (3 page(s));
3. a Declaration For Patent Application by Stephen M. Weilnau (3 page(s));
4. a Declaration For Patent Application by Scott R. Cockroft (3 page(s));
5. a Declaration For Patent Application by Joseph Janus IV (3 page(s));
6. a Power of Attorney -- Bella Technologies, LLC, the Assignee by the Assignment of Patent Rights (1 page(s));
7. a Statement under 37 CFR 3.73 (c) (2 page(s)) along with the copy of an Assignment of Patent Rights from Nicholas P. Rettedal, Stephen M. Weilnau, Scott R. Cockroft, and Joseph Janus IV to Bella Technologies, LLC (7 page(s));
8. a Statement Establishing Small Entity Status -- Small Business (2 page(s)), hereby claimed;
9. a Specification (43 page(s));

10. Formal Drawings (7 sheet(s));

11. an Information Disclosure Statement By Applicant (4 page(s)) along with copies of each cited reference not already available at the USPTO;

12. a Preliminary Amendment (8 page(s)); and

13. this firm Letter of Transmittal (2 page(s)).

Please note:

All right, title, and interest in this United States patent application entitled "Calf Bolus" filed June 12, 2015 is owned by Bella Technologies, LLC.

I have this 12 day of June, 2015, either myself personally, or through my direction of staff at this office, deposited all of the items listed in this Letter of Transmittal with the United States Patent and Trademark Office via EFS-Web.

Please process the submitted United States non-provisional patent application.

Direct all correspondence to:

CR MILES, P.C.
405 Mason Court, Suite 119
Fort Collins, CO 80524

Customer Number: 39208

Dated this 12 day of June, 2015

Respectfully Submitted,

By: _____

Craig R. Miles
ATTORNEY FOR APPLICANT
USPTO Reg. No. 45,954
CR MILES, P.C.
405 Mason Court, Suite 119
Fort Collins, CO 80524
(970) 492-0000 telephone
(970) 492-0003 facsimile

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the application of: Nicholas P. Rettedal, Stephen M. Weilnau, Scott R. Cockroft, and Joseph Janus IV	**Confirmation No.:**
Application No.:	**Group Art Unit:**
Filed:	**Examiner:**
For: Calf Bolus	
Attorney Docket No.: bellaUScalf (280-10)	

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

APPLICATION DATA SHEET UNDER 37 CFR 1.76

Secrecy Order in Parent Application::	No

Inventor Information

Inventor::	**1**
Prefix::	
Given Name:	Nicholas
Middle Name::	P.
Family Name::	Rettedal
Suffix::	
Residence Information::	US Residency
City of Residence::	Loveland
State or Province of Residence::	CO
Country of Residence::	US
Street of Mailing Address::	1701 E 15th Street
City of Mailing Address::	Loveland

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 82 of 607

State or Province of Mailing Address::	CO
Postal or Zip Code of Mailing Address::	80538
Country::	US

Inventor::	**2**
Prefix::	
Given Name:	Stephen
Middle Name::	M.
Family Name::	Weilnau
Suffix::	
Residence Information::	US Residency
City of Residence::	Greeley
State or Province of Residence::	CO
Country of Residence::	US
Street of Mailing Address::	1937 Montview Drive
City of Mailing Address::	Greeley
State or Province of Mailing Address::	CO
Postal or Zip Code of Mailing Address::	80631
Country::	US

Inventor::	**3**
Prefix::	
Given Name:	Scott
Middle Name::	R.
Family Name::	Cockroft
Suffix::	
Residence Information::	US Residency
City of Residence::	Greeley
State or Province of Residence::	CO
Country of Residence::	US

Street of Mailing Address::	27712 County Road 62
City of Mailing Address::	Greeley
State or Province of Mailing Address::	CO
Postal or Zip Code of Mailing Address::	80631
Country::	US

Inventor::	**4**
Prefix::	
Given Name:	Joseph
Middle Name::	
Family Name::	Janus
Suffix::	IV
Residence Information::	US Residency
City of Residence::	Loveland
State or Province of Residence::	CO
Country of Residence::	US
Street of Mailing Address::	125 E 23rd Street
City of Mailing Address::	Loveland
State or Province of Mailing Address::	CO
Postal or Zip Code of Mailing Address::	80538
Country::	US

Correspondence Information

Name::	CR MILES P.C.
Correspondence Customer Number::	39208
Electronic Mail::	intentionally left blank
Street of Mailing Address::	405 Mason Court, Suite 119
City of Mailing Address::	Fort Collins
State or Province of Mailing Address::	Colorado
Postal or Zip Code of Mailing Address::	80524

Telephone::	(970) 492-0000
Fax::	(970) 492-0003

Application Information

Title::	Calf Bolus
Attorney Docket Number::	bellaUScalf (280-10)
Small Entity::	Yes
Application Type::	Non-Provisional
Subject Matter::	Utility
Total Drawing Sheets::	5
Suggested Figure for Publication::	1

Publication Information

Request for Early Publication::	No
Request Not To Publish::	No

Representative Information

Customer Number::	39208
Attorney Name::	Craig R. Miles
Registration Number::	45,954

Domestic Priority Information None

Foreign Priority Information None

Statement Under 37 C.F.R 1.55 or 1.78 for AIA: No

This Application (1) claims priority to or the benefit of an application filed before March 16, 2013 and (2) also contains, or contained at any time, a claim to a claimed invention that has an effective filing date on or after March 16, 2013.

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 85 of 607

Authorization to Permit Access: No

The undersigned hereby grants the USPTO authority to provide the European Patent Office (EPO), the Japan patent Office (JPO), the Korean Intellectual Property Office (KIPO), the World Intellectual Property Office (WIPO), and any other intellectual property offices in which the foreign application claiming priority to the instant patent application is filed access to the instant patent application.

Applicant Information

Applicant Authority Type::	Assignee
Applicant is an Organization::	Yes
Applicant Name::	Bella Technologies, LLC
Street of Mailing Address for Applicant::	27906 Weld County Road 388
City of Mailing Address for Applicant::	Kersey
State/Province of Mailing Address for Applicant::	CO
Postal Code of Mailing Address for Applicant::	80644
Country::	US
Phone Number for Applicant::	intentionally left blank
Fax Number for Applicant::	intentionally left blank
E-mail Address for Applicant::	intentionally left blank

Assignee Information:

Assignee is an Organization::	Yes
Assignee Name::	Bella Technologies, LLC
Street of Mailing Address for Assignee::	27906 Weld County Road 388
City of Mailing Address for Assignee::	Kersey
State/Province of Mailing Address for Assignee::	CO
Postal Code of Mailing Address for Assignee::	80644
Country::	US
Phone Number for Assignee::	intentionally left blank
Fax Number for Assignee::	intentionally left blank
E-mail Address for Assignee::	intentionally left blank

Dated this 12 day of June, 2015

Respectfully Submitted,

By: _____

Craig R. Miles
ATTORNEY FOR APPLICANT
USPTO Reg. No. 45,954
CR MILES, P.C.
405 Mason Court, Suite 119
Fort Collins, CO 80524
(970) 492-0000 telephone
(970) 492-0003 facsimile

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 87 of 607

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the application of: Nicholas P. Rettedal, Stephen M. Weilnau, Scott R. Cockroft, and Joseph Janus IV	**Confirmation No.:**
Application No.:	**Group Art Unit:**
Filed:	**Examiner:**
For: Calf Bolus	
Attorney Docket No.: bellaUScalf (280-10)	

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

DECLARATION FOR PATENT APPLICATION

Declaration of Nicholas P. Rettedal:

I, Nicholas P. Rettedal, hereby declare:

I am a citizen of the United States of America and that my residence and mailing address is 1701 E 15th Street, Loveland, Colorado 80538 USA.

Nicholas P. Rettedal declares:

The above-identified application was made or authorized to be made by me.

I believe that I am the original joint inventor of the subject matter which is claimed and for which a patent is sought on the invention entitled "Calf Bolus" the specification and the preliminary amendment of which are attached hereto.

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment specifically referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in 37 C.F.R. §1.56, including for continuation-in-part applications, material information which became available between the filing date of the prior application and the national or PCT international filing date of the continuation-in-part application.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under 18 U.S.C. §1001 and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

SIGNATURES ON THE FOLLOWING PAGE:

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 89 of 607

Nicholas P. Rettedal

Date: 2/17/2015

UNITED STATES OF AMERICA)
STATE OF COLORADO)
COUNTY OF LARIMER)

SUBSCRIBED AND AFFIRMED OR SWORN to before me in the County of Larimer, State of Colorado, United States of America, by Nicholas P. Rettedal, this 17 day of February, 2015. WITNESS my hand and official seal pursuant to the authority vested in me as a Notary Public by the State of Colorado.

Notary Public
My Commission Expires: Nov. 9, 2016

MELANIE CARTER
NOTARY PUBLIC
STATE OF COLORADO
NOTARY ID 20084037911
MY COMMISSION EXPIRES NOV. 9, 2016

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the application of: Nicholas P. Rettedal, Stephen M. Weilnau, Scott R. Cockroft, and Joseph Janus IV	**Confirmation No.:**
Application No.:	**Group Art Unit:**
Filed:	**Examiner:**
For: Calf Bolus	
Attorney Docket No.: bellaUScalf (280-10)	

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

DECLARATION FOR PATENT APPLICATION

Declaration of Stephen M. Weilnau:

I, Stephen M. Weilnau, hereby declare:

I am a citizen of the United States of America and that my residence and mailing address is 1937 Montview Drive, Greeley, Colorado 80631 USA.

Stephen M. Weilnau declares:

The above-identified application was made or authorized to be made by me.

I believe that I am the original joint inventor of the subject matter which is claimed and for which a patent is sought on the invention entitled "Calf Bolus" the specification and the preliminary amendment of which are attached hereto.

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment specifically referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in 37 C.F.R. §1.56, including for continuation-in-part applications, material information which became available between the filing date of the prior application and the national or PCT international filing date of the continuation-in-part application.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under 18 U.S.C. §1001 and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

SIGNATURES ON THE FOLLOWING PAGE:

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 92 of 607

Stephen M. Weilnau

Date: Feb. 17-2015

UNITED STATES OF AMERICA)
STATE OF COLORADO)
COUNTY OF Larimer)

SUBSCRIBED AND AFFIRMED OR SWORN to before me in the County of Larimer, State of Colorado, United States of America, by Stephen M. Weilnau, this 17 day of February, 2015. WITNESS my hand and official seal pursuant to the authority vested in me as a Notary Public by the State of Colorado.

Notary Public
My Commission Expires: Nov. 9, 2016

MELANIE CARTER
NOTARY PUBLIC
STATE OF COLORADO
NOTARY ID 20084037911
MY COMMISSION EXPIRES NOV. 9, 2016

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the application of: Nicholas P. Rettedal, Stephen M. Weilnau, Scott R. Cockroft, and Joseph Janus IV

Application No.:

Filed:

For: Calf Bolus

Attorney Docket No.: bellaUScalf (280-10)

Confirmation No.:

Group Art Unit:

Examiner:

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

DECLARATION FOR PATENT APPLICATION

Declaration of Scott R. Cockroft:

I, Scott R. Cockroft, hereby declare:

I am a citizen of the United States of America and that my residence and mailing address is 27712 County Road 62, Greeley, Colorado 80631 USA.

Scott R. Cockroft declares:

The above-identified application was made or authorized to be made by me.

I believe that I am the original joint inventor of the subject matter which is claimed and for which a patent is sought on the invention entitled "Calf Bolus" the specification and the preliminary amendment of which are attached hereto.

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment specifically referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in 37 C.F.R. §1.56, including for continuation-in-part applications, material information which became available between the filing date of the prior application and the national or PCT international filing date of the continuation-in-part application.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under 18 U.S.C. §1001 and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

SIGNATURES ON THE FOLLOWING PAGE:

Scott R. Cockroft

Date: 2-23-2015

Scott R. Cockroft

UNITED STATES OF AMERICA)
STATE OF COLORADO)
COUNTY OF Weld)

SUBSCRIBED AND AFFIRMED OR SWORN to before me in the County of Weld, State of Colorado, United States of America, by Scott R. Cockroft, this 23rd day of February, 2015. WITNESS my hand and official seal pursuant to the authority vested in me as a Notary Public by the State of Colorado.

CYNTHIA J. KENNEDY
NOTARY PUBLIC
STATE OF COLORADO
NOTARY ID 2000401995
MY COMMISSION EXPIRES MARCH 21, 2017

Cynthia J Kennedy
Notary Public
My Commission Expires: 3-21-17

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the application of: Nicholas P. Rettedal, Stephen M. Weilnau, Scott R. Cockroft, and Joseph Janus IV	**Confirmation No.:**
Application No.:	**Group Art Unit:**
Filed:	**Examiner:**
For: Calf Bolus	
Attorney Docket No.: bellaUScalf (280-10)	

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

DECLARATION FOR PATENT APPLICATION

Declaration of Joseph Janus IV:

I, Joseph Janus IV, hereby declare:

I am a citizen of the United States of America and that my residence and mailing address is 125 E 23rd Street, Loveland, Colorado 80538 USA.

Joseph Janus IV declares:

The above-identified application was made or authorized to be made by me.

I believe that I am the original joint inventor of the subject matter which is claimed and for which a patent is sought on the invention entitled "Calf Bolus" the specification and the preliminary amendment of which are attached hereto.

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment specifically referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in 37 C.F.R. §1.56, including for continuation-in-part applications, material information which became available between the filing date of the prior application and the national or PCT international filing date of the continuation-in-part application.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under 18 U.S.C. §1001 and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

SIGNATURES ON THE FOLLOWING PAGE:

Joseph Janus IV

Date: 2-17-15

UNITED STATES OF AMERICA)
STATE OF COLORADO)
COUNTY OF LARIMER)

SUBSCRIBED AND AFFIRMED OR SWORN to before me in the County of Larimer, State of Colorado, United States of America, by Joseph Janus IV, this 17 day of February, 2015. WITNESS my hand and official seal pursuant to the authority vested in me as a Notary Public by the State of Colorado.

Notary Public
My Commission Expires: Nov 9, 2016

MELANIE CARTER
NOTARY PUBLIC
STATE OF COLORADO
NOTARY ID 20084037911
MY COMMISSION EXPIRES NOV. 9, 2016

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the application of: Nicholas P. Rettedal, Stephen M. Weilnau, Scott R. Cockroft, and Joseph Janus IV	**Confirmation No.:**
Application No.:	**Group Art Unit:**
Filed:	**Examiner:**
For: Calf Bolus	
Attorney Docket No.: bellaUScalf (280-10)	

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

STATEMENT ESTABLISHING SMALL ENTITY STATUS
SMALL BUSINESS CONCERN

I, Scott R. Cockroft as President of Bella Technologies, LLC, pursuant to 37 C.F.R. §1.27(c) state that the following facts are true:

Bella Technologies, LLC is the assignee of record under 37 C.F.R. §3.71 of the entire interest in the above-identified application. As President of Bella Technologies, LLC, I am empowered to act on behalf of the Assignee.

As set forth in 13 C.F.R. §121.801 through §121.805, Bella Technologies, LLC is an entity whose number of employees, including those of its affiliates, does not exceed 500 persons and which has not assigned, granted, conveyed, or licensed, and is under no obligation under contract or law to assign, grant, convey, or license, any rights in the subject matter of the enclosed patent application to another entity that does not qualify for small entity status. Bella Technologies, LLC appears to qualify as a small business concern as defined in 37 C.F.R. §1.27(a)(2).

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements so made are punishable by fine or imprisonment, or both under 18 U.S.C. §1001 and that such willful false statements may jeopardize the validity of the patent application or any patent issued thereon.

Dated this 23 day of February, 2015

By: _____
Scott R. Cockroft, President
Bella Technologies, LLC

CALF BOLUS

I. FIELD OF THE INVENTION

Generally, an animal monitoring device configured as a bolus for oral administration to reside in the reticulorumen of a ruminant animal having a memory element, a processor in communication with the memory element and a computer code contained in the memory element including a power management module executable by the processor to regulate power use by the bolus based on determination of remaining energy stored in an energy source and the determined power requirements over a pre-determined life cycle of the bolus.

II. BACKGROUND OF THE INVENTION

Conventional bolus orally administered to reside in the reticulorumen for monitoring of physiological parameters of ruminant animals may not have a configuration capable of oral administration at birth. Additionally, bolus, even when orally administered to adult ruminant animals, may not have an operational lifespan long enough to monitor useful physiological parameters over the remaining productive lifespan of the ruminant animal. Moreover, uncontrollable changes in the orientation of the bolus and correspondingly uncontrolled orientation of the bolus antenna in the reticulorumen of the ruminant animal may cause variable quality in radio signal transmission from the ruminant animal resulting in the loss of encoded physiological data.

III. SUMMARY OF THE INVENTION

Accordingly, a broad object of the invention can be to provide a bolus having an outer most surface configuration and a density which allows oral administration to a ruminant animal immediately after birth and prevents or substantially reduces the likelihood of being regurgitated or ejected from the reticulorumen of a ruminant animal over the entire lifespan or productive lifespan of the ruminant animal.

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 102 of 607

Another broad object of the invention can be to provide a bolus which can reside in the reticulorumen of a ruminant animal having an operational lifespan corresponding to the entire lifespan or the productive lifespan of the ruminant animal. One aspect of this broad object of the invention involves a power management module including an activation element which maintains the bolus in a sleep mode in which one or more encoded sensor signals are compared to a pre-selected activation code and upon achieving a pre-selected activation match threshold between the encoded sensor signals and the pre-selected activation code causes the bolus to be activated for normal monitoring of one or more physiological parameters of the ruminant animal. As to particular embodiments, a first and second pre-selected activation match threshold can be met by comparison of a corresponding first and second encoded sensor signals and a first and second pre-selected activation code to provide assurance that environmental events to not inadvertently activate the bolus for normal monitoring. Another aspect of this broad object involves a power management module pre-programmed or re-programmable to reconfigure the operating parameters of the bolus during residence in the reticulorumen of a ruminant animal to collect only useful physiological data and encode and transmit such physiological data at intervals based upon the life stage of the ruminant animal. Another aspect of this broad object of the invention involves a power management module which functions to evaluate the remaining amount of energy stored in the power source of the bolus and compare the remaining amount of energy to the energy requirements of the bolus during a pre-determined period of time based on the existing programmed operational parameters of the bolus and further functions to employ power regulation events to offset the difference between the energy requirement of the bolus over the pre-determined period of time and the amount of energy remaining in the power source.

Another broad object of the invention can be to provide an antenna having a structure that alters the magnetic field and electrical field generation in a manner that reduces the impact of uncontrollable changes in the orientation of the bolus and correspondingly the orientation of the antenna during residence of the bolus in the reticulorumen of the ruminant animal.

Naturally, further objects of the invention are disclosed throughout other areas of the specification, drawings, photographs, and claims.

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 103 of 607

IV. BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a diagram which shows a particular method of using an embodiment of the animal monitoring system to monitor one or more physiological parameters of a ruminant animal.

Figure 2 is a block diagram of a particular embodiment of a bolus capable of being orally administered to a ruminant animal.

Figure 3 is a block diagram which shows a particular embodiment of an animal monitoring system including a specialized computer, a radio frequency reader and a bolus.

Figure 4 is an exploded view of a particular embodiment of a bolus capable of being orally administered to a ruminant animal.

Figure 5 is a diagram of a particular embodiment of the animal monitoring assembly of the bolus.

Figure 6 is an exploded view of a particular embodiment of an antenna included in the particular embodiment of the bolus shown in Figures 4 and 5.

Figure 7 is a top perspective view of the particular embodiment of the antenna shown in Figure 6 having first and second electrically conductive loops disposed on the opposed surfaces of a non-electrically conductive sheet material.

Figure 8 is top plan view of the particular embodiment of the antenna shown in Figure 6 with vias (shown in broken line) interconnecting a first and second electrically conductive loops without being disposed on opposed surfaces of a non-electrically conductive sheet material.

Figure 9 is a top plan view of the particular embodiment of the antenna shown in Figure 8.

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 104 of 607

Figure 10 is a first side elevation view of the particular embodiment of the antenna shown in Figure 8.

Figure 11 is a second side elevation view of the particular embodiment of the antenna shown in Figure 8.

Figure 12 is a first end elevation view of the particular embodiment of the antenna shown in Figure 8.

Figure 13 is a second end elevation view of the particular embodiment of the antenna shown in Figure 8.

V. DETAILED DESCRIPTION OF THE INVENTION

Now generally referring to Figures 1 through 13, which provide illustrative examples of an inventive bolus (1) and a method of using a bolus (1) to monitor one or more physiological parameters (2) of a ruminant animal (3) and a computer implemented animal monitoring system (4). The bolus (1) can be orally administered to reside in the reticulorumen (5) of the ruminant animal (3). As to certain embodiments, the bolus (1) can include a bolus body (6) having an outer most external surface (7) configured to allow oral administration to a ruminant animal (3), with certain embodiments capable of being orally administered immediately after birth. As to certain embodiments, the bolus (1) can include a microcontroller (8) including a processor (9) in communication with a memory element (10) containing a program code (11) including a power management module (12) which allows the bolus (1) to operate in the reticulorumen (5) of the ruminant animal (3) during the entire life span of the ruminant animal from birth to death or from birth to the end of the productive lifespan of the ruminant animal (3).

For the purposes of this invention the term "ruminant animal (3)" means any mammal of the suborder Ruminantia (both wild and domestic) and, without limiting the breadth of the

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 105 of 607

foregoing definition, includes as illustrative examples: cattle, buffalo, goats, sheep, deer, antelope, giraffes, yaks, okapi, chevotain or the like.

For the purposes of this invention the term "birth" means the emergence of the ruminant animal (3) from the body of its mother to begin life as a physically separate ruminant animal (3).

For the purposes of this invention the term "death" means the permanent cessation of vital bodily functions to end life of a ruminant animal (3).

For the purposes of this invention the term "life span" means the period of time between birth and death of a ruminant animal (3).

For the purposes of this invention the term "productive lifespan" means the period of time between birth and the age reached before being culled from production."

For the purposes of this invention the term "reticulorumen (5)" means the first chamber in the alimentary canal of a ruminant animal (3) composed of the rumen and reticulum. The reticulum differs from the rumen with regard to the texture of its lining. The rumen wall is covered in small, finger-like projections called papillae, whereas the reticulum is lined with ridges that form a hexagonal honeycomb pattern. Despite the differences in the texture of the lining of the two parts of the reticulorumen (5), it represents one functional space.

The bolus (1) and the animal monitoring system (4) are described herein in terms of functional block components and various process steps. It should be appreciated that such functional blocks may be realized by any number of hardware or software components configured to perform the specified functions. For example, the bolus (1) and the animal monitoring system (4) may employ various integrated circuit components which function as: memory elements, processing elements, logic elements, look-up tables, or the like, which may carry out a variety of functions under the control of one or more processors or other control devices.

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 106 of 607

Now referring generally to Figure 2, the bolus (1) can include one or more sensors (13) each capable of generating a sensor signal (14)(whether analog or digital) which varies based on a corresponding change the one or more physiological parameters (2) of a ruminant animal (3). For the purposes of this invention the term "physiological parameter" means a measurable condition of a ruminant animal (3), and without limitation to the breadth of the foregoing, includes one or more of: movement (including one or more of the pitch, yaw, roll, tilt, vibration, jolt, impact or the like), temperature, sound (including one or more of reticulorumen digestive sounds, heartbeat sound, or the like), heart rate, or the like. Each of the one or more sensors (13) can generate a sensor signal (14) (whether analog or digital) which varies based upon occurrence or change in the sensed physiological parameter (2).

As illustrative examples, sensors (13) suitable for use in particular embodiments include: an omnidirectional tilt and vibration sensor (16)(also referred to as an "accelerometer")(PN SQ-SEN-200) distributed by Signal Quest Precision Microsensors; a temperature sensor (17) such as a Betachip Thermistor (PN 1K2OG3) distributed by BetaTHERM Sensors; a microphone (18) distributed by ST Microelectronics (PN MP34DT01); a humidity sensor (PN HCZ-D5) distributed by Ghitron Technology CO., Ltd; an ultra-miniature pressure transducer (PN COQ-062) distributed by Kulite, a proximity sensor (PN PY3-AN-3) distributed by Automation Direct.com., or similar or equivalent sensors. The illustrative examples and description of these sensors (13) are intended to provide a person of ordinary skill in the art sufficient information to make and use embodiments of the bolus including a numerous and wide variety of sensors whether or not specifically enumerated.

The microcontroller (8) includes a processor (9) in communication with the memory element (10) which contains a computer code (11). In part, the computer code (11) can be executed to continuously or intermittently transform the analog or digital sensor signal (14) from the one or more sensors (13) as encoded physiological data (19)(also referred to as "encoded sensor signals"). The encoded physiological data (19) varies based upon change in the sensor signal (14) which correspondingly varies based upon change in the sensed physiological parameter (2). As to particular embodiments, the computer code (11) can be executed to encode or recode from time to time an amount of sensor calibration data (19A) which allows calculation

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 107 of 607

and output of a physiological parameter value (20) of the ruminant animal (3)(whether by the bolus (1) or by operation of a remote computer (82)). The computer code (11) can be further executed to couple animal identification data (83) to the encoded physiological data (19).

The computer code (11) can be further executed to control a radio signal generator (21), for example, an oscillator to generate a stable radio signal (22). An oscillator suitable for use with the invention is available from Freescale Semiconductor, Part No. MC1319x, MC1320x, MC1321x, and MC1322x, and similar or equivalent components. In regard to the particular embodiment of the invention, the radio signal generator (21) can generate a radio signal (22) having a radio signal frequency (23) between about 410MHz and about 1Gz. As one particular embodiment of the invention, the radio signal generator (21) can generate a radio signal frequency (23) of about 433MHz. As to other particular embodiments, the radio signal generator (21) can generate a radio signal (22) having a radio signal frequency (23) of about between about 700 MHz to about 1GHz. The radio signal frequency (23) can be selected from the group including or consisting of: between about 700 MHz to about 800MHz, 750 MHz to about 850MHz, about 800 MHz to about 900MHz, 850 MHz to about 950MHz, 900 MHz to about 1GHz.

The computer code (11) can further function to control a radio frequency stabilizer (24)(shown in the example of Figure 2 as a low pass filter (24A) and a surface acoustic wave filter (24B)) which functions to offset changes in radio signal wave flux caused by changes in temperature or power to the radio signal generator (21). A radio frequency stabilizer (24) suitable for use with embodiments is available from Hope Microelectronics Co., Ltd, Part No. HF433E, RF Monolithics, Inc., Part No. RF1172C, and similar or equivalent parts.

Embodiments of the bolus (1) can further include matching elements (25) which function to match the input impedance of the electrical load or the output impedance of the loads corresponding signal source to maximize the power transfer or minimize signal reflection from the load. In an ideal situation, source impedance and load impedance should be equal to maximize power transfer.

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 108 of 607

Three elements influence the balance of impedance in radio design: the antenna (28) or "load", the radio signal generator (21) or "source", and the device's ground plane. Since each of these elements have different physical characteristics, their corresponding impedances are inherently different. The passive capacitors (26) and inductors (27) that make up the matching elements (25) of embodiments of the bolus (1) are used to mitigate these differences and rebalance the impedance for a given radio signal frequency (23).

Impedance for an inductor (27) is given by,

$$Z = iwL$$

where L is the inductance and w is angular frequency.

Impedance for a capacitor (26) is given by,

$$Z = \frac{1}{iwC}$$

where C is capacitance

The reactance is,

$$X = -\frac{1}{wC}$$

The matching elements (25) (also referred to as the "resonant circuit") include an array of inductors (27) and capacitors (26) used in series or in parallel to balance the circuit impedance once the impedance of the antenna (28), the radio signal generator (21), and the ground plane (not shown) are known.

A series resonant circuit (25) has an impedance that is the sum of the impedances of the inductor(s)(27) and capacitor(s)(26),

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 109 of 607

$$Z = i\omega L + \frac{1}{i\omega C} = i\left(\omega L - \frac{1}{\omega C}\right)$$

The impedance of a Parallel Resonant Circuit is found as follows,

$$Z = i\left(\frac{\omega L}{1 - \omega^2 LC}\right)$$

Resonance in the resonant circuit (25) occurs when the resonant circuit (25) is driven at a frequency *w0* at which the inductive and capacitive reactances are equal in magnitude. The frequency at which this equality holds for the resonant circuit is called the resonant frequency, and can be determined, as follows,

$$\omega_0 = \frac{1}{\sqrt{LC}}$$

This value can then be converted to hertz,

$$f_0 = \frac{\omega_0}{2\pi} = \frac{1}{2\pi\sqrt{LC}}$$

The calculations above can be used to identify the inductors (27) and capacitors (26) used as matching elements (25) in association with the radio signal generator (21) that operates at a specific radio signal frequency (23) to balance the impedance between the radio signal generator (21) and the antenna (28) and limiting the bandwidth to eliminate interference. After the signal passes through the matching elements (25) the resistance of the circuit can be altered to ensure an industry standard 50 ohm resistance in the transmission line to the antenna (28). The resistance of the circuit can be altered by inclusion of resistor (25A) to establish the standard 50 ohm resistance in the circuit.

These calculations, however, apply to a radio frequency generator (21) used in normal atmospheric air (also known as "free air"). Because the radio signal generator (23) included in embodiments of the bolus (1) operate within the mass of a ruminant animal (3), it has been

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 110 of 607

discovered that the center frequency (the arithmetic mean of the lower cutoff frequency and the upper cutoff frequency) is shifted lower and may not have the maximum gain.

Accordingly, there can be a substantial advantage, by selection of the inductors (27) and capacitors (26) as well as their position in the resonant circuit (25) to increase the inductance and capacitance values to purposefully shift the center frequency upward and allowing the radio signal frequency (23) to be re-tuned to a desired radio signal frequency (23) by passing through the mass of the ruminant animal (3).

Embodiments of the bolus (1) further include an antenna (28) which converts electric power into radio signal (22). In transmission, the radio signal generator (21) supplies an electric current oscillating at one of the above described radio signal frequencies (23). In reception, the antenna (28) intercepts some of the power of an electromagnetic wave (29) in order to produce a tiny voltage at its terminals that is applied to a receiver (30). As to particular embodiments, the antenna (28) can, but need not necessarily, be a laid down electrically conductive path on a printed circuit board (31). An advantage of this configuration of antenna (28) can be that it does not require winding upon or interaction with a magnetic field of a magnet to transmit the radio signal (22). Accordingly, this configuration of antenna (28) can produce a lesser amount of interference from a magnetic field of a magnet (69) contained in the bolus (1) resulting a lower incidence of loss of the radio signal (22) or less modulation of the radio signal (22) which results in a greater consistency (or lesser amount of lost data) in transmission of encoded physiological data (19) associated with the ruminant animal (3).

Now referring primarily to Figures 4 through 13, particular embodiments can, but need not necessarily, include an antenna (28) including a first electrically conductive loop (32) electrically interconnected to a second electrically conductive loop (33)(as shown in the example of Figures 6 through 13) electrically connected to the radio signal generator (21) or radio signal receiver (30)(or combined as a radio signal transceiver (21/30)). 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).

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 111 of 607

Typically, the conductive sheet material will be a copper sheet material or a copper layer. As to particular embodiments, the antenna (28) can further include a non-electrically conductive substrate (38) such as a circuit board (31) (as shown in the example of Figure 6) disposed between the pair of electrically conductive loops (32)(33) with one or more vias (39) electrically interconnecting the first and second electrically conductive loops (32)(33) by one or more holes (40) through the non-electrically conductive substrate (38). The one or more holes (40) can be made electrically conductive by electroplating, or by lining the hole with a tube or a rivet thereby electrically interconnecting the pair of electrically conductive loops (32)(33). There can be substantial advantages in structuring the antenna (28) as above described and as shown in Figures 4 through 13. First, the structure increases the cross-section width of the antenna (28) which increases the stability of the radiated electrical field (41) of the antenna (28). Second, the structure increases the bandwidth of the antenna (28) allowing shift in radio signal frequency (23) or attenuation resulting from passing through the mass of the ruminant animal (3) to be more readily counteracted. Third, the structure alters the magnetic field and electrical field generation which reduces the impact of uncontrollable changes in the orientation of the bolus (1) and correspondingly the orientation of the antenna (28) in the reticulorumen (5) of the ruminant animal (3).

Again referring primarily to Figures 2, 4 and 5, embodiments of the bolus (3) further include a power source (46)(and associated power regulator (46A)) which supplies and adjusts energy (42)(electrical power) to the bolus (1). The power source (46) shown in Figures 2, 4 and 5 can take the form of a battery such as a AA battery, a AAA battery, or the like. The power source (42) provides power to the electronic components supported on the printed circuit board (31) including for example: the microcontroller (8), radio frequency generator (21) and one or more sensors (13). Because the power source (46) of a bolus (1) disposed in the reticulorumen (5) of the ruminant animal (3) cannot be recharged, the operational lifespan of bolus (1) will depend upon capacity of the power source (46) in ampere-hours (Ah) and the load current of the circuit. Power source (46) life will be longer as the load current is reduced and vice versa. The calculation to find out the capacity of power source (46) in the form of a battery can be mathematically derived from the following formula:

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 112 of 607

Battery Life = Battery Capacity in amps per hour / load current in amps x 0.70

As to particular embodiments of the bolus (1), the computer code (11) can include a power management module (12) which functions to regulate energy use by the bolus (1) to extend the operational life of the bolus (1) disposed in the reticulorumen (5) of the ruminant animal (3). Embodiments of the bolus (1), including particular embodiments the power management module (12), can be operational within the reticulorumen (5) of the ruminant animal (3) for greater than three years and up to about ten years, a period of time substantially greater than that of conventional bolus.

As one illustrative example, embodiments of the inventive bolus (1) can be orally administered to a calf at, or immediately after birth, and remain operational over the entire productive lifespan (53) of the dairy cow, on average about 2.4 lactations, or about five to six years.

As another illustrative example, a ewe typically has a productive lifespan (53) of between about five years to about seven years of age. A ewe's productivity usually peaks between 3 and 6 years of age and begins to decline after the age of seven. As a result, most ewes are removed from a flock before they would reach their natural life expectancy. Accordingly, embodiments of the bolus (1) disposed in the reticulorumen (5) of the ewe at birth can be operational throughout the entire productive lifetime (53) of the ewe.

As to particular embodiments of the bolus (1), the power management module (12), can but need not necessarily include, an activation element (43) which functions to enable and encode the sensor signal(s)(14) from one or more sensors (13) and can further function to compare the one or more encoded sensor signals (19) against one or more preselected activation code(s)(44). If by comparison of the encoded sensor signal(s)(19) against the preselected activation code(s)(44), a pre-selected activation match threshold (45) is met, the activation element (43) can further function to cause activation of the bolus (1) for normal operation. This provides the advantage of avoiding inadvertent or premature activation of the bolus (1) and the corresponding unnecessary expenditure of energy (42) from the power source (46).

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 113 of 607

As one illustrative example of the function of the activation element (43), the bolus (1) can include a first sensor (13A) which can be an accelerometer (16). Accelerometers (16) in accordance with embodiments of the invention can sense the movement of the bolus (1)(whether within or without the ruminant animal), in a manner similar to accelerometers (16) used in tablet computers and digital cameras, such that images on display screens are always displayed upright, or as used in drones for flight stabilization. The accelerometer (16) can be enabled by the function of the activation element (43), and the activation element (43) can further function to encode the first sensor signal (14A) from the accelerometer (16) and compare the first encoded sensor signal (19A) against a first preselected activation code (44A). The first preselected activation code (44A), in the context of this illustrative embodiment, can correspond to a particular pre-activation movement (47) of the bolus (1) which can, but need not necessarily be, three serial reciprocal linear movements of the bolus (1) each terminating in an impact of the bolus (1) within a period of time of between about five seconds and ten seconds (also referred as "three bumps"). If the pre-activation movement (47) of the bolus (1) including "three bumps" meets the first pre-selected activation match threshold (45A) relating to the first preselected activation code (44A) corresponding to "three bumps" the activation element (43) can cause the bolus (1) to be activated for normal monitoring of the ruminant animal (3). As to particular embodiments, the bolus (1) can, but need not necessarily, include an illumination element (48), such as a light emitting diode (49). The illumination element (48) can be switched on by operation of the activation element (43) to provide an amount of light (50) as an indicator that the bolus (1) has been activated and can be orally administered to a ruminant animal (3).

As to particular embodiments, the bolus (1) can, but need not necessarily, include a second sensor (13B) which can be a temperature sensor (17)(also referred to as a "thermistor"). Thermistors (17) in accordance with embodiments of the invention can sense the temperature (57) of the bolus (1)(whether within or without of the ruminant animal) in a useful range of temperature and accuracy depending upon the ruminant animal (3) into which the bolus (1) is to be orally administered and the determinations to be made from the sensed temperature (57). For example, the useful temperature range in dairy cow will be between about 95°F (about 35°C) to about 115°F (about 46°C) with an accuracy of between about 0.1°C and about 0.3°C. The

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 114 of 607

normal temperature of an adult cow will typically be about 101.5°F (about 38.5°C), but can vary throughout the estrous cycle with the lowest temperature being just before heat and highest temperature on the day of heat or due to being in milk, and a temperature of about 103.0°F (about 39.4°C) to about 104.0°F (about 40°C) and upward to about 108°F (about 42.2°C), typically indicative of a sick cow. However, this illustrative example is not intended to preclude the use of thermistors (17) which may sense a wider temperature range, as one illustrative example, about -40°C to about +125°C, as long as the accuracy is not less than about 0.1°C to about 0.2°C of the actual temperature about the bolus (1) and the time constant to change from one temperature value to another temperature value is sufficiently short to support the sampling rate of the sensor signal (14) effected by the computer code (11) in regard to the thermistor (17). For example, thermistors (17) utilized with embodiments of the bolus (1) may have a time constant of about one minute or less and while the sampling rate may be once every 10 minutes to 20 minutes or longer depending upon the application.

As to particular embodiments, the activation element (43) having activated the bolus (1)(and as to particular embodiments, switched on the light illumination element (48)) can, but need not necessarily, further enable and encode a second sensor signal (14B) from a second sensor (13B) which can be a thermistor (17). The activation element (43) can further function to encode the second sensor signal (14B) from the second sensor (13B) such as thermistor (17) and compare the second encoded sensor signal (19B) against the second preselected activation code (44B). The second preselected activation code (44B), in the context of this illustrative embodiment, can correspond to a pre-activation temperature (51) of the bolus (3) which can, but need not necessarily be, three serial temperature reads of the bolus (1) each about 15 minutes apart within a period of time of about 45 minutes (also referred to as "three temperature reads"). If the pre-activation temperature (51) of the bolus (1) including "three temperature reads" meets the second pre-selected activation match threshold (45B) for the second preselected activation code (44B) corresponding to "three temperature reads" the activation element (43) can cause the bolus (1) to be activated for normal monitoring of a ruminant animal (3). In the illustrative example of a bolus (1) used in calves or cows, if the three temperature reads are between about 100°F (about 37.8°C) and about 105°F (about 40.6°C), this would be indicative that the bolus (1) resides in the reticulorumen (5) of a calf or cow, and the activation element (43) can then

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 115 of 607

function to cause the bolus (1) to be activated for normal monitoring of the ruminant animal (3). This provides the advantage of avoiding inadvertent or premature activation of the bolus (1) and the corresponding unnecessary expenditure of energy (42).

As to particular embodiments, the power management module (12) can, but need not necessarily, further function to reconfigure the mode of operation of the bolus (1) or allow the mode of operation of the bolus (1) to be reconfigured while residing in the reticulorumen (5) of the ruminant animal (3) to regulate energy (42) use by the bolus (1) which can have the advantage of extending the operational life of the bolus (1).

As to particular embodiments, the power management module (12) can regulate energy (42) use by the bolus (1) by enabling or disabling one or more sensors (13) based upon a pre-determined set of physiological parameters (2) to be sensed during one or more stages (52) in a lifespan (53) of the ruminant animal (3). The encoded physiological data (19) useful in make determinations relating to a ruminant animal (3) may be different in a first stage (54) in the lifespan (53)(for example, the time period between birth and puberty) as compared to a second stage (55)(for example, the time period commencing with puberty until the end of reproductive age (or useful reproductive age))(as shown in the example of Figure 1). As one illustrative example in dairy cows, from the birth until puberty in dairy cows at about eight months to about seventeen months age depending upon the breed, the useful encoded physiological data (19) may only include encoded physiological data (19) relating to temperature (57). Accordingly, in a first stage (54) of the ruminant animal (3) lifespan (53) the power management module (12) can function upon activation of the bolus (1), as above described, to only enable and periodically read the sensor signal (14A) and generate encoded physiological data (19) for temperature (57) of the ruminant animal (3). Additionally, because the encoded physiological data (19) for temperature (57) may only be used to determine whether the ruminant animal (3) is sick, there may be a substantial period of time between reads of the temperature sensor signal (14), such as, once in a twenty four hour period. Similarly, there may be a substantial period of time between operational periods of the radio signal generator (22), such as twenty four hours, and the operational period of the radio signal generator (22) may be very short, such as, a few milliseconds (also referred to as a "transmission burst (56)"). Because the majority of energy

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 116 of 607

(42) used by the bolus (1) is in operation of the radio signal generator (21), increasing the time period between transmission bursts (56) and limiting the duration of the transmission burst (56) only to that period of time necessary to transmit the limited amount of encoded physiological data (19) can substantially increase the operating lifespan of the bolus (1).

By comparison, in second stage (55) of the lifespan (53) of a ruminant animal (3) from puberty to the end of reproductive age of the ruminant animal (3), the useful encoded physiological data (19) may include both encoded physiological data (19) for temperature (57) and encoded physiological data (19) for movement (58). As above explained, the temperature (57) of ruminant animal (3) may vary throughout the estrous cycle with the lowest temperature being just before heat and highest temperature on the day of heat. Additionally, the activity of the cow can measurably change prior to or concurrent with heat.

Accordingly, as to particular embodiments, the power management module (12) can further include a timer element (59) which functions to assess elapsed time from activation of the bolus (1) allowing regulation of energy use by the bolus (1) based on elapsed time which can be coordinated to one or more of the stages (52) in the lifespan (53) of the ruminant animal (3). As one illustrative example, if the bolus (1) is orally administered at birth the timer element (59) and the power management module (12) can function to enable a first sensor (13A)(or first set of sensors (13) providing useful encoded physiological data (19) during the first stage (54)) and encode physiological data (19) for temperature (57)(or first set of physiological parameters) for a period of time corresponding the first stage (54) of the lifespan (53) of the ruminant animal (3)(for example, between birth and puberty) and then function to further enable a second sensor (13B)(or second set of sensors (13) providing useful encoded physiological data (19) during a second stage (55) of the ruminant animal (3)) and encode physiological data (19) for both temperature (57) and movement (58).

Additionally, because the encoded physiological data (19) for movement (58) and temperature (57) may be used to determine whether the ruminant animal (3) is in estrus, the power management module (12) can function to reduce the period of time between reads of the sensor signal (14) temperature (57) and the sensor signal (14) for movement (58), such as, four

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 117 of 607

times in a twenty four hour period. Similarly, there may be a lesser period of time between operational periods of the radio signal generator (21), such as every six hours, and the operational period of the radio signal generator (14) may be adjusted to a period of time to transmit the additional encoded physiological data (19).

As to particular embodiments, once the ruminant animal (3) becomes pregnant and during the pregnancy, the power management module (12) can further function to reconfigure the operation of the bolus (1) to disable the sensor (13) for movement (58) and read only the sensor (13) for temperature (57) and transmit encoded physiological data (19) at less frequent intervals.

As to particular embodiments, the program code (11) can be reprogrammed while the bolus (1) resides in the reticulorumen (5) of the ruminant animal (3) by receiving programming data (60) to reconfigure the power management module (12) to regulate energy (42) use by the bolus (1), as above described.

As to particular embodiments, the power management module (12) can, but need not necessarily, include a power sensor element (61) executable to determine the remaining amount of energy (42) in the power source (46). The power management module (12) can be further executed to determine the amount of energy (42) required to power the bolus (1) through a pre-determined period of time (62) based on the then existing program code (11) contained in the memory element (10) of the bolus (1). The power management module (12) can be further executed to compare the remaining amount of energy (42) in the power source (46) with the amount of energy (42) required to power the bolus (1) through the pre-determined period of time (62) based on the then existing program code (11) to determine the difference in the amount of energy (42) remaining in the power source (46) and the amount of energy (42) required to power the bolus (1) through the pre-determined period of time (62). The power management module (12) can be further executed to perform one or more power regulation events (63) to make up the difference in the amount of energy (42) to allow operation of the bolus (1) through the pre-determined period of time (62). The power regulation events (63) can include or consist of one or more of: switching off the light illumination element (48), increasing the interval of time

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 118 of 607

between operation of the radio signal generator (21), decreasing the operational time period of the radio signal generator (21), disabling one or more of the plurality of sensors (13), interrupt encoding of the sensor signal (14) from one or more of said plurality of sensors (13), or other re-programming that reduces energy (42) use.

As to particular embodiments, the power management module (12) can be pre-programmed to perform one or more of the power regulation events (63) in one or more pre-programmed priority orders based upon the magnitude of the difference in the amount of energy (42) remaining in the energy source (46) and the required amount of energy (42) to power the bolus through the remaining portion of a pre-programmed or re-programmed life cycle. Alternately, the power management module (12) can function to encode and transmit as part of a transmission burst (56) encoded power source data (64) from which the remaining amount of energy (42) in the energy source (46) can be calculated using a remote specialized computer (82) and the power management module (12) can be re-programmed to execute one more power regulation events (63) based on a priority order encoded in the programming data (60) received by the bolus (1).

Now referring primarily to Figures 4 and 5, embodiments of the bolus (1) which are orally administered to a ruminant animal (3) can, but need not necessarily, include an inert bolus body (6) having external dimensional relations adapted to allow oral administration and retention of the bolus (1) in the reticulorumen (5) of a ruminant animal (3). As one non-limiting example, the inert bolus body (6) can include an amount of plastic resin (65) cast about the animal monitoring assembly (66) ("AMA"), including one or more of the components above-described. The amount of plastic resin (65) can be, as an example, a plastic resin such as urethane resin, epoxy resin, polyester resin, or the like used in accordance with the manufacturer's instructions. As to other embodiments, the inert bolus body (6) can comprise a sealable housing (67) defining a hollow inside space (68) which receives the AMA (66). As to other embodiments, the sealable housing (67) including the AMA (66) received in the hollow space (68)(and as to particular embodiments further including one or more magnets (69) received in the hollow space (68)) can have the amount of plastic resin (65) cast about the AMA (66) (and one or more magnets (69)) located inside said sealable housing (67).

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 119 of 607

Again referring primarily to Figure 4, configurations of the inventive bolus (1) suitable for oral administration to a ruminant animal (3) can have a generally cylindrical configuration with a diameter (77) in orthogonal cross section in the range of about one-half inch (about 13 millimeters ("mm")) to about one and one quarter inch (about 32 mm) and having a bolus length (70) disposed between a first bolus end (71) and a second bolus end (72) in the range of about two inches (about 50 mm) and about five inches (about 127 mm). Particular embodiments of the bolus (1) can have a length of about four inches (about 102 mm) and a diameter (77) in orthogonal cross section of about one inch (about 25 mm). While the example of Figure 4 shows the bolus (1) including a housing (67) having matable halves (73)(74) with an outer most external surface (7) configured as a cylinder; the bolus (1) can have numerous and varied outer most external surface (7) configurations capable of oral administration and retention within the reticulorumen (5) of a ruminant animal (3). The inert bolus body (6) can be molded, cast, or machined from biocompatible (or biologically inert) non-magnetic materials which allow transmission of the radio signal (22) from within the bolus (1) to outside of the ruminant animal (3). As examples, the inert bolus body (6) can be made from plastics such as nylon, fluorocarbon, polypropylene, polycarbonate, urethane, epoxy, polyethylene, or the like; or metals such as stainless steel; or other materials such as glass can be utilized. The bolus (1) having a hollow inside space (68) can be generated by a wide variety of procedures such as molding, casting, fabrication or the like. As one non-limiting example, a cylindrical tube having an external diameter and an internal diameter, as above described, can be divided into sections of suitable length to which end caps can be fitted. Alternately, a bore can be made in a cylindrical solid rod having an external diameter, as above described, to provide a closed end tube with the bore having sufficient dimension to provide the hollow inside space (68).

As to particular embodiments, the inert bolus body (1) can, but need not necessarily, include a translucent or transparent element (75) to allow viewing of the amount of light (50) generated by the illumination element (48) as a viewable indicator that the bolus is activated as above described. The translucent or transparent element (75) can include a portion or the entirety of the housing (67) of the inert bolus body (6).

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 120 of 607

As to particular embodiments of the bolus (1), the inert bolus body (1) can be configured for oral administration to ruminant animals (3) at birth. The digestive track between the mouth (76) and the reticulorumen (5) of a ruminant animal (3) at birth can have comparatively restrictive dimensions as compared to adult ruminant animals (3). Therefore, conventionally configured bolus (1) may not be orally administered to ruminant animals (3) at birth or when orally administered may cause injury or be regurgitated as the digestive track between the mouth (76) and the reticulorumen (5) enlarges due to growth of the ruminant animal (3).

The configuration of outer most external surface (7) of the housing (67) of the inert bolus body (6) or the bolus density (78), or combinations thereof, can be critical when a bolus (1) is orally administered to a ruminant animal (3) at birth. It has been discovered that while the bolus length (70) between the first and second bolus ends (71)(72) can be more variable bolus (1), it can be critical that the greatest bolus diameter (77) (or width) of the outer most external surface (7) along the length (70) between the pair of bolus ends (71)(72) should be between one half inch (about 13 mm) and not exceed three quarters of an inch (about 19 millimeters). The configuration of the outer most external surface (7) of the bolus (1) can have a bolus width (77) selected from the group including or consisting of: about 13 mm to about 15 mm, about 14 mm to about 16 mm, about 15 mm to about 17 mm, about 16 mm to about 18 mm, and about 17 mm to about 19mm.

As one illustrative example, a bolus (1) configured for oral administration to ruminant animals (3) at birth can have an outer most external surface (7) of the bolus body (6) having cylindrical configuration as shown in the example of Figure 4. The bolus length (70) can vary between about three inches (about 76 mm) and about six inches (about 152 mm) between the a pair of bolus ends (71)(72); however, the outer most external surface (7) at any cross section orthogonal to the bolus length (70) should not exceed about 19 millimeters. As a second illustrative example, the bolus body can be substantially spherical having an external diameter not exceeding about three quarters of an inch (about 19 mm).

Embodiments of the inventive bolus (1) can, but need not necessarily, have a bolus density (78) of between about 2.1 grams per cubic centimeter ("g/cm^3") to about 3.3 g/cm^3.

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 121 of 607

However, there can be substantial advantages in configuring the bolus (1) to achieve a bolus density (78) in the range of between about 2.1 g/cm^3 to about 3.3 g/cm^3 in that the bolus (1) is substantially less likely to be regurgitated or ejected from reticulorumen (5) of a ruminant animal (1) as compared to conventional bolus. It can be critical to achieve a bolus density (78) of between about 2.1 g/cm^3 to about 3.3 g/cm^3 when dimensions of the outer most external surface (7) are reduced for oral administration to ruminant animals (3) at birth or the bolus (1) resides in the reticulorumen (5) of the ruminant animal (1) for the entire lifespan (53) of the ruminant animal (3). Within the range of bolus density (78), the bolus density can be selected from the group including or consisting of: about 2.3 g/cm^3 to about 2.5 g/cm^3, about 2.4 g/cm^3 to about 2.6 g/cm^3, about 2. g/cm^3 to about 2.7 g/cm^3, about 2.6 g/cm^3 to about 2.8 g/cm^3, about 2.7 grams g/cm^3 to about 2.9 g/cm^3; about 2.8 g/cm^3 to about 3.0 g/cm^3, about 2.9 g/cm^3 to about 3. g/cm^3; about 3.0 g/cm^3 to about 3.2 g/cm^3, and about 3.1 g/cm^3 to about 3.3 g/cm^3.

Now referring primarily to Figure 3, the animal monitoring system (4) can, but need not necessarily, include one or more radio signal reader(s)(79) can be located to receive the radio signal (22) carrying the encoded physiological data (19) from one or more bolus (1). As to particular embodiments, the one or more radio signal readers (79)("RSR") can further operate to assemble the encoded physiological data (19) into one or more data packets (80) which can be transmitted and received by a wired or wireless reception device (81)(which can be integrated into a specialized computer (82)). The reception device (81) can transfer the data packets (80) to a specialized computer (82). The specialized computer (82) can operate to transform the encoded animal identification data (83) and encoded physiological data (19) to output an animal identification value (84)(an alpha or numeric or other animal identifier) and to output physiological parameter values (85)(an alpha or numeric or other symbols). A computer user (86) can access the animal identification value (84) and the physiological parameter values (85) by use of the specialized computer (82).

Now referring generally to Figure 3, the specialized computer (82) is described herein in terms of functional block components, screen shots, and various process steps. It should be appreciated that such functional blocks may be realized by any number of hardware or software components configured to perform the specified functions.

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 122 of 607

Similarly, the software elements of the present invention may be implemented with any programming or scripting language such as C, C++, Java, COBOL, assembler, PERL, Labview or any graphical user interface programming language, extensible markup language (XML), Microsoft's Visual Studio .NET, Visual Basic, or the like, with the various algorithms or Boolean Logic being implemented with any combination of data structures, objects, processes, routines or other programming elements. Further, it should be noted that the present invention might employ any number of conventional wired or wireless techniques for data transmission, signaling, data processing, network control, and the like.

It should be appreciated that the particular computer implementations shown and described herein are illustrative of the invention and its best mode and are not intended to otherwise limit the scope of the present invention in any way. Indeed, for the sake of brevity, conventional data networking, application development and other functional aspects of the systems (and components of the individual operating components of the systems) may not be described in detail herein. Furthermore, the connecting lines shown in the various figures contained herein are intended to represent exemplary functional relationships and/or physical couplings between the various elements. It should be noted that many alternative or additional functional relationships or physical connections may be present in a computer implemented animal monitoring system (4).

As will be appreciated by one of ordinary skill in the art, the present invention may be embodied in the alternative as a method, a data processing system, a device for data processing, a computer program product, or the like. Accordingly, the present invention may take the form of an entirely software embodiment, an entirely hardware embodiment, or an embodiment combining aspects of both software and hardware. Furthermore, the present invention may take the form of a computer program product on a computer-readable storage medium having computer-readable program code means embodied in the storage medium. Any suitable computer-readable storage medium may be utilized, including hard disks, CD-ROM, optical storage devices, magnetic storage devices, ROM, flash RAM, or the like.

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 123 of 607

It will be understood that each functional block of the block diagrams and the flowchart illustrations, and combinations of functional blocks in the block diagrams and flowchart illustrations, respectively, can be implemented by computer program instructions. These computer program instructions may be loaded onto a general purpose computer, special purpose computer or other programmable data processing apparatus to produce a machine, such that the instructions which execute on the computer or other programmable data processing apparatus for implementing the functions specified in the flowchart block or blocks.

These computer program instructions may also be stored in a computer-readable memory that can direct a computer or other programmable data processing apparatus to function in a particular manner, such that the instructions stored in the computer-readable memory produce an article of manufacture including instruction means which implement the function specified in the flowchart block or blocks. The computer program instructions may also be loaded onto a computer or other programmable data processing apparatus to cause a series of operational steps to be performed on the computer or other programmable apparatus to produce a computer-implemented process such that the instructions which execute on the computer or other programmable apparatus provide steps for implementing the functions specified in the flowchart block or blocks.

Accordingly, functional blocks of the block diagrams and flowchart illustrations support combinations of elements for performing the specified functions, combinations of steps for performing the specified functions, and program instruction means for performing the specified functions. It will also be understood that each functional block of the block diagrams and flowchart illustrations, and combinations of functional blocks in the block diagrams and flowchart illustrations, can be implemented by either special purpose hardware based computer systems which perform the specified functions or steps, or suitable combinations of special purpose hardware and computer instructions.

Again referring to Figure 3, the computer implemented animal monitoring system (4) can include a specialized computer (82) for receiving, processing and transforming a radio signal (22) from a reception device (81) carrying animal identification data (83) and animal

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 124 of 607

physiological parameter data (19) to generate animal identification values (84) and physiological parameter values (85) accessible by the computer user (86). The specialized computer (82) can include at least one processing unit (87), a memory unit (88), and a bus (89) which operably couples components of the computer (82), including, without limitation the memory unit (88) to the processing unit (87). The computer (82) may be a conventional computer, a distributed computer, or any other type of computer which may contain all or a part of the elements described or shown to accomplish the functions described herein; the invention is not so limited. The processing unit (87) can comprise without limitation one central-processing unit (CPU), or a plurality of processing units which operate in parallel to process digital information, or a digital signal processor (DSP) plus a host processor, or the like. The bus (89) can be without limitation any of several types of bus configurations such as a memory bus or memory controller, a peripheral bus, and a local bus using any of a variety of bus architectures. The memory element (88) can without limitation be a read only memory (ROM)(90) or a random access memory (RAM)(91), or both. A basic input/output system (BIOS)(92) containing routines that assist transfer of data between the components of the specialized computer (82), for example during start-up, can be stored in ROM (90). The computer (82) can further include a hard disk drive (93) for reading from and writing to a hard disk (94), a magnetic disk drive (95) for reading from or writing to a removable magnetic disk (96), and an optical disk drive (97) for reading from or writing to a removable optical disk (98) such as a CD ROM or other optical media.

The hard disk drive (93), magnetic disk drive (95), and optical disk drive (97) and the reception device (81) can be connected to the bus (89) by a hard disk drive interface (99), a magnetic disk drive interface (100), and an optical disk drive interface (101), and a radio signal reception device interface (102), respectively. The drives and their associated computer-readable media provide nonvolatile storage of computer-readable instructions, data structures, program modules and other data for the computer (82). It can be appreciated by those skilled in the art that any type of computer-readable media that can store data that is accessible by a computer, such as magnetic cassettes, flash memory cards, digital video disks, Bernoulli cartridges, random access memories (RAMs), read only memories (ROMs), RFID devices or the like, may be used in the exemplary operating environment.

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 125 of 607

The computer (82) can further include an operating system (103) and an animal monitoring program (104)("AMP") which as to particular embodiments of the invention can include an animal monitoring assembly encoder-decoder module (105) ("AMA encoder-decoder") for programming the animal monitoring assembly (AMA)(66) with animal identification data (83). As to particular embodiments, programming of the AMA (66) can be accomplished using an animal monitoring assembly programmer (106) connected to the bus (89) by an AMA interface (107). The AMA encoder-decoder module (105) can be stored on or in the hard disk (94), magnetic disk (96), optical disk (98), ROM (90), in RAM (91) of the specialized computer (82) or alternately the functionalities of the AMA encoder-decoder module (105) may be implemented as an application specific integrated chip (ASIC) or file programmable gate array (FPGA), or the like.

As to particular embodiments, the specialized computer (82) can be further configured to generate programming data (60) based on computer user (86) interaction the AMP (104) which can be received by the RSR (79) over a local area network (108) over a wide area network (109). The RSR (79) can generate a second radio signal (110) to carry the programming data (60) to the radio signal receiver (30) contained in the AMA (66). The second radio signal (110) can be processed by the microcontroller (8) to reprogram the program code (11) and particularly the power management module (12) to correspondingly alter the operation of the AMA (66), regardless as to whether the bolus (1) containing the AMA (66) has a location outside of the ruminant animal (3) or has a location inside of the ruminant animal (3).

The computer user (86) can enter commands and information into the computer (82) through input devices such as a keyboard (111) and a pointing device (112) such as a mouse. Other input devices (not shown) may include for example: touch on a touch screen, a microphone, joystick, game pad, satellite dish, scanner, magnetic strip of a card, or the like. These and other input devices are often connected to the processing unit (87) through a serial port interface (113) that can be coupled to the bus (89), but may be connected by other interfaces, such as a parallel port, game port, or a universal serial bus (USB). A monitor (114) or other type of display device can also be connected to the bus (89) via interfaces such as a video adapter (115), or the like. In addition to the monitor (114), the computer (82) can further include

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 126 of 607

peripheral output devices (116), such as speakers and printers.

The computer (82) may operate in a networked environment using logical connections to one or a plurality of remote second computers (117). These logical connections can be achieved by a communication device (118) coupled to or a part of the computer (82). Each of the plurality of remote second computers (117) can include a part or all of the elements as included in the specialized computer (82) although only a single box has been illustrated in Figure 3 for the remote second computer (117).

When used in a LAN (108) networking environment, the computer (82) can be connected to the LAN (108) through a network interface (119). When used in a WAN (109)-networking environment, the computer (92) typically includes a modem (120), or other type of communications device, for establishing communications over the WAN (109), such as the Internet. The modem (120), which may be internal or external to the specialized computer (82), can be connected to the bus (89) via the serial port interface (113). In a networked environment, the AMP (104), or portions thereof, may be stored in any one or more of the plurality of remote second computers (117). It is appreciated that the logical connections shown are exemplary and other hardware elements and communications elements can be utilized for establishing a communications link between the specialized computer (82) and one or more of the a plurality of remote second computers (117).

While the computer elements and the network elements shown in Figure 3 can be utilized to practice the invention including the best mode, it is not intended that the description of the best mode of the invention or any preferred embodiment of the invention be limiting with respect to the utilization of a wide variety of similar, different, or equivalent computer elements or network elements to practice embodiments of the invention which include without limitation hand-held devices, such as personal digital assistants or camera/cell phone, tablet or slate computers, multiprocessor systems, microprocessor-based or programmable consumer electronics, network PCs, minicomputers, mainframe computers, PLCs, or the like.

Now referring primarily to Figures 1 and 3, the RSR (79) can receive the first radio signal

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 127 of 607

(22) from the AMA (66) inside the bolus (1) whether inside or outside of the reticulorumen (5) of the ruminant animal (3). The AMA (66) within the bolus (1) can send encoded animal identification data (83) and the encoded physiological data (19) using the first radio signal (22), as above described.

One illustrative embodiment of the RSR (79) as shown in Figures 1 and 3, provides a reader microcontroller (121) which includes a reader processor (122) which controls the functions of a variety of reader processor elements (123) stored in a reader memory element (124) each of which provides a response to events related to receiving the first radio signal (22) from the AMA (66) within the bolus (1) carrying encoded animal identification data (83) and encoded physiological data (19), or receiving reader sensor signals (125) from reader sensors (126) which monitor environmental parameters proximate the RSR (79) such as ambient temperature (127); or generating data packets (80) which include all or parts of such information, or sending data packets (80) to the computer (82) or a remote second computer (117) for access by a computer user (86). A reader microcontroller (121) suitable for use with embodiments of the RSR (79) can be obtained from Microchip Technology. Inc., 2355 West Chandler Blvd., Chandler, Arizona, Part No. PIC18F4620-I/PT, or similar or equivalent components can be suitable as a reader microcontroller (121) programmable to perform the above-described functions of the RSR (79).

Again referring primarily to Figure 3, a reader antenna (128) can receive encoded animal identification data (83) and encoded physiological data (19) and other information generated by operation of the AMA (66) within the bolus (1) within or without of the ruminant animal (3). The reader antenna (128) can be tuned to the first radio signal (22) generated by the AMA (66).

Again referring primarily to Figure 3, the reader sensor (126) can be located to sense the ambient temperature (127) surrounding the RSR (79). The reader sensor (126) can take the form of a thermistor. A suitable thermistor for use in embodiments of the RSR (79) is available from Microchip Technology, Inc., 2355 West Chandler Blvd., Chandler, Arizona, Part No. MCP98242, and similar and equivalent parts.

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 128 of 607

The reader sensor (126) can be operated under the control of a second reader processor (129) which functions to regulate power to the reader sensor (126) and converts the reader sensor signal (125) into a digital representation of the ambient temperature (127). The second reader processor (129) can further function to encode or re-encode from time to time an amount of reader temperature calibration data (130) which allows calculation and output of an ambient temperature value (131).

Again referring primarily to Figure 3, a reader clock element (132) can operate under the control of a third reader processor element (133) to generate a date and time signal (134) that represents a date and time value (135).

Again referring primarily to Figure 3, a fourth reader processor element (136) can function to assemble data packets (80) which as an example can include a representation of the ambient temperature value (141) and the date and time value (135) at which the information from the AMA (66) was received by the RSR (79). The assembled data packet (80) can be stored and retrieved from the reader memory element (124) under the control of the fourth reader processor element (136).

Again referring primarily to Figure 3, a fifth reader processor element (137) can function to provide an ether net interface (138) for an ether net controller (139) to receive instructions or requests from the computer (82)(or remote computer (117). The fifth reader processor (137) can further function to operate a second radio signal generator (140) and transmit the second radio signal (110) to reprogram the computer code (11) or the power management module (12) of the AMA (66) within the bolus (1). The fifth reader processor element (137) can further function to send the data packets (80) to the ether net controller (139) for transmission to the computer (82).

As can be easily understood from the foregoing, the basic concepts of the present invention may be embodied in a variety of ways. The invention involves numerous and varied embodiments of a reciprocally telescoping door stop and methods for making and using such door stops including the best mode.

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 129 of 607

As such, the particular embodiments or elements of the invention disclosed by the description or shown in the figures or tables accompanying this application are not intended to be limiting, but rather exemplary of the numerous and varied embodiments generically encompassed by the invention or equivalents encompassed with respect to any particular element thereof. In addition, the specific description of a single embodiment or element of the invention may not explicitly describe all embodiments or elements possible; many alternatives are implicitly disclosed by the description and figures.

It should be understood that each element of an apparatus or each step of a method may be described by an apparatus term or method term. Such terms can be substituted where desired to make explicit the implicitly broad coverage to which this invention is entitled. As but one example, it should be understood that all steps of a method may be disclosed as an action, a means for taking that action, or as an element which causes that action. Similarly, each element of an apparatus may be disclosed as the physical element or the action which that physical element facilitates. As but one example, the disclosure of a "generator" should be understood to encompass disclosure of the act of "generating" -- whether explicitly discussed or not -- and, conversely, were there effectively disclosure of the act of "generating", such a disclosure should be understood to encompass disclosure of a "generator" and even a "means for generating." Such alternative terms for each element or step are to be understood to be explicitly included in the description.

In addition, as to each term used it should be understood that unless its utilization in this application is inconsistent with such interpretation, common dictionary definitions should be understood to be included in the description for each term as contained in the Random House Webster's Unabridged Dictionary, second edition, each definition hereby incorporated by reference.

All numeric values herein are assumed to be modified by the term "about", whether or not explicitly indicated. For the purposes of the present invention, ranges may be expressed as from "about" one particular value to "about" another particular value. When such a range is expressed, another embodiment includes from the one particular value to the other particular

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 130 of 607

value. The recitation of numerical ranges by endpoints includes all the numeric values subsumed within that range. A numerical range of one to five includes for example the numeric values 1, 1.5, 2, 2.75, 3, 3.80, 4, 5, and so forth. It will be further understood that the endpoints of each of the ranges are significant both in relation to the other endpoint, and independently of the other endpoint. When a value is expressed as an approximation by use of the antecedent "about," it will be understood that the particular value forms another embodiment. The term "about" generally refers to a range of numeric values that one of skill in the art would consider equivalent to the recited numeric value or having the same function or result. Similarly, the antecedent "substantially" means largely, but not wholly, the same form, manner or degree and the particular element will have a range of configurations as a person of ordinary skill in the art would consider as having the same function or result. When a particular element is expressed as an approximation by use of the antecedent "substantially," it will be understood that the particular element forms another embodiment.

Moreover, for the purposes of the present invention, the term "a" or "an" entity refers to one or more of that entity unless otherwise limited. As such, the terms "a" or "an", "one or more" and "at least one" can be used interchangeably herein.

Thus, the applicant(s) should be understood to claim at least: i) each of the bolus or animal monitoring systems herein disclosed and described, ii) the related methods disclosed and described, iii) similar, equivalent, and even implicit variations of each of these devices and methods, iv) those alternative embodiments which accomplish each of the functions shown, disclosed, or described, v) those alternative designs and methods which accomplish each of the functions shown as are implicit to accomplish that which is disclosed and described, vi) each feature, component, and step shown as separate and independent inventions, vii) the applications enhanced by the various systems or components disclosed, viii) the resulting products produced by such systems or components, ix) methods and apparatuses substantially as described hereinbefore and with reference to any of the accompanying examples, x) the various combinations and permutations of each of the previous elements disclosed.

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 131 of 607

The background section of this patent application provides a statement of the field of endeavor to which the invention pertains. This section may also incorporate or contain paraphrasing of certain United States patents, patent applications, publications, or subject matter of the claimed invention useful in relating information, problems, or concerns about the state of technology to which the invention is drawn toward. It is not intended that any United States patent, patent application, publication, statement or other information cited or incorporated herein be interpreted, construed or deemed to be admitted as prior art with respect to the invention.

The claims set forth in this specification, if any, are hereby incorporated by reference as part of this description of the invention, and the applicant expressly reserves the right to use all of or a portion of such incorporated content of such claims as additional description to support any of or all of the claims or any element or component thereof, and the applicant further expressly reserves the right to move any portion of or all of the incorporated content of such claims or any element or component thereof from the description into the claims or vice-versa as necessary to define the matter for which protection is sought by this application or by any subsequent application or continuation, division, or continuation-in-part application thereof, or to obtain any benefit of, reduction in fees pursuant to, or to comply with the patent laws, rules, or regulations of any country or treaty, and such content incorporated by reference shall survive during the entire pendency of this application including any subsequent continuation, division, or continuation-in-part application thereof or any reissue or extension thereon.

Additionally, the claims set forth in this specification, if any, are further intended to describe the metes and bounds of a limited number of the preferred embodiments of the invention and are not to be construed as the broadest embodiment of the invention or a complete listing of embodiments of the invention that may be claimed. The applicant does not waive any right to develop further claims based upon the description set forth above as a part of any continuation, division, or continuation-in-part, or similar application.

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 132 of 607

VI. CLAIMS

1. A bolus, comprising:

one or more sensors each capable of generating a sensor signal which varies based on a corresponding change in one or more physiological parameters of a ruminant animal;

a memory element;

a processor in communication with said memory element; and

a computer code contained in said memory element, said computer code containing a power management module executable by said processor to enable and disable one or more of said plurality of sensors.

2. The bolus of claim 1, wherein said power management module is further executable to enable or disable said one or more sensors based upon elapsed duration of time from activation of said bolus.

3. The bolus of claim 2, wherein said power management module is further executable to enable or disable said one or more sensors based upon a pre-determined set of said one or more physiological parameters to be sensed during a stage in a life cycle of said ruminant animal.

4. The bolus of claim 3, wherein said one or more sensors is selected from the group consisting of: a temperature sensor, an accelerometer, a microphone, an inductance sensor, or combinations thereof.

5. The bolus of claim 1, where said power management module further includes a bolus activation element executable to:

monitor said sensor signal from said one or more sensors;

compare said sensor signal from said one or more sensors to a first pre-selected activation code; and

activate said bolus upon generation of said sensor signal from said one or more sensors which by comparison to said first pre-selected activation code exceeds a first pre-selected activation match threshold.

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 133 of 607

6. The bolus of claim 5, where said bolus activation element is further executable to:

compare said sensor signal from said one or more sensors to a second pre-selected activation code; and

activate said bolus upon generation of said sensor signal from said one or more sensors which by comparison to said first and said second pre-selected activation codes exceeds said first and a second pre-selected activation match threshold.

7. The bolus of claim 5, wherein said computer code is further executable upon activation of said bolus to:

encode 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; and

store said encoded physiological data in said memory element.

8. The bolus of claim 6, further comprising a radio signal generator capable of generating a radio signal to carry said encoded physiological data, and wherein said power management module is further executable to:

enable said radio signal generator; and

activate said radio signal generator at pre-determined intervals to generate said radio signal to carry said encoded physiological data.

9. The bolus of claim 1, further comprising an energy source which supplies energy to operate said bolus, and wherein said power management module is further executable to periodically determine a remaining amount of energy stored in said energy source.

10. The bolus of claim 9, wherein said power management module further comprises a power sensor element executable to:

determine an amount of energy required by said bolus to operate through a pre-determined period of time based on current programming of said computer code;

compare said amount of energy required by said bolus to operate through said pre-determined period of time to said remaining amount of energy stored in said energy source; and.

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 134 of 607

calculate a difference in said amount of energy remaining in the power source and said amount of energy required by said bolus to operate through said pre-determined period of time.

11. The bolus of claim 10, wherein said power management module is further executable to: perform one or more power regulation events to offset said difference in said amount of energy remaining in the power source and said amount of energy required by said bolus to operate through said pre-determined period of time.

12. The bolus of claim 11, wherein said one or more power regulation events is selected from the group consisting of: disable one or more of said sensors; interrupt encoding of said sensor signal from said one or more sensors; deactivate said radio signal generator, adjust intervals of time between operational time periods of said radio signal generator, adjust operational time periods of said radio signal generator.

13. The bolus of claim 8, wherein said radio signal generator generates a radio signal having a frequency of between about 700MHz to about 1GHz.

14. The bolus of claim 13, wherein said frequency is selected from the group consisting of: between about 700 MHz to about 800MHz, 750 MHz to about 850MHz, about 800 MHz to about 900MHz, 850 MHz to about 950MHz, 900 MHz to about 1GHz.

15. The bolus of claim 13, further comprising a matching elements configured to adjust said frequency of said radio signal to compensate for change in said frequency upon passing through a mass of said animal.

16. The bolus of claim 13, wherein said radio signal generator generates said radio signal having only one frequency.

17. The bolus of claim 8, further comprising an antenna capable of transmitting said radio signal, wherein said antenna comprises a pair of electrically conductive loops disposed a distance apart.

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 135 of 607

18. The bolus of claim 17, wherein said pair of electrically conductive loops comprise a loop of conductive sheet material having an inner annular edge and an outer annular edge which join opposed loop faces.

19. The bolus of claim 18, further comprising one or more vias which interconnect said pair of electrically conductive loops.

20. The bolus of claim 19, further comprising a non-conductive sheet material disposed between said pair of loops.

21. The bolus of claim 1, further comprising an illumination element responsive to said power management module, said illumination element upon activation of said bolus generates an amount of light indicating activation of said bolus.

22. The bolus of claim 21, further comprising a housing providing an outer most external surface of said bolus, said housing sufficiently translucent or transparent to transmit said amount of light generated by said illumination element to said outer most external surface indicating activation of said bolus.

23. The bolus of claim 22, wherein said outermost external surface of said housing has a length disposed between a pair of ends and a width along said length of not greater than about 20 millimeters.

24. The bolus of claim 23, wherein said outermost external surface of said housing comprises a substantially spherical external surface having a diameter of not greater than about 20 millimeters.

25. The bolus of claim 23, wherein said outermost external surface of said housing comprises a substantially cylindrical external surface, said width along said length having a substantially circular cross section of not greater than about 20 millimeters.

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 136 of 607

26. The bolus of claim 25, further comprising an amount of thermoset resin disposed inside of said housing.

27. The bolus of claim 23, further comprising a bolus density of between about 2.3 grams per centimeter cubed to about 3.3 grams per centimeter cubed ("g/cm^3").

28. The bolus of claim 27, wherein said bolus density is selected from the group consisting of: about 2.3 g/cm^3 to about 2.5 g/cm^3, about 2.4 g/cm^3 to about 2.6 g/cm^3, about 2. g/cm^3 to about 2.7 g/cm^3, about 2.6 g/cm^3 to about 2.8 g/cm^3, about 2.7 grams g/cm^3 to about 2.9 g/cm^3; about 2.8 g/cm^3 to about 3.0 g/cm^3, about 2.9 g/cm^3 to about 3. g/cm^3; about 3.0 g/cm^3 to about 3.2 g/cm^3, and about 3.1 g/cm^3 to about 3.3 g/cm^3.

29. A bolus, comprising:

a radio signal generator capable of generating a radio signal;

an antenna electrically connected to said radio signal generator, said antenna having a pair of electrically conductive loops disposed a distance apart; and

one or more vias which interconnect said pair of loops.

30. The bolus of claim 29, wherein each of said pair of electrically conductive loops comprise a loop of conductive sheet material having an inner annular edge and an outer annular edge which join opposed loop faces.

31. The bolus of claim 30, wherein said loop of conductive sheet material comprises a laid down electrically conductive path on a printed circuit board.

32. A bolus, comprising:

one or more sensors each capable of generating a sensor signal which varies based on a corresponding change in a corresponding one or more physiological parameters of a ruminant animal;

a memory element;

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 137 of 607

a processor in communication with said memory element;

a computer code contained in said memory element, said computer code executable by said processor to:

encode 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;

activate a radio signal generator to generate a radio signal to carry said encoded physiological data; and

a housing providing an outer most external surface of said bolus, wherein said outermost external surface of said housing has a length disposed between a pair of ends and a width along said length of not greater than about 20 millimeters.

33. The bolus of claim 32, wherein said outermost external surface of said housing comprises a substantially spherical external surface having a diameter of not greater than about 20 millimeters.

34. The bolus of claim 32, wherein said outermost external surface of said housing comprises a substantially cylindrical external surface, said width along said length having a substantially circular cross section of not greater than about 20 millimeters.

35. The bolus of claim 34, further comprising a bolus density of between about 2.3 grams per centimeter cubed to about 3.3 grams per centimeter cubed ("g/cm^3").

36. The bolus of claim 35, wherein said bolus density is selected from the group consisting of: about 2.3 g/cm^3 to about 2.5 g/cm^3, about 2.4 g/cm^3 to about 2.6 g/cm^3, about 2. g/cm^3 to about 2.7 g/cm^3, about 2.6 g/cm^3 to about 2.8 g/cm^3, about 2.7 grams g/cm^3 to about 2.9 g/cm^3; about 2.8 g/cm^3 to about 3.0 g/cm^3, about 2.9 g/cm^3 to about 3. g/cm^3; about 3.0 g/cm^3 to about 3.2 g/cm^3, and about 3.1 g/cm^3 to about 3.3 g/cm^3.

37. A method of monitoring the physiological parameters of an animal, comprising:

obtaining a bolus configured for oral administration to a ruminant animal, said bolus including:

one or more sensors each capable of generating a sensor signal which varies based on a corresponding change in one or more physiological parameters of a ruminant animal;

a memory element;

a processor in communication with said memory element;

a computer code contained in said memory element, said computer code containing a power management module executable by said processor to enable and disable one or more of said plurality of sensors; and

a housing providing an outer most external surface of said bolus; and

orally administering said bolus to said ruminant animal to dispose said bolus in a reticulorumen of said ruminant animal.

38. The method of claim 37, further comprising enabling or disabling said one or more sensors based upon elapsed duration of time from activation of said bolus.

39. The method of claim 37, further comprising enabling or disabling said one or more sensors based upon a pre-determined set of said one or more physiological parameters to be sensed during a stage in a life cycle of said ruminant animal.

40. The method of claim 39, wherein said one or more sensors is selected from the group consisting of: a temperature sensor, an accelerometer, a microphone, an inductance sensor, or combinations thereof.

41. The method of claim 40, further comprising:

monitoring said sensor signal from said one or more sensors;

comparing said sensor signal from said one or more sensors to a first pre-selected activation code; and

activating said bolus upon generation of said sensor signal from said one or more sensors which by comparison to said first pre-selected activation code exceeds a first pre-selected activation match threshold.

42. The method of claim 41, further comprising:

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 139 of 607

comparing said sensor signal from said one or more sensors to a second pre-selected activation code; and

activating said bolus upon generation of said sensor signal from said one or more sensors which by comparison to said first and said second pre-selected activation codes exceeds said first and a second pre-selected activation match threshold.

43. The method of claim 42, further comprising:

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; and

storing said encoded physiological data in said memory element.

44. The method of claim 43, wherein said bolus further comprises a radio signal generator capable of generating a radio signal to carry said encoded physiological data, and further comprising:

enabling said radio signal generator; and

activating said radio signal generator at pre-determined intervals to generate said radio signal to carry said encoded physiological data.

45. The method of claim 44, wherein said bolus further comprises an energy source which supplies energy to operate said bolus, and further comprising:

determining a remaining amount of energy stored in said energy source;

determining an amount of energy required by said bolus to operate through a pre-determined period of time based on current programming of said computer code;

comparing said amount of energy required by said bolus to operate through said pre-determined period of time to said remaining amount of energy stored in said energy source; and

calculating a difference in said amount of energy remaining in the power source and said amount of energy required by said bolus to operate through said pre-determined period of time.

46. The method of claim 45, further comprising performing one or more power regulation events to offset said difference in said amount of energy remaining in the power source and said amount of energy required by said bolus to operate through said pre-determined period of time.

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 140 of 607

47. The method of claim 46, wherein said one or more power regulation events is selected from the group consisting of: disabling one or more of said sensors; interrupting encoding of said sensor signal from said one or more sensors; deactivating said radio signal generator, adjusting intervals of time between operational time periods of said radio signal generator, adjusting operational time periods of said radio signal generator.

48. The method of claim 47, further comprising generating a radio signal having a frequency of between about 700MHz to about 1GHz.

49. The method of claim 48, wherein said frequency is selected from the group consisting of: between about 700 MHz to about 800MHz, 750 MHz to about 850MHz, about 800 MHz to about 900MHz, 850 MHz to about 950MHz, 900 MHz to about 1GHz.

50. The method of claim 49, wherein said bolus further comprises matching elements configured to adjust said frequency of said radio signal, and further comprising adjusting said frequency to compensate for change in said frequency upon passing through a mass of said ruminant animal.

51. The method of claim 50, wherein said radio signal generator generates said radio signal having only one frequency.

52. The method of claim 51, wherein said bolus further comprises an antenna having a pair of electrically conductive loops disposed a distance apart and further comprising transmitting said radio signal through said antenna.

53. The method of claim 52, 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.

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 141 of 607

54. The method of claim 53, wherein said antenna further comprises one or more vias interconnecting said pair of electrically conductive loops.

55. The method of claim 54, wherein said antenna further comprises a non-conductive sheet material disposed between said pair of electrically conductive loops.

56. The method of claim 55, wherein said bolus further comprises an illumination element capable of generating an amount of light, and further comprising generating said amount of light upon activation of said bolus.

57. The method of claim 56, wherein said housing is translucent or transparent, and further comprising transmitting said amount of light generated by said illumination element to said outer most external surface indicating activation of said bolus.

58. The method of claim 57, wherein said outermost external surface of said housing has a length disposed between a pair of ends and a width along said length of not greater than about 20 millimeters.

59. The method of claim 58, wherein said outermost external surface of said housing comprises a substantially spherical external surface having a diameter of not greater than about 20 millimeters.

60. The method of claim 58, wherein said outermost external surface of said housing comprises a substantially cylindrical external surface, said width along said length having a substantially circular cross section of not greater than about 20 millimeters.

61. The method of claim 58, wherein said bolus further comprises an amount of thermoset resin disposed inside of said housing.

62. The method of claim 61, wherein said bolus further comprises a bolus density of between about 2.3 grams per centimeter cubed to about 3.3 grams per centimeter cubed ("g/cm^3").

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 142 of 607

63. The method of claim 62, wherein said bolus density is selected from the group consisting of: about 2.3 g/cm^3 to about 2.5 g/cm^3, about 2.4 g/cm^3 to about 2.6 g/cm^3, about 2. g/cm^3 to about 2.7 g/cm^3, about 2.6 g/cm^3 to about 2.8 g/cm^3, about 2.7 grams g/cm^3 to about 2.9 g/cm^3; about 2.8 g/cm^3 to about 3.0 g/cm^3, about 2.9 g/cm^3 to about 3. g/cm^3; about 3.0 g/cm^3 to about 3.2 g/cm^3, and about 3.1 g/cm^3 to about 3.3 g/cm^3.

64. The method of claim 46, wherein said bolus further comprises a radio signal receiver and further comprising:

receiving radio signal containing programming data; and

re-programming said computer code contained within said memory element.

65. The method of claim 64, further comprising re-programming said computer code based upon based upon said pre-determined set of said plurality of physiological parameters to be sensed during said stage in said life cycle of said ruminant animal.

66. The method of claim 65, further comprising re-programming said computer code to offset said difference in said amount of energy remaining in the power source and said amount of energy required by said bolus to operate through said pre-determined period of time.

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 143 of 607

VII. ABSTRACT

Generally, an animal monitoring device configured as a bolus for oral administration to reside in the reticulorumen of a ruminant animal having a memory element, a processor in communication with the memory element and a computer code contained in the memory element including a power management module executable by the processor to regulate power use by the bolus based on determination of remaining energy stored in an energy source and the determined power requirements over a pre-determined life cycle of the bolus.

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 144 of 607

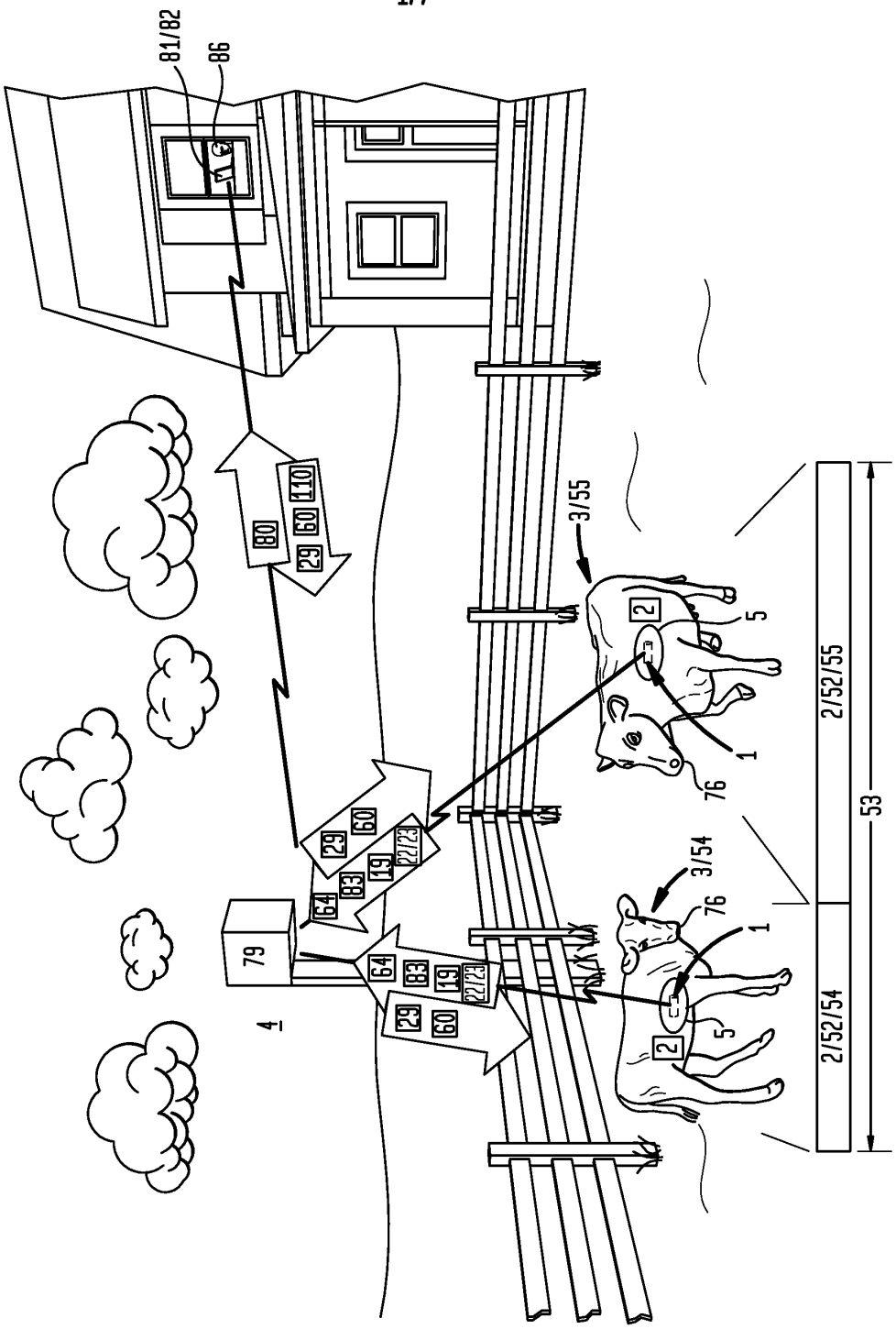
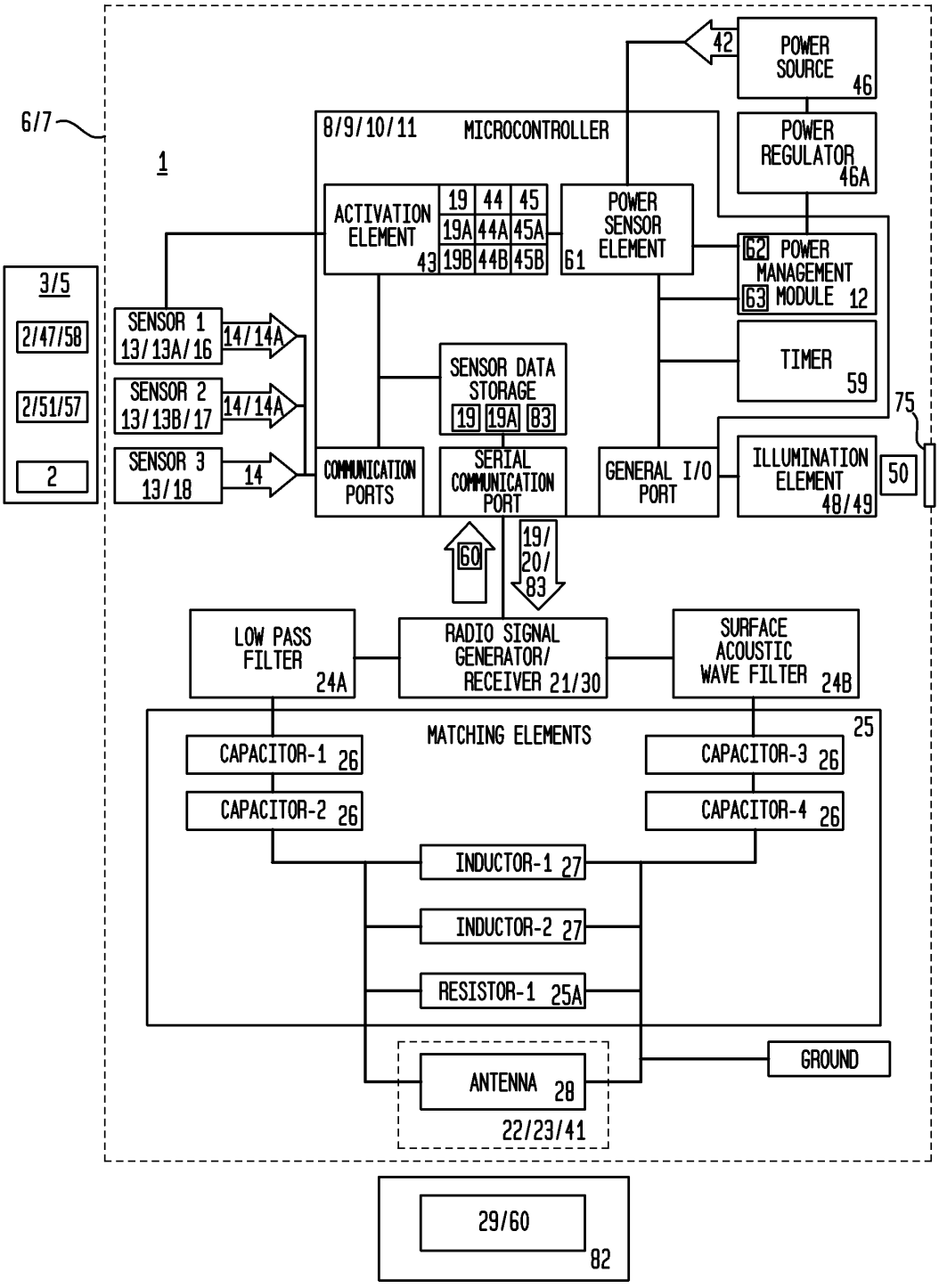

81/82
86
80
110
60
29
3/55
2
5
1
76
2/52/55
53
29
60
19
22/23
83
64
3/54
79
4
2/52/54

FIG. 1

FIG. 2


6/7
1
42
POWER SOURCE 46
8/9/10/11 MICROCONTROLLER
POWER REGULATOR 46A
ACTIVATION ELEMENT 43
19 44 45
19A 44A 45A
19B 44B 45B
POWER SENSOR ELEMENT 61
62 POWER MANAGEMENT 63 MODULE 12
TIMER 59
3/5
2/47/58
2/51/57
2
SENSOR 1 13/13A/16
SENSOR 2 13/13B/17
SENSOR 3 13/18
14/14A
14/14A
14
SENSOR DATA STORAGE 19 19A 83
COMMUNICATION PORTS
SERIAL COMMUNICATION PORT
GENERAL I/O PORT
ILLUMINATION ELEMENT 48/49
50
75
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19/20/83
LOW PASS FILTER 24A
RADIO SIGNAL GENERATOR/ RECEIVER 21/30
SURFACE ACOUSTIC WAVE FILTER 24B
25
MATCHING ELEMENTS
CAPACITOR-1 26
CAPACITOR-2 26
CAPACITOR-3 26
CAPACITOR-4 26
INDUCTOR-1 27
INDUCTOR-2 27
RESISTOR-1 25A
ANTENNA 28
22/23/41
GROUND
29/60
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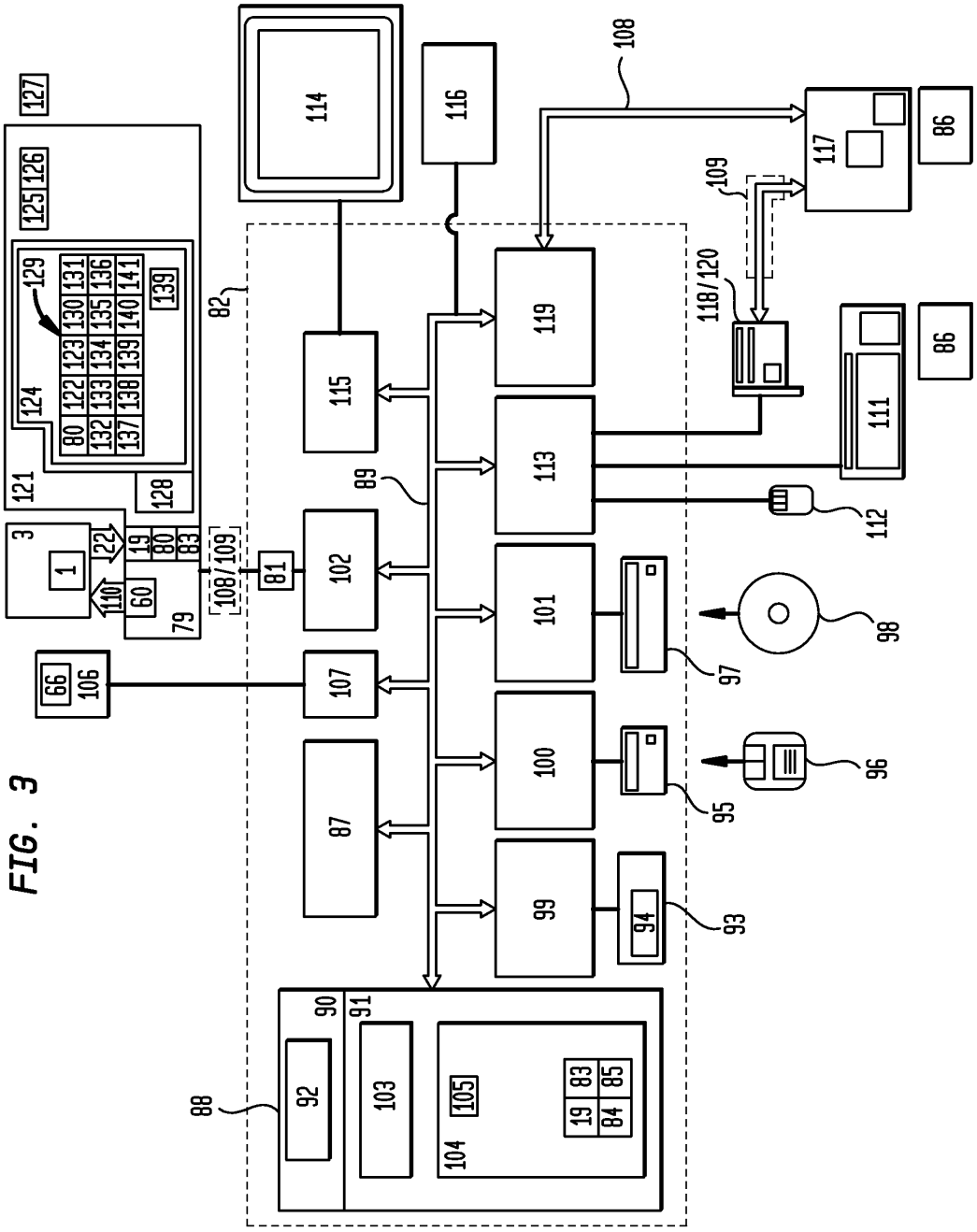

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FIG. 3

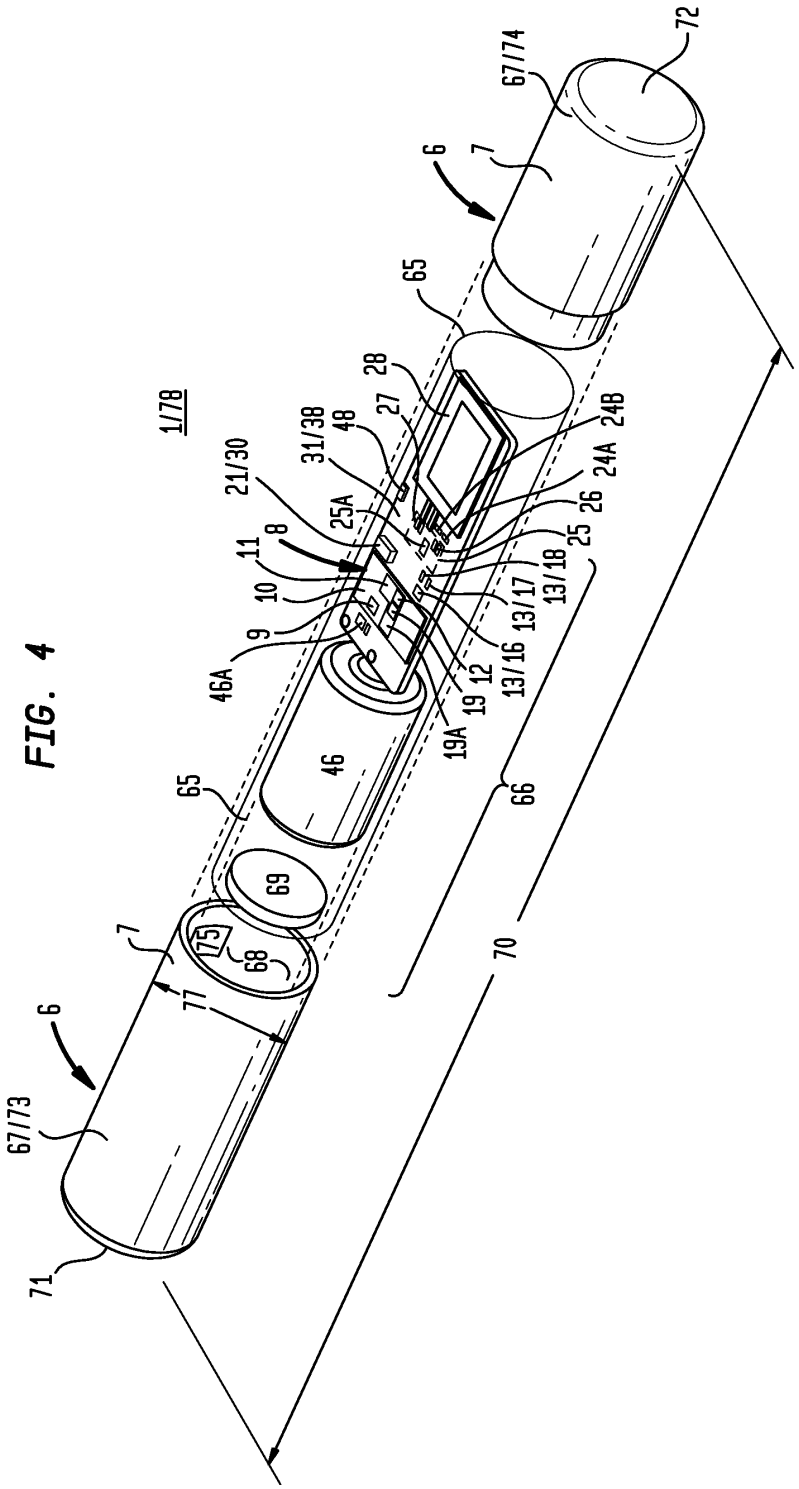

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13/18
13/17
13/16
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FIG. 4

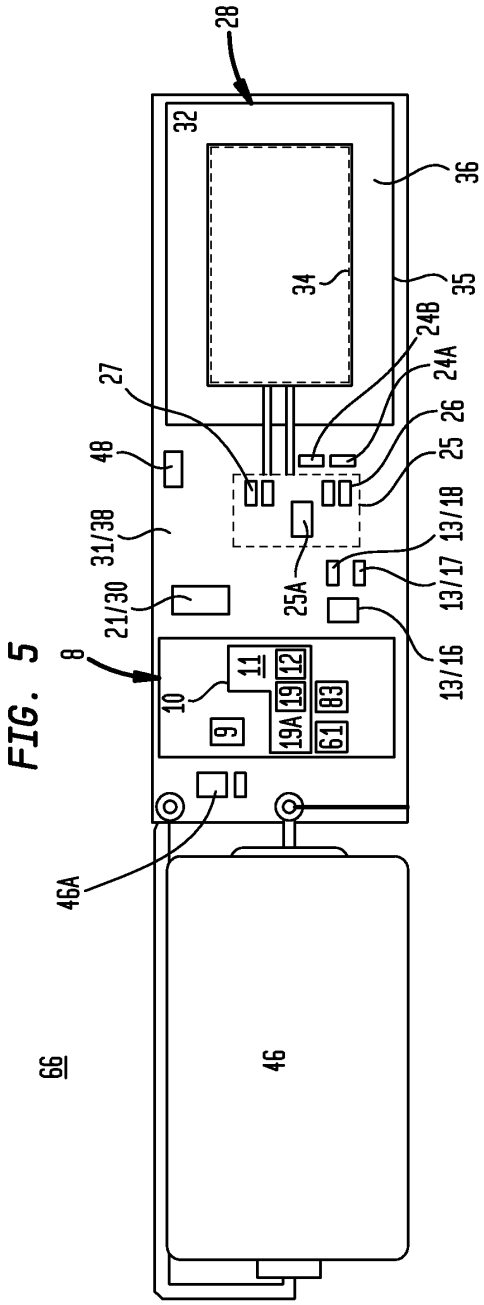

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FIG. 5

FIG. 6

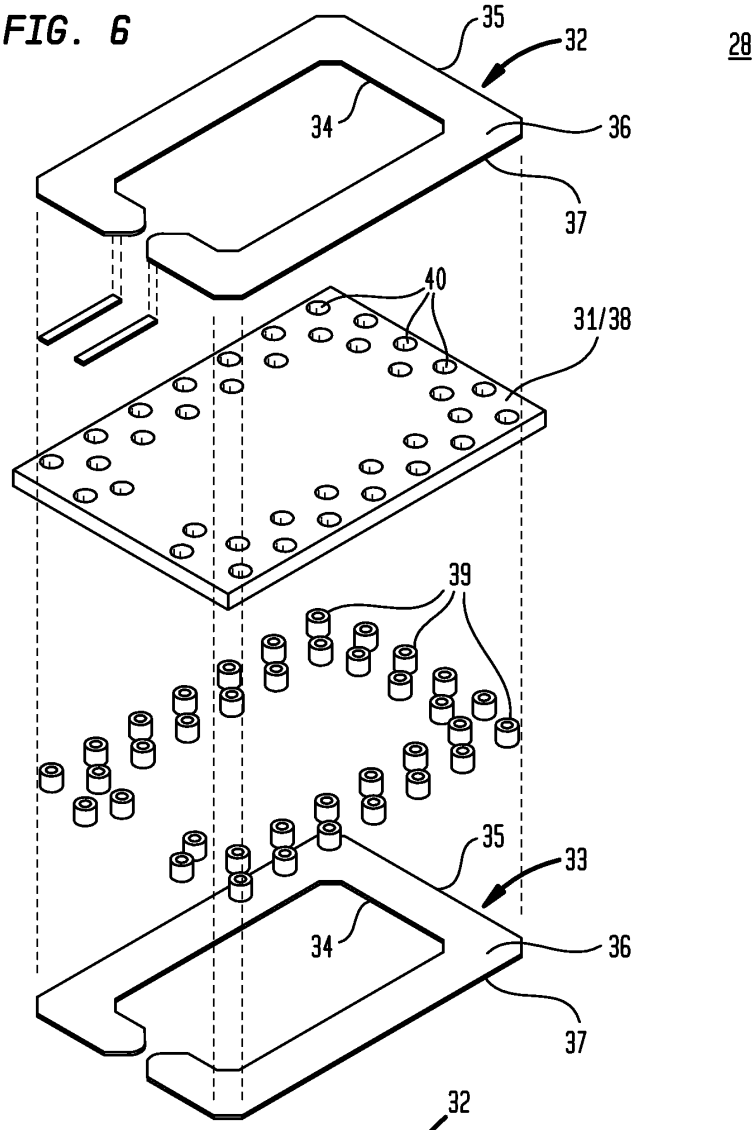


FIG. 7

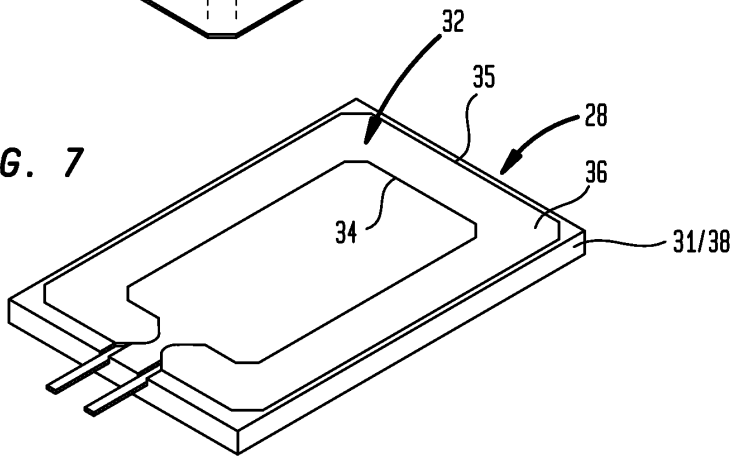


FIG. 8

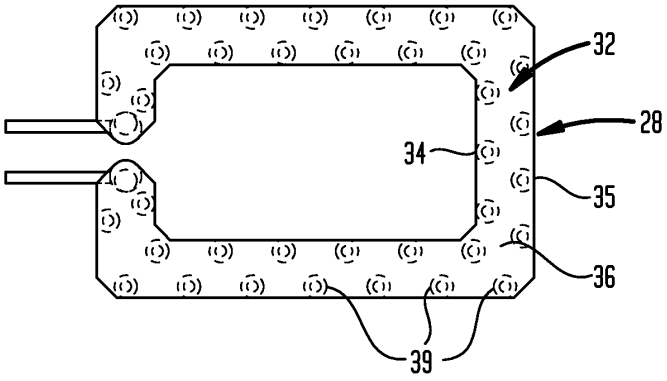


FIG. 9

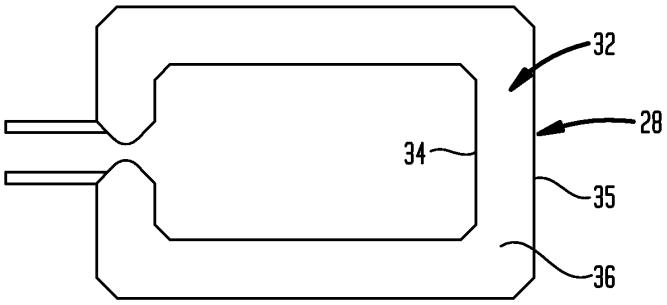


FIG. 10

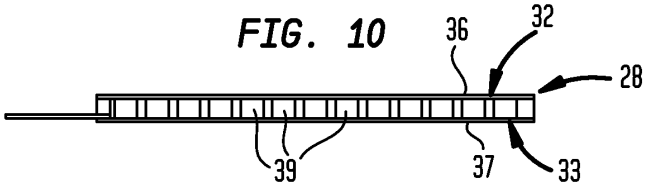


FIG. 11

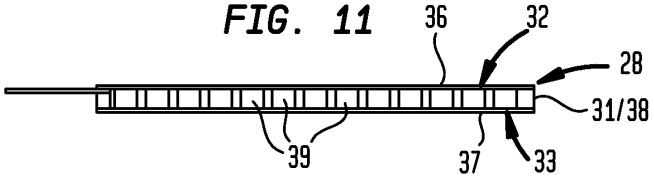


FIG. 12

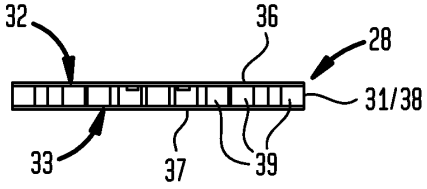
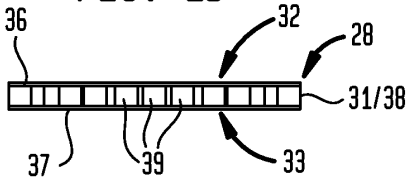


FIG. 13



IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the application of: Nicholas P. Rettedal, Stephen M. Weilnau, Scott R. Cockroft, and Joseph Janus IV

Application No.:

Filed:

For: Calf Bolus

Attorney Docket No.: bellaUScalf (280-10)

Confirmation No.:

Group Art Unit:

Examiner:

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

POWER OF ATTORNEY

I, Scott R. Cockroft, President of Bella Technologies, LLC being the assignee of record under §37 C.F.R. 3.71 of the entire interest in the above-identified application, am empowered to act on behalf of the Assignee/Applicant and hereby appoint CR MILES, P.C., having its principal office at 405 Mason Court, Suite 119, Fort Collins, Colorado 80524 USA assigned USPTO Customer Number 39208 including Craig R. Miles, whose registration number before the United States Patent and Trademark Office is 45,954 as my attorney to prosecute this application entitled "Calf Bolus" and to transact all business in the United States Patent and Trademark Office therewith.

Dated this 27 day of February, 2015

By: _____
Scott R. Cockroft, President
Bella Technologies, LLC,
Assignee/Applicant

PTO/AIA/96 (08-12)
Approved for use through 01/31/2013. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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STATEMENT UNDER 37 CFR 3.73(c)

Applicant/Patent Owner: Bella Technologies, LLC

Application No./Patent No.: _____ Filed/Issue Date: _____

Titled: Calf Bolus

Bella Technologies, LLC, a limited liability company

(Name of Assignee) (Type of Assignee, e.g., corporation, partnership, university, government agency, etc.)

states that, for the patent application/patent identified above, it is (choose **one** of options 1, 2, 3 or 4 below):

1. ☑ The assignee of the entire right, title, and interest.

2. ☐ An assignee of less than the entire right, title, and interest (check applicable box):

   ☐ The extent (by percentage) of its ownership interest is _____%. Additional Statement(s) by the owners holding the balance of the interest must be submitted to account for 100% of the ownership interest.

   ☐ There are unspecified percentages of ownership. The other parties, including inventors, who together own the entire right, title and interest are:

   Additional Statement(s) by the owner(s) holding the balance of the interest must be submitted to account for the entire right, title, and interest.

3. ☐ The assignee of an undivided interest in the entirety (a complete assignment from one of the joint inventors was made). The other parties, including inventors, who together own the entire right, title, and interest are:

   Additional Statement(s) by the owner(s) holding the balance of the interest must be submitted to account for the entire right, title, and interest.

4. ☐ The recipient, via a court proceeding or the like (*e.g.*, bankruptcy, probate), of an undivided interest in the entirety (a complete transfer of ownership interest was made). The certified document(s) showing the transfer is attached.

The interest identified in option 1, 2 or 3 above (not option 4) is evidenced by either (choose **one** of options A or B below):

A. ☑ An assignment from the inventor(s) of the patent application/patent identified above. The assignment was recorded in the United States Patent and Trademark Office at Reel _____, Frame _____, or for which a copy thereof is attached.

B. ☐ A chain of title from the inventor(s), of the patent application/patent identified above, to the current assignee as follows:

   1. From: _____ To: _____

      The document was recorded in the United States Patent and Trademark Office at

      Reel _____, Frame _____, or for which a copy thereof is attached.

   2. From: _____ To: _____

      The document was recorded in the United States Patent and Trademark Office at

      Reel _____, Frame _____, or for which a copy thereof is attached.

This collection of information is required by 37 CFR 3.73(b). The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

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STATEMENT UNDER 37 CFR 3.73(c)

3. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at

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4. From: _____ To: _____

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The document was recorded in the United States Patent and Trademark Office at

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6. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at

Reel _____, Frame _____, or for which a copy thereof is attached.

☐ Additional documents in the chain of title are listed on a supplemental sheet(s).

☑ As required by 37 CFR 3.73(c)(1)(i), the documentary evidence of the chain of title from the original owner to the assignee was, or concurrently is being, submitted for recordation pursuant to 37 CFR 3.11.

[NOTE: A separate copy (i.e., a true copy of the original assignment document(s)) must be submitted to Assignment Division in accordance with 37 CFR Part 3, to record the assignment in the records of the USPTO. See MPEP 302.08]

The undersigned (whose title is supplied below) is authorized to act on behalf of the assignee.

Craig Miles — 06/12/2015

Signature — Date

Craig Miles

Printed or Typed Name

Attorney of Record; Registration Number 45,954

Title or Registration Number

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the application of: Nicholas P. Rettedal, Stephen M. Weilnau, Scott R. Cockroft, and Joseph Janus IV	**Confirmation No.:**
Application No.:	**Group Art Unit:**
Filed:	**Examiner:**
For: Calf Bolus	
Attorney Docket No.: bellaUScalf (280-10)	

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

ASSIGNMENT OF PATENT RIGHTS

THIS ASSIGNMENT is between and among Nicholas P. Rettedal, whose address is 1701 E 15th Street, Loveland, Colorado 80538 USA, Stephen M. Weilnau, whose address is 1937 Montview Drive, Greeley, Colorado 80631 USA, Scott R. Cockroft, whose address is 27712 County Road 62, Greeley, Colorado 80631 USA, and Joseph Janus IV, whose address is 125 E 23rd Street, Loveland, Colorado 80538 USA (individually and collectively "Assignors") and Bella Technologies, LLC, a Colorado corporation, having its principal offices at 27906 Weld County Road 388, Kersey, Colorado 80644 USA ("Assignee").

WHEREAS, Each Assignor has conceived or developed technology relating to a calf bolus including the technology described or indicated in the above-identified application, along with any improvements of such technology to the extent conceived or developed during the time serving as a consultant or employee of Assignee or utilizing the trade secrets or confidential information of Assignee, or which are likely to cause disclosure of such trade secrets or confidential information (the "Invention");

WHEREAS, Each Assignor, either by him or in conjunction with other individuals, may be an inventor of the Invention;

WHEREAS, Each Assignor desires to assign all right, title and interest to the Invention to Assignee to the extent he has any such rights worldwide; and

NOW, THEREFORE, for US $10.00 or other good and valuable consideration, receipt of which is hereby acknowledged, each of the undersigned hereby agree as follows:

1. Each Assignor warrants that:

a. he has the authority to assign all right, title, and interest in an to the Invention;

b. he has conveyed no right, title, or interest in the Invention to any party other than the Assignee;

c. to the extent he conducted any efforts relevant to the ownership of all rights to the Invention under, on behalf of, or through any entity or assumed name, he has the authority to act as agent for such an entity and to fully transfer such rights; and

d. at the time of signing of this Assignment, he neither knows nor has reason to know of any outstanding right, title, or interest in the Invention inconsistent with a full assignment of rights to the Assignee other than any right, title, or interest which may exist as a result of any coinventorship.

2. Each Assignor, for good and valuable consideration, hereby sells, grants, transfers, authorizes application for, agrees to support, and assigns to the Assignee the entire right, title, and interest in and to the Invention, including, but not limited to:

a. all such worldwide rights to make, use, and sell the Invention;

b. any applications for United States or foreign patents relating to the Invention, and specifically to the above-identified application, and to make a claim for any priority to which such applications are entitled, and to any division, substitution, continuation, or continuation-in-part, of such applications, all patents which may be granted thereon, and all reissues, and extensions thereof;

c. the right to file applications for United States or foreign patents based upon the Invention, and to make a claim for any priority to which such applications are entitled, and to any division, substitution, continuation, or continuation-in-part, of such applications, all patents which may be granted thereon, and all reissues and extensions thereof;

d. all related rights involving the Invention in any country such as utility-model registrations, inventor's certificates, and the like, and all rights, titles, and interests involving the Invention under any foreign government;

e. all rights to any documents, notes, and evidence regarding any aspect of the Invention; and

f. all rights to seek protection covering such aspects or claims as the Assignee deems appropriate, specifically, including, but not limited to: claims which seek protection for device, apparatus, method, process, business method, or other coverage; claims which seek protection for as broad a level of coverage as might be desired by the Assignee; claims which address any aspect conceived, developed, or disclosed as separate inventions; claims which address any permutations or combinations of any aspects; claims which address any aspects independent of any initial context considered as preferred embodiments; and claims which seek broad protection in general.

3. Each Assignor further covenants and agrees that he will communicate to the Assignee any facts known to him respecting any improvements involving or in any way

related to the Invention, and will testify in any legal proceeding, sign all lawful papers, execute all division, continuation, continuation-in-part, substitute, foreign, or reissue applications, make all rightful oaths, and generally do everything possible to aid the Assignee to obtain and enforce full protection and title in and to said Invention and to such improvements in all countries without further consideration but at the expense of the Assignee.

4. Each Assignor acknowledges that pursuant to the sale, grant, transfer, and assignment to the Assignee of the entire right, title, and interest in and to the Invention, as provided in the above paragraphs, this assignment shall be complete as to all rights owned. As such, Assignor consents to a waiver of any and all access rights to any applications for United States or foreign patents relating to the Invention, and including but not limited to the above-identified application, and to any division, substitution, continuation, or continuation-in-part, of such applications, all related access rights involving the Invention in any country such as utility-model registrations, inventor's certificates and the like, and all access rights, titles, and interests involving the Invention under any foreign government, to the extent permissible. Access rights may particularly include: any and all rights to any files, documents, notes, or evidence regarding any aspect of the prosecution of the Invention in the United States or foreign countries; any right to obtain, view or copy in any form the files, documents, notes, or evidence related to prosecution history or status of any application for United States or foreign patents relating to the Invention; any other right to obtain information relating to prosecution history, or status of any application for United States, or foreign patents relating to the Invention.

5. Each Assignor further covenants and agrees that he will sign all lawful papers and consents, as well as aid the Assignee in petitioning waiver of access of Assignor to the United States or foreign patent offices of any and all applications for United States or foreign patents relating to the Invention, as provided above.

6. Each Assignor grants the firm of CR MILES P.C., or other designated agent, the power to insert on this Assignment any further identification which may be necessary or desirable in order to comply with the rules of the Patent Cooperation Treaty or the United States Patent Office or any foreign patent office for recordation of this document, including, but not limited to, inserting the application number, the execution date, or the filing date of the above-identified United States Patent Application based upon the Invention.

7. This assignment shall be binding on all parties, their heirs, executors, administrators, successors, or assigns, and may be recorded in the United States Patent and Trademark Office or elsewhere. In the event any provision of this Agreement is found to be unenforceable or to be unreasonable in scope, such provision shall be modified only to the extent necessary to make it enforceable, and as so modified, this Agreement shall remain in full force and effect.

SIGNATURES ON THE FOLLOWING PAGES:

Nicholas P. Rettedal

Date: 2/17/2015

UNITED STATES OF AMERICA)
STATE OF COLORADO)
COUNTY OF LARIMER)

SUBSCRIBED AND AFFIRMED OR SWORN to before me in the County of Larimer, State of Colorado, United States of America, by Nicholas P. Rettedal, this 17 day of February, 2015. WITNESS my hand and official seal pursuant to the authority vested in me as a Notary Public by the State of Colorado.

Notary Public
My Commission Expires: Nov. 9. 2016

MELANIE CARTER
NOTARY PUBLIC
STATE OF COLORADO
NOTARY ID 20084037911
MY COMMISSION EXPIRES NOV 9, 2016

Stephen M. Weilnau

Date: Feb. 17-2015

UNITED STATES OF AMERICA)
STATE OF COLORADO)
COUNTY OF Larimer)

SUBSCRIBED AND AFFIRMED OR SWORN to before me in the County of Larimer, State of Colorado, United States of America, by Stephen M. Weilnau, this 17 day of February, 2015. WITNESS my hand and official seal pursuant to the authority vested in me as a Notary Public by the State of Colorado.

Notary Public
My Commission Expires: Nov. 9, 2016

MELANIE CARTER
NOTARY PUBLIC
STATE OF COLORADO
NOTARY ID 20084037911
MY COMMISSION EXPIRES NOV 9, 2016

Scott R. Cockroft

Date: 2-23-2015

UNITED STATES OF AMERICA)
STATE OF COLORADO)
COUNTY OF Weld)

SUBSCRIBED AND AFFIRMED OR SWORN to before me in the County of Weld, State of Colorado, United States of America, by Scott R. Cockroft, this 23rd day of February, 2015. WITNESS my hand and official seal pursuant to the authority vested in me as a Notary Public by the State of Colorado.

Notary Public
My Commission Expires: 3-21-17

CYNTHIA J. KENNEDY
NOTARY PUBLIC
STATE OF COLORADO
NOTARY ID 2000401995
MY COMMISSION EXPIRES MARCH 21, 2017

Joseph Janus IV

Date: 2-17-15

UNITED STATES OF AMERICA)
STATE OF COLORADO)
COUNTY OF LARIMER)

SUBSCRIBED AND AFFIRMED OR SWORN to before me in the County of Larimer, State of Colorado, United States of America, by Joseph Janus IV, this 17 day of February, 2015. WITNESS my hand and official seal pursuant to the authority vested in me as a Notary Public by the State of Colorado.

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MELANIE CARTER
NOTARY PUBLIC
STATE OF COLORADO
NOTARY ID 20084037911
MY COMMISSION EXPIRES NOV. 9, 2016

PTO/SB/08a (07-09)
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet 1 of 4

Complete if Known	
Application Number	
Filing Date	
First Named Inventor	Nicholas P. Rettedal
Art Unit	
Examiner Name	
Attorney Docket Number	bellaUScalf (280-10)

U. S. PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Document Number Number-Kind Code[2] *(if known)*	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
		US- 5,482,008	01-09-1996	Stafford et al.	
		US- 5,818,354	10-06-1998	Gentry	
		US- 5,963,132	10-05-1999	Yoakum	
		US- 5,984,875	11-16-1999	Brune	
		US- 6,059,733	05-09-2000	Brune et al.	
		US- 6,099,482	08-08-2000	Brune et al.	
		US- 6,371,927	04-16-2002	Brune et al.	
		US- 7,441,515	10-28-2008	Renz et al.	
		US- 7,962,096	06-14-2011	Cox	
		US- 8,001,168	08-16-2011	Tsuyuzaki	
		US- 8,545,436	10-01-2013	Robertson et al.	
		US- 8,547,248	10-01-2013	Zdeblich et al.	
		US- 8,588,887	11-19-2013	Arneson et al.	
		US- 8,640,712	02-04-2014	Ardrey, Jr.	
		US- 8,694,091	04-08-2014	Birk et al.	
		US- 8,771,201	07-08-2014	Gabriel et al.	
		US- 8,823,515	09-02-2014	Rettedal et al.	
		US- 2004/0133131	07-08-2004	Kuhn et al.	
		US- 2005/0134452	06-23-2005	Smith	

FOREIGN PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Foreign Patent Document Country Code[3]-Number[4]-Kind Code[5] *(if known)*	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages Or Relevant Figures Appear	T[6]
		EP 2314154 A1	04-27-2011	Sewalt et al.		
		WO 2011/079338 A2	07-07-2011	Rozenkranz et al.		
		WO 2012/173502 A1	12-20-2012	Mallinson et al.		

Examiner Signature		Date Considered	

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. [1] Applicant's unique citation designation number (optional). [2] See Kinds Codes of USPTO Patent Documents at www.uspto.gov or MPEP 901.04. [3] Enter Office that issued the document, by the two-letter code (WIPO Standard ST.3). [4] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [5] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [6] Applicant is to place a check mark here if English language Translation is attached.

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

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Sheet 2 of 4

Complete if Known	
Application Number	
Filing Date	
First Named Inventor	Nicholas P. Rettedal
Art Unit	
Examiner Name	
Attorney Docket Number	bellaUScalf (280-10)

U. S. PATENT DOCUMENTS

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		US- 2005/0145187	07-07-2005	Gray	
		US- 2008/0104209	05-01-2008	Singhal et al.	
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		US-			
		US-			

FOREIGN PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Foreign Patent Document Country Code[3]-Number[4]-Kind Code[5] *(if known)*	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages Or Relevant Figures Appear	T[6]

Examiner Signature		Date Considered	

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This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 2 hours to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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Substitute for form 1449/PTO

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet 3 of 4

Complete if Known	
Application Number	
Filing Date	
First Named Inventor	Nicholas P. Rettedal
Art Unit	
Examiner Name	
Attorney Docket Number	bellaUScalf (280-10)

NON PATENT LITERATURE DOCUMENTS

Examiner Initials*	Cite No.[1]	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.	T[2]
		BOEHMER, et al. Effects of Temperature of Consumed Water on Rumen Temperature of Beef Cows. Oklahoma Agricultural Experiment Station, 2009, 4 total pages.	
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		National Animal System-compliant data. Journal of Animal Science, December 2007, Vol. 85, Issue 12, pp. 503-511.	
		SMARTSTOCK USA. Website, http://www.smartstock-usa.com, originally downloaded 12/30/2011, 12 total pages.	

Examiner Signature		Date Considered	

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1 Applicant's unique citation designation number (optional). 2 Applicant is to place a check mark here if English language Translation is attached.

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet 4 of 4

Complete if Known	
Application Number	
Filing Date	
First Named Inventor	Nicholas P. Rettedal
Art Unit	
Examiner Name	
Attorney Docket Number	bellaUScalf (280-10)

NON PATENT LITERATURE DOCUMENTS

Examiner Initials*	Cite No.[1]	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.	T[2]
		Corresponding AU Patent Application No. 2010296053; Patent Examination Report No. 1, mailed July 16, 2014, 3 total pages.	
		Corresponding New Zealand patent application No.: 599357; Letters Patent dated September 3, 2012, 1 page.	
		Corresponding New Zealand patent application No.: 599357; OA dated October 19, 2012, 1 page.	
		Corresponding New Zealand patent application No.: 599357; OA dated February 8, 2013, 1 page.	
		Corresponding New Zealand Patent Application No. 610343; OA mailed May 12, 2013, 3 total pages.	
		New Zealand patent application No.: 610343; OA dated November 11, 2013, 3 total pages.	
		International Patent Cooperation Treaty Patent Application No. PCT/US2010/002509, filed September 14, 2010.	
		International Patent Cooperation Treaty Patent Application No. PCT/US2011/001788, filed October 19, 2011.	
		United States Provisional Patent Application No. 61/276,723, filed September 15, 2009.	
		United States Provisional Patent Application No. 61/455,419, filed October 19, 2010.	

Examiner Signature		Date Considered	

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1 Applicant's unique citation designation number (optional). 2 Applicant is to place a check mark here if English language Translation is attached.

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PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 14/738,789	Filing Date 06/12/2015	☐ To be Mailed

ENTITY: ☐ LARGE ☒ SMALL ☐ MICRO

APPLICATION AS FILED – PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA	RATE ($)	FEE ($)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*	X $ =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*	X $ =	
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).			
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))				
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL	

APPLICATION AS AMENDED – PART II

AMENDMENT	06/12/2015	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	* 20	Minus	** 20	= 0	X $40 =	0
	Independent (37 CFR 1.16(h))	* 1	Minus	***3	= 0	X $210 =	0
	☐ Application Size Fee (37 CFR 1.16(s))						
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))						
						TOTAL ADD'L FEE	**0**

AMENDMENT		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	*	Minus	**	=	X $ =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	X $ =	
	☐ Application Size Fee (37 CFR 1.16(s))						
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))						
						TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

LIE
/MOLIKI MAY/

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PATENT APPLICATION FEE DETERMINATION RECORD

Substitute for Form PTO-875

Application or Docket Number: 14/738,789

APPLICATION AS FILED - PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA	SMALL ENTITY RATE($)	SMALL ENTITY FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY FEE($)
BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A	70		N/A	
SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A	300		N/A	
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A	360		N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	20 minus 20 =	*	x 40 =	0.00	OR		
INDEPENDENT CLAIMS (37 CFR 1.16(h))	1 minus 3 =	*	x 210 =	0.00			
APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).			0.00			
MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))				0.00			
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL	730		TOTAL	

APPLICATION AS AMENDED - PART II

		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	SMALL ENTITY RATE($)	SMALL ENTITY ADDITIONAL FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY ADDITIONAL FEE($)
AMENDMENT A	Total (37 CFR 1.16(i))	*	Minus	**	=	x =		OR	x =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x =		OR	x =	
	Application Size Fee (37 CFR 1.16(s))									
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	SMALL ENTITY RATE($)	SMALL ENTITY ADDITIONAL FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY ADDITIONAL FEE($)
AMENDMENT B	Total (37 CFR 1.16(i))	*	Minus	**	=	x =		OR	x =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x =		OR	x =	
	Application Size Fee (37 CFR 1.16(s))									
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".
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United States Patent and Trademark Office
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APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY.DOCKET.NO	TOT CLAIMS	IND CLAIMS
14/738,789	06/12/2015	1615	730	bellaUScalf (280-10)	20	1

CONFIRMATION NO. 8986

FILING RECEIPT

39208
CR MILES, P.C.
CRAIG R. MILES
405 MASON COURT, SUITE 119
FORT COLLINS, CO 80524



Date Mailed: 06/23/2015

Receipt is acknowledged of this non-provisional patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF APPLICANT, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection. Please verify the accuracy of the data presented on this receipt. **If an error is noted on this Filing Receipt, please submit a written request for a Filing Receipt Correction. Please provide a copy of this Filing Receipt with the changes noted thereon. If you received a "Notice to File Missing Parts" for this application, please submit any corrections to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections**

Inventor(s)

Nicholas P. Rettedal, Loveland, CO;
Stephen M. Weilnau, Greeley, CO;
Scott R. Cockroft, Greeley, CO;
Joseph Janus IV, Loveland, CO;

Applicant(s)

Bella Technologies, LLC, Kersey, CO;

Assignment For Published Patent Application

Bella Technologies, LLC, Kersey, CO

Power of Attorney: The patent practitioners associated with Customer Number 39208

Domestic Applications for which benefit is claimed - None.
A proper domestic benefit claim must be provided in an Application Data Sheet in order to constitute a claim for domestic benefit. See 37 CFR 1.76 and 1.78.

Foreign Applications for which priority is claimed (You may be eligible to benefit from the **Patent Prosecution Highway** program at the USPTO. Please see http://www.uspto.gov for more information.) - None.
Foreign application information must be provided in an Application Data Sheet in order to constitute a claim to foreign priority. See 37 CFR 1.55 and 1.76.

If Required, Foreign Filing License Granted: 06/23/2015
The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 14/738,789**
Projected Publication Date: 12/15/2016
Non-Publication Request: No

Early Publication Request: No
**** SMALL ENTITY ****
Title

Calf Bolus

Preliminary Class

424

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications: No

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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
14/738,789	06/12/2015	Nicholas P. Rettedal	bellaUScalf (280-10)

CONFIRMATION NO. 8986

39208
CR MILES, P.C.
CRAIG R. MILES
405 MASON COURT, SUITE 119
FORT COLLINS, CO 80524

MISCELLANEOUS NOTICE

OC000000075897519

Date Mailed: 06/23/2015

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APPLICATION NUMBER	FILING DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
14/738,789	06/12/2015	Nicholas P. Rettedal	bellaUScalf (280-10)

CONFIRMATION NO. 8986

OC000000075897519

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CRAIG R. MILES
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Date Mailed: 06/23/2015

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Application Assistance Unit
(571) 272-4200

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the application of: Nicholas P. Rettedal, Stephen M. Weilnau, Scott R. Cockroft, and Joseph Janus IV

Application No.: 14/738,789

Filed: June 12, 2015

For: Calf Bolus

Attorney Docket No.: bellaUScalf (280-10)

Confirmation No.: 8986

Group Art Unit: 1615

Examiner: -

Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

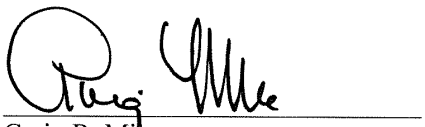
SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT UNDER 37 C.F.R. §1.97(b)(3)

The applicant respectfully requests entry of the attached Supplemental Information Disclosure Statement under 37 C.F.R. §1.97(b)(3) made in compliance with Section 1.98 during the pendency of the above-identified United States patent application. No fee is required because submission of the supplemental information disclosure statement is made prior to the mailing date of the first official action on the merits.

Dated this 23 day of September, 2015

Respectfully Submitted,

CR MILES, P.C.

By: 

Craig R. Miles
ATTORNEY FOR APPLICANT
USPTO Reg. No. 45,954
405 Mason Court, Suite 119
Fort Collins, CO 80524
(970) 492-0000
(970) 492-0003 facsimile

SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT BY APPLICANT	Application Number	14/738,789
	Filling Date	June 12, 2015
	First Named Inventor	Nicholas P. Rettedal
	Art Unit	1615
	Examiner Name	-
	Attorney Docket Number	bellaUScalf (280-10)
Sheet 1 of 1	Express Mail Label No.:	-

UNITED STATES PATENT DOCUMENTS

EXAMINER INITIALS	DOCUMENT NUMBER	PUBLICATION DATE MM-DD-YYYY	NAME OF PATENTEE OR APPLICANT
	5,532,692	07-02-1996	Tatsuya
	6,702,185	03-09-2004	Zercher
	2004/0155782	08-12-2004	Letkomiller et al.
	2007/0156016	07-05-2007	Betesh et al.
	2009/0187392	07-23-2009	Riskey et al.
	2010/0030025	02-04-2010	Segawa et al.

EXAMINER SIGNATURE:	DATE CONSIDERED:

Electronic Acknowledgement Receipt

EFS ID:	23586439
Application Number:	14738789
International Application Number:	
Confirmation Number:	8986
Title of Invention:	Calf Bolus
First Named Inventor/Applicant Name:	Nicholas P. Rettedal
Customer Number:	39208
Filer:	Craig R. Miles/Lioudmila Townsend
Filer Authorized By:	Craig R. Miles
Attorney Docket Number:	bellaUScalf (280-10)
Receipt Date:	23-SEP-2015
Filing Date:	12-JUN-2015
Time Stamp:	20:03:50
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Transmittal Letter	Transmittal_Letter.pdf	38014 8c7293a35df1e0fa19d7ed5065f0c9e87fdda2d8	no	2

Warnings:	
Information:	

2	Information Disclosure Statement (IDS) Form (SB08)	Statement.pdf	29119 ff3a44899e6faf4b1762ad288aed6d76ced319c9	no	1
Warnings:					
Information:					
This is not an USPTO supplied IDS fillable form					
3	Information Disclosure Statement (IDS) Form (SB08)	Citation.pdf	26220 cb315fae6b4a845f11d7abe688b18228dfa80143	no	1
Warnings:					
Information:					
This is not an USPTO supplied IDS fillable form					
		Total Files Size (in bytes):	93353		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the application of: Nicholas P. Rettedal, Stephen M. Weilnau, Scott R. Cockroft, and Joseph Janus IV

Application No.: 14/738,789

Filed: June 12, 2015

For: Calf Bolus

Attorney Docket No.: bellaUScalf (280-10)

Confirmation No.: 8986

Group Art Unit: 1615

Examiner:

Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

LETTER OF TRANSMITTAL

Sir/Madam:

Please find attached for entry into the above-identified patent application, documents as follow:

1. a Supplemental Information Disclosure Statement under 37 C.F.R. § 1.97 (b)(3) (1 page(s));

2. a Supplemental Information Disclosure Statement (1 page(s)) along with copies of each cited reference not already available at the PTO; and

3. this firm Letter of Transmittal (2 page(s)).

I have this 23 day of September, 2015, either myself personally, or through my direction of staff at this office, deposited all of the items listed in this Letter of Transmittal with the United States Patent and Trademark Office via EFS-Web.

Please enter the submitted documents into the above-identified patent application.

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 177 of 607

Direct all correspondence to:

CR MILES, P.C.
405 Mason Court, Suite 119
Fort Collins, CO 80524

Customer No.: 39208

Dated this 23 day of September, 2015

Respectfully Submitted,

CR MILES, P.C.

By: _____

Craig R. Miles
ATTORNEY FOR APPLICANT
USPTO Reg. No. 45,954
405 Mason Court, Suite 119
Fort Collins, CO 80524
(970) 492-0000
(970) 492-0003 facsimile

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the application of: Nicholas P. Rettedal, Stephen M. Weilnau, Scott R. Cockroft, and Joseph Janus IV

Application No.: 14/738,789

Filed: June 12, 2015

For: Calf Bolus

Attorney Docket No.: bellaUScalf (280-10)

Confirmation No.: 8986

Group Art Unit: 3769

Examiner: -

Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT UNDER 37 C.F.R. §1.97(b)(3)

The applicant respectfully requests entry of the attached Supplemental Information Disclosure Statement under 37 C.F.R. §1.97(b)(3) made in compliance with Section 1.98 during the pendency of the above-identified United States patent application. No fee is required because submission of the supplemental information disclosure statement is made prior to the mailing date of the first official action on the merits.

Dated this 3 day of June, 2016

Respectfully Submitted,

CR MILES P.C.

By: _____

Craig R. Miles
ATTORNEY FOR APPLICANT
USPTO Reg. No. 45,954
405 Mason Court, Suite 119
Fort Collins, CO 80524
(970) 492-0000
(970) 492-0003 facsimile

SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT BY APPLICANT	Application Number	14/738,789
	Filling Date	June 12, 2015
	First Named Inventor	Nicholas P. Rettedal
	Art Unit	3769
	Examiner Name	-
	Attorney Docket Number	bellaUScalf (280-10)
Sheet 1 of 1	Express Mail Label No.:	-

UNITED STATES PATENT DOCUMENTS

EXAMINER INITIALS	DOCUMENT NUMBER	PUBLICATION DATE MM-DD-YYYY	NAME OF PATENTEE OR APPLICANT
	6,085,751	07-11-2000	Taparia

NON-PATENT LITERATURE DOCUMENTS

EXAMINER INITIALS	CITE NO.	AUTHOR, title of article, title of item, date, page(s), volume-issue number(s), publisher, city and /or country where published	T2
		European Patent Application No. 11834759.0; Office Action mailed May 24, 2016, 8 pages total.	

EXAMINER SIGNATURE:	DATE CONSIDERED:

Electronic Acknowledgement Receipt	
EFS ID:	25970555
Application Number:	14738789
International Application Number:	
Confirmation Number:	8986
Title of Invention:	Calf Bolus
First Named Inventor/Applicant Name:	Nicholas P. Rettedal
Customer Number:	39208
Filer:	Craig R. Miles/Lioudmila Townsend
Filer Authorized By:	Craig R. Miles
Attorney Docket Number:	bellaUScalf (280-10)
Receipt Date:	03-JUN-2016
Filing Date:	12-JUN-2015
Time Stamp:	20:24:32
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Transmittal Letter	Transmittal_Letter.pdf	38209 18c17146297fcaa2542efb70b5554b0493a01fee	no	2
Warnings:					
Information:					

2	Information Disclosure Statement (IDS) Form (SB08)	Statement.pdf	29743 4073798636f38d663cbb17d8a5e1281a4ec82ba8	no	1
Warnings:					
Information:					
This is not an USPTO supplied IDS fillable form					
3	Information Disclosure Statement (IDS) Form (SB08)	Citation.pdf	27702 b19b7a1bfc7b0007bf36d02a33ba6b50b013dcea	no	1
Warnings:					
Information:					
This is not an USPTO supplied IDS fillable form					
4	Non Patent Literature	EP_OA.pdf	266121 9cb956aa30711c6d6a50ba2159ece1af7e9a22ec	no	8
Warnings:					
Information:					
		Total Files Size (in bytes):	361775		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the application of: Nicholas P. Rettedal, Stephen M. Weilnau, Scott R. Cockroft, and Joseph Janus IV

Application No.: 14/738,789

Filed: June 12, 2015

For: Calf Bolus

Attorney Docket No.: bellaUScalf (280-10)

Confirmation No.: 8986

Group Art Unit: 3769

Examiner: -

Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

LETTER OF TRANSMITTAL

Sir/Madam:

Please find attached for entry into the above-identified patent application, documents as follow:

1. a Supplemental Information Disclosure Statement under 37 C.F.R. § 1.97 (b)(3) (1 page(s));

2. a Supplemental Information Disclosure Statement (1 page(s)) along with copies of each cited reference not already available at the PTO; and

3. this firm Letter of Transmittal (2 page(s)).

I have this 3 day of June, 2016, either myself personally, or through my direction of staff at this office, deposited all of the items listed in this Letter of Transmittal with the United States Patent and Trademark Office via EFS-Web.

Please enter the submitted documents into the above-identified patent application.

Direct all correspondence to:

CR MILES P.C.
405 Mason Court, Suite 119
Fort Collins, CO 80524

Customer No.: 39208

Dated this 3 day of June, 2016

Respectfully Submitted,

CR MILES P.C.

By: _____

Craig R. Miles
ATTORNEY FOR APPLICANT
USPTO Reg. No. 45,954
405 Mason Court, Suite 119
Fort Collins, CO 80524
(970) 492-0000
(970) 492-0003 facsimile

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
14/738,789	06/12/2015	Nicholas P. Rettedal	bellaUScalf (280-10)	8986

39208 7590 11/01/2016

CR MILES, P.C.
CRAIG R. MILES
405 MASON COURT, SUITE 119
FORT COLLINS, CO 80524

EXAMINER	
HELLER, TAMMIE K	

ART UNIT	PAPER NUMBER
3766	

MAIL DATE	DELIVERY MODE
11/01/2016	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No. 14/738,789	Applicant(s) RETTEDAL ET AL.	
	Examiner Tammie K. Heller	Art Unit 3766	AIA (First Inventor to File) Status Yes

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTHS FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *6/12/2015*.

☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

4)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims*

5)☒ Claim(s) *37-39,41-46,48-55 and 64-66* is/are pending in the application.

5a) Of the above claim(s) _____ is/are withdrawn from consideration.

6)☐ Claim(s) _____ is/are allowed.

7)☒ Claim(s) *37-39,41-46,48-55 and 64-66* is/are rejected.

8)☐ Claim(s) _____ is/are objected to.

9)☐ Claim(s) _____ are subject to restriction and/or election requirement.

* If any claims have been determined allowable, you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov.

Application Papers

10)☒ The specification is objected to by the Examiner.

11)☒ The drawing(s) filed on *6/12/2015* is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

Certified copies:

a)☐ All b)☐ Some** c)☐ None of the:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

** See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☒ Information Disclosure Statement(s) (PTO/SB/08a and/or PTO/SB/08b) Paper No(s)/Mail Date *Attached*.

3) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

4) ☐ Other: _____.

DETAILED ACTION

1. The present application, filed on or after March 16, 2013, is being examined under the first inventor to file provisions of the AIA.

Information Disclosure Statement

2. The information disclosure statement filed June 12, 2015 fails to comply with 37 CFR 1.98(a)(2), which requires a legible copy of each cited foreign patent document; each non-patent literature publication or that portion which caused it to be listed; and all other information or that portion which caused it to be listed. It has been placed in the application file, but the information referred to therein which has been lined through has not been considered.

3. The information disclosure statement(s) (IDS) submitted on 9/23/2015 and 6/3/2016 has/have been acknowledged and is/are being considered by the Examiner.

Drawings

4. The drawings filed on June 12, 2015 are objected to because Figures 1-3 consist of blocks without a functional description of what they represent. Therefore, one of ordinary skill in the art would be unable to ascertain from Figures 1-3 what is being shown in the figure. Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as "amended." If a drawing figure is to be canceled, the appropriate figure must be removed from the

replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Specification

5. Applicant is reminded of the proper language and format for an abstract of the disclosure.

The abstract should be in narrative form and generally limited to a single paragraph on a separate sheet within the range of 50 to 150 words in length. The abstract should describe the disclosure sufficiently to assist readers in deciding whether there is a need for consulting the full patent text for details.

The language should be clear and concise and should not repeat information given in the title. It should avoid using phrases which can be implied, such as, “The disclosure concerns,” “The disclosure defined by this invention,” “The disclosure describes,” etc. In addition, the form and legal phraseology often used in patent claims, such as “means” and “said,” should be avoided.

6. The abstract of the disclosure is objected to because the Abstract is a single run-on sentence. Correction is required. See MPEP § 608.01(b).

7. The disclosure is objected to because of the following informalities: the Applicant should review the entire disclosure to ensure that it is grammatically correct as there are a number of instances where grammatical abnormalities exist (i.e. the run-on sentence of page 1, lines 5-10; the use of "bolus" instead of "boluses" or “a bolus” at page 1, line 14 and line 16; the incorrect usage of commas at page 1, line 16).

Appropriate correction is required.

Claim Objections

8. Claim 65 is objected to because of the following informalities: on line 2, the phrase “based upon” is repeated twice. Appropriate correction is required.

Claim Rejections - 35 USC § 112

9. The following is a quotation of the first paragraph of 35 U.S.C. 112(a):

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

The following is a quotation of the first paragraph of pre-AIA 35 U.S.C. 112:

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

10. Claim 39 is rejected under 35 U.S.C. 112(a) or 35 U.S.C. 112 (pre-AIA), first paragraph, as failing to comply with the enablement requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention. Claim 39 recites “enabling or disabling said one or more sensors based upon a pre-determined set of said one or more physiological parameters

to be sensed during a stage in a life cycle of said ruminant animal" in lines 1-3. However, the disclosure fails to adequately describe how the one or more sensors are enabled or disabled *based on* a pre-determined set of parameters sensed. One of ordinary skill in the art would therefore be unable to make or use the invention without knowledge of how to base the enablement/disablement of the sensors on a pre-determined set of parameters sensed.

11. The following is a quotation of 35 U.S.C. 112(b):

> (b) CONCLUSION.—The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the inventor or a joint inventor regards as the invention.
>
> The following is a quotation of 35 U.S.C. 112 (pre-AIA), second paragraph:
> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

12. Claims 37-39, 41-46, 48-55, and 64-66 are rejected under 35 U.S.C. 112(b) or 35 U.S.C. 112 (pre-AIA), second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which the inventor or a joint inventor, or for pre-AIA the applicant regards as the invention.

13. Claim 37 recites the limitation "the physiological parameters" in line 1. There is insufficient antecedent basis for this limitation in the claim.

14. Claim 37 recites the limitation "a ruminant animal" in lines 6-7. It is unclear if this is the same, or a different, ruminant animal as that referred to in line 3 of the claim.

15. Claim 37 recites the limitation "said plurality of sensors" in line 12. There is insufficient antecedent basis for this limitation in the claim.

16. Claim 38 recites the limitation "elapsed duration of time from activation of said bolus" in line 2. There is insufficient antecedent basis for this limitation in the claim because the activation of the bolus has not been previously recited.

17. Claim 41 recites the limitation “activating said bolus upon generation of said sensor signal” in line 5. It is unclear if the bolus is activated upon generation of said sensor signal or after the comparison of said sensor signal to a first pre-selected activation code.

18. Claim 41 recites the limitation “which by comparison to said first pre-selected activation code exceeds a first pre-selected activation match threshold” at lines 6-7. It is unclear what is being required by such a recitation.

19. Claim 42 recites the limitation “activating said bolus upon generation of said sensor signal” in line 4. It is unclear if the bolus is activated upon generation of said sensor signal or after the comparison of said sensor signal to a second pre-selected activation code.

20. Claim 42 recites the limitation “which by comparison to said first and second pre-selected activation codes exceeds said first and second pre-selected activation match threshold” at lines 5-6. It is unclear what is being required by such a recitation.

21. Claim 42 recites the limitation "said first and second pre-selected activation match threshold" in line 6. There is insufficient antecedent basis for this limitation in the claim.

22. Claim 42 recites the limitation “activating said bolus upon generation of said sensor signal from said one or more sensors which by comparison to said first and

second pre-selected activation codes exceeds said first and second pre-selected activation match threshold" at lines 4-6. Claim 41 from which claim 42 depends already claims activation of said bolus and, thus, it is unclear if claim 42 is requiring that the bolus is activated twice, in which case it is unclear how it could be activated twice.

23. Claim 50 recites the limitation "adjusting said frequency to compensate for change in said frequency" in line 3. It is unclear what is being claimed, as it appears that the claim is requiring adjusting the frequency to compensate for the adjustment of the frequency, which does not make sense.

24. Claim 51 recites the limitation "said radio signal generator" in line 1. There is insufficient antecedent basis for this limitation in the claim.

25. Claim 51 recites the limitation "wherein said radio signal generator generates said radio signal having only one frequency". It is unclear what is being claimed with such a recitation.

26. Claim 65 recites the limitation "further comprising re-programming said computer code". Claim 64 requires re-programming said computer code and, thus, it is unclear if claim 65 is further defining the re-programming of the computer code that is recited in claim 64, or if the computer code is intended to be re-programmed twice.

27. Claim 65 recites the limitation "said pre-determined set" in line 2. There is insufficient antecedent basis for this limitation in the claim.

28. Claim 65 recites the limitation "said plurality of physiological parameters" in lines 2-3. There is insufficient antecedent basis for this limitation in the claim.

29. Claim 65 recites the limitation "said stage" in line 3. There is insufficient antecedent basis for this limitation in the claim.

30. Claim 65 recites the limitation "said life cycle" in line 3. There is insufficient antecedent basis for this limitation in the claim.

31. Claim 66 recites the limitation “further comprising re-programming said computer code”. Claims 64 and 65 require re-programming said computer code and, thus, it is unclear if claim 66 is further defining the re-programming of the computer code that is recited in claims 64 or 65, or if the computer code is intended to be re-programmed twice or thrice.

Claim Rejections - 35 USC § 101

32. 35 U.S.C. 101 reads as follows:

> Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

33. Claims 37-39, 41-46, 48-55, and 64-66 are rejected under 35 U.S.C. 101 because the claimed invention is directed to non-statutory subject matter. The claim(s) does/do not fall within at least one of the four categories of patent eligible subject matter because the claims fail the machine-or-transformation test because they do not require that the method be implemented by a particular machine, as the method steps are only obtaining a bolus and orally administering said bolus, which could both be done by hand. Furthermore, the claims do not require that the method particularly transform a particular article, as there is no transformation that occurs at all. Further, the recitation of "computer code" is considered to be a recitation of a computer program product that covers signals per se, which the Office rejects under 35 U.S.C. § 101 as covering both

non-statutory subject matter and statutory subject matter. To overcome this rejection, the Examiner suggests Applicant narrow the claim's scope to cover only the statutory embodiments supported by the originally-filed disclosure by adding the limitation "non-transitory" to the claim. See In re Nuijten, 500 F.3d 1346, 1356-57 (Fed. Cir. 2007) (transitory embodiments are not directed to statutory subject matter) and Interim Examination Instructions for Evaluating Subject Matter Eligibility Under 35 U.S.C. § 101, Aug. 24, 2009; p, 2.

Claim Rejections - 35 USC § 102

34. In the event the determination of the status of the application as subject to AIA 35 U.S.C. 102 and 103 (or as subject to pre-AIA 35 U.S.C. 102 and 103) is incorrect, any correction of the statutory basis for the rejection will not be considered a new ground of rejection if the prior art relied upon, and the rationale supporting the rejection, would be the same under either status.

35. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (a)(1) the claimed invention was patented, described in a printed publication, or in public use, on sale or otherwise available to the public before the effective filing date of the claimed invention.

36. Claim(s) 37-39, as best understood, is/are rejected under 35 U.S.C. 102(a)(1) as being anticipated by Brune et al. (U.S. Patent No. 6,371,927), herein Brune. Regarding claim 37, Brune discloses a method of monitoring the physiological parameters of a ruminant animal (see Abstract), comprising: obtaining a bolus 2/20/50 configured for oral administration to a ruminant animal (see Figures 1, 5-7, and 12 and col. 3, ln. 10-

12); and orally administering said bolus to said animal (see col. 4, ln. 48-51). It has been held that to be entitled to weight in method claims, the recited structure limitations therein must affect the method in a manipulative sense, and not to amount to the mere claiming of a user of a particular structure. *Ex parte Pfeiffer,* 1962 C.D. 408 (1961). It is respectfully submitted that the recited structural limitations in claim 37 do not affect the method in a manipulative sense and are not entitled to weight. Despite not giving weight to the structural limitations, it is respectfully submitted that Brune satisfies such limitations of said bolus including: one or more sensors 8 each capable of generating a sensor signal which varies based on a corresponding change in one or more physiological parameters of an animal (see Figure 2, col. 5, ln. 36-37, and col. 6, ln. 39); a memory element (see Abstract); a processor 7 in communication with said memory element (see Abstract and Figure 2); a computer code contained in said memory element, said computer code containing a power management module executable by said processor to enable and disable one or more of said plurality of sensors (see col. 6, ln. 47-57); and a housing providing an outer most external surface of said bolus (see Figures 1, 5-7, and 12).

37. Regarding claim 38, Brune discloses enabling or disabling said one or more sensors based upon elapsed duration of time from activation of said bolus (see col. 7, ln. 7, ln. 27-30).

38. Regarding claim 39, Brune discloses enabling or disabling said one or more sensors based upon a pre-determined set of said one or more physiological parameters

to be sensed, the enablement of the diagnostic sensors after the target condition is met (see col. 6, ln. 47-57).

Claim Rejections - 35 USC § 102/103

39. In the event the determination of the status of the application as subject to AIA 35 U.S.C. 102 and 103 (or as subject to pre-AIA 35 U.S.C. 102 and 103) is incorrect, any correction of the statutory basis for the rejection will not be considered a new ground of rejection if the prior art relied upon, and the rationale supporting the rejection, would be the same under either status.

40. The following is a quotation of 35 U.S.C. 103 which forms the basis for all obviousness rejections set forth in this Office action:

> A patent for a claimed invention may not be obtained, notwithstanding that the claimed invention is not identically disclosed as set forth in section 102, if the differences between the claimed invention and the prior art are such that the claimed invention as a whole would have been obvious before the effective filing date of the claimed invention to a person having ordinary skill in the art to which the claimed invention pertains. Patentability shall not be negated by the manner in which the invention was made.

41. The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103 are summarized as follows:

1. Determining the scope and contents of the prior art.

2. Ascertaining the differences between the prior art and the claims at issue.

3. Resolving the level of ordinary skill in the pertinent art.

4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

42. This application currently names joint inventors. In considering patentability of the claims the examiner presumes that the subject matter of the various claims was

commonly owned as of the effective filing date of the claimed invention(s) absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and effective filing dates of each claim that was not commonly owned as of the effective filing date of the later invention in order for the examiner to consider the applicability of 35 U.S.C. 102(b)(2)(C) for any potential 35 U.S.C. 102(a)(2) prior art against the later invention.

43. Claim(s) 37-39 and 41-44, as best understood, is/are rejected under 35 U.S.C. 102(a)(1) as anticipated by or, in the alternative, under 35 U.S.C. 103 as obvious over Zander et al. (U.S. 2009/0030279), herein Zander. Regarding claim 37, Zander discloses a method of monitoring the physiological parameters of an animal (see paragraph [0033]), comprising: obtaining a bolus 20/28/36/48 configured for oral administration to an animal (see Figures 1-4); and orally administering said bolus to said animal (see Figure 4 and paragraph [0040]). It has been held that to be entitled to weight in method claims, the recited structure limitations therein must affect the method in a manipulative sense, and not to amount to the mere claiming of a user of a particular structure. *Ex parte Pfeiffer,* 1962 C.D. 408 (1961). It is respectfully submitted that the recited structural limitations in claim 37 do not affect the method in a manipulative sense and are not entitled to weight. Despite not giving weight to the structural limitations, it is respectfully submitted that Zander satisfies such limitations of said bolus including: one or more sensors 24/30/32 each capable of generating a sensor signal which varies based on a corresponding change in one or more physiological parameters of an animal (see Figures 1-3 and paragraph [0014]); a memory element in controller 22 (see

paragraph [0034]); a processor in controller 22 in communication with said memory element (see paragraph [0034]); a computer code contained in said memory element, said computer code containing a power management module executable by said processor to enable and disable one or more of said plurality of sensors (see paragraphs [0016], [0034], and [0037]); and a housing providing an outer most external surface of said bolus (see Figures 1-4). Furthermore, the method of obtaining a bolus and orally administering said bolus is not dependent upon the animal and, thus, it is respectfully submitted that the method of Zander would be applicable to ruminant animals. In the alternative it would have been obvious to one having ordinary skill in the art to apply the method of Zander to ruminant animals, as it has been held that known work in one field of endeavor may prompt variations of it for use in either the same field or a different one based on design incentives or other market forces if the variations are predictable to one of ordinary skill in the art.

44. Regarding claim 38, Zander discloses enabling or disabling said one or more sensors based upon elapsed duration of time from activation of said bolus (see paragraph [0043]).

45. Regarding claim 39, Zander discloses enabling or disabling said one or more sensors based upon a pre-determined set of said one or more physiological parameters to be sensed, the enablement of the diagnostic sensors after the target condition is met (see paragraph [0043]).

46. Regarding claim 41, Zander discloses monitoring said sensor signal from said one or more sensors, target sensors; comparing said sensor signal from said one or

more sensors to a first pre-selected activation code, the target condition; and activating said bolus upon generation of said sensor signal from said one or more sensors which by comparison to said first pre-selected activation code exceeds a first pre- selected activation match threshold (see paragraph [0042]).

47. Regarding claim 42, Zander discloses comparing said sensor signal from said one or more sensors to a second pre-selected activation code, block 62 in Figure 5; and activating said bolus upon generation of said sensor signal from said one or more sensors which by comparison to said first and said second pre-selected activation codes exceeds said first and a second pre-selected activation match threshold (see Figure 5).

48. Regarding claim 43, Zander discloses encoding said sensor signal from said one or more sensors as encoded physiological data corresponding to said one or more physiological parameters of said animal; and storing said encoded physiological data in said memory element (see paragraph [0048]).

49. Regarding claim 44, Zander discloses that said bolus further comprises a radio signal generator 26 capable of generating a radio signal to carry said encoded physiological data, and further comprising: enabling said radio signal generator; and activating said radio signal generator at pre-determined intervals to generate said radio signal to carry said encoded physiological data (see Figures 1-3 and paragraph [0037]).

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Tammie K. Heller whose telephone number is (571)272-

1986. The examiner can normally be reached on Monday through Friday from 7am until 3:30 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carl H. Layno can be reached on 571-272-4949. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Tammie K Heller/
Primary Examiner, Art Unit 3766

Notice of References Cited	Application/Control No. 14/738,789	Applicant(s)/Patent Under Reexamination RETTEDAL ET AL.	
	Examiner Tammie K. Heller	Art Unit 3766	Page 1 of 1

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	D	US-				
	E	US-				
	F	US-				
	G	US-				
	H	US-				
	I	US-				
	J	US-				
	K	US-				
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Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT BY APPLICANT	Application Number	14/738,789
	Filling Date	June 12, 2015
	First Named Inventor	Nicholas P. Rettedal
	Art Unit	3769
	Examiner Name	-
	Attorney Docket Number	bellaUScalf (280-10)
Sheet 1 of 1	Express Mail Label No.:	-

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EXAMINER INITIALS	DOCUMENT NUMBER	PUBLICATION DATE MM-DD-YYYY	NAME OF PATENTEE OR APPLICANT
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		European Patent Application No. 11834759.0; Office Action mailed May 24, 2016, 8 pages total.	

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/TAMMIE K HELLER/	10/27/2016

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SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT BY APPLICANT	Application Number	14/738,789
	Filling Date	June 12, 2015
	First Named Inventor	Nicholas P. Rettedal
	Art Unit	1615
	Examiner Name	-
	Attorney Docket Number	bellaUScalf (280-10)
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First Named Inventor	Nicholas P. Rettedal
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Examiner Name	
Attorney Docket Number	bellaUScalf (280-10)

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Examiner Initials*	Cite No.[1]	Document Number Number-Kind Code[2] *(if known)*	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
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First Named Inventor	Nicholas P. Rettedal
Art Unit	
Examiner Name	
Attorney Docket Number	bellaUScalf (280-10)

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First Named Inventor	Nicholas P. Rettedal
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Examiner Name	
Attorney Docket Number	bellaUScalf (280-10)

NON PATENT LITERATURE DOCUMENTS

Examiner Initials*	Cite No.[1]	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.	T[2]
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		United States Provisional Patent Application No. 61/455,419, filed October 19, 2010.	

Examiner Signature	/TAMMIE K HELLER/	Date Considered	10/27/2016

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

1 Applicant's unique citation designation number (optional). 2 Applicant is to place a check mark here if English language Translation is attached.

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ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /T.K.H/

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L2	29	("20040133131" | "20050134452" | "20050145187" | "20080104209" | "20080236500" | "20090182207" | "20110212782" | "20110301437" | "20120068848" | "20130197323" | "20130231188" | "20140368338" | "5482008" | "5818354" | "5963132" | "5984875" | "6059733" | "6099482" | "6371927" | "7441515" | "7962096" | "8001168" | "8545436" | "8547248" | "8588887" | "8640712" | "8694091" | "8771201" | "8823515" | "us-" | "us-" | "us-" | "us-" | "us-" | "us-" | "us-" | "us-" | "us-" | "us-" | "us-" | "us-" | "us-" | "us-" | "us-" | "us-" | "us-" | "us-" | "us-" | "us-" | "us-" | "us-" | "us-" | "us-").PN.	US-PGPUB; USPAT	OR	ON	2016/10/27 17:41
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L8	3306	A61D7/00.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2016/10/27 17:41
L9	2920	A01K11/006.cpc.	US-	OR	ON	2016/10/27

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L21	0	(("RETTEDAL") near3 ("Nicholas")).INV.	EPO; JPO; DERWENT	OR	ON	2016/10/27 17:52
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L23	0	(("WEILNAU") near3 ("Stephen")).INV.	EPO; JPO; DERWENT	OR	ON	2016/10/27 17:52
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L27	1	(("JANUS") near3 ("Joseph")).INV.	EPO; JPO; DERWENT	OR	ON	2016/10/27 17:52
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S16	11236	A61B5/0031.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO;	OR	ON	2016/10/27 09:26

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S18	2920	A01K11/006.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2016/10/27 09:26
S19	399	A01K11/007.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2016/10/27 09:26
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S26	1246	S25 and (mouth oral$6 swallow$6 animal)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2016/10/27 09:47
S27	1245	S26 and sens$6	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2016/10/27 09:47
S28	273	(S22 S23) and ((power near3 manage$6) (sens$6 with (((turn turned turning) near3 ("on" "off")) enabl$6 disabl$6)))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2016/10/27 09:48
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S33	9	(S22 S23) and S32	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2016/10/27 09:57
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S35	85	(S24) and S32	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2016/10/27 09:57
S36	86	S33 S35	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2016/10/27 09:57
S37	86	(US-20020050248-$ or US-20030188689-$ or US-20050000458-$ or US-20080270173-$ or US-20120158463-$ or US-20080190369-$ or US-20130151310-$ or US-20090031961-$ or US-20090307111-$ or US-20110161125-$ or US-20090031960-$ or US-20070131175-$ or US-20070157888-$ or US-20090030279-$ or US-20080146871-$ or US-20140309503-$ or US-20090030293-$ or US-20130013031-$ or US-20080114224-$ or US-20080112885-$ or US-20140200418-$ or US-20080161660-$ or US-20140343378-$ or US-20090131768-$ or US-20090131769-$ or US-20090131776-$).did. or (US-20090131777-$ or US-20090137886-$ or US-20090137887-$ or US-20090143659-$ or US-20090178459-$ or US-	US-PGPUB; USPAT	OR	ON	2016/10/27 09:57

		20090182217-$ or US-20140058235-$ or US-20140088391-$ or US-20160198978-$ or US-20020132226-$ or US-20080269664-$ or US-20130043975-$ or US-20130043993-$ or US-20130043974-$ or US-20130043991-$ or US-20130046153-$ or US-20130046477-$ or US-20150297116-$ or US-20110295079-$ or US-20040032957-$ or US-20040171915-$ or US-20150374262-$ or US-20110130658-$).did. or (US-6805075-$ or US-6135055-$ or US-7726258-$ or US-6516746-$ or US-7464666-$ or US-5673647-$ or US-6318289-$ or US-8028657-$ or US-7464667-$ or US-7836849-$ or US-8261694-$ or US-7827934-$ or US-8474405-$ or US-7748345-$ or US-7347161-$ or US-7607405-$ or US-6000361-$ or US-8588887-$ or US-8512241-$ or US-9173592-$ or US-8287453-$ or US-8886273-$ or US-8275438-$ or US-8298142-$ or US-8447376-$ or US-8449464-$).did. or (US-8478377-$ or US-8562528-$ or US-8626257-$ or US-8615284-$ or US-8617058-$ or US-8816814-$ or US-8599009-$ or US-8723640-$ or US-8514067-$ or US-8663105-$ or US-7118529-$).did.				
S38	86	S37 and (sens$6 with (((turn turned turning) near3 ("on" "off")) (enabl$6 and disabl$6)))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2016/10/27 09:58
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S40	13	S39 and ((power near3 manage$6) (sens$6 with (((turn turned turning) near3 ("on" "off")) (enabl$6 and disabl$6))))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2016/10/27 10:14

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Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
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	TAMMIE K HELLER	3766

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CRAIG R. MILES
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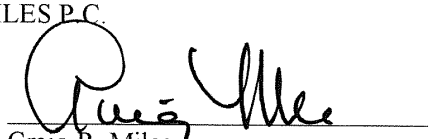
SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT UNDER 37 C.F.R. §1.97(c) AND STATEMENT UNDER 37 C.F.R. 1.97(e)(1)

Applicant respectfully requests entry of the attached Supplemental Information Disclosure Statement under 37 C.F.R. §1.97(c) made in compliance with Section 1.98 during the pendency of the above-identified United States patent application. No fee is required because submission of the supplemental information disclosure statement is accompanied by the statement under 37 C.F.R. §1.97(e)(1) that each item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in § 1.56(c) more than three months prior to the filing of the information disclosure statement.

Dated this 24 day of January, 2017

Respectfully Submitted,

CR MILES P.C.

By: 

Craig R. Miles
ATTORNEY FOR APPLICANT
USPTO Reg. No. 45,954
405 Mason Court, Suite 119
Fort Collins, CO 80524
(970) 492-0000
(970) 492-0003 facsimile

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	6,416,782	07-09-2002	Maas

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EXAMINER INITIALS	DOCUMENT NUMBER	PUBLICATION DATE MM-DD-YYYY	NAME OF PATENTEE OR APPLICANT
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	2010/0302039	12-02-2010	Goto et al.

FOREIGN PATENT DOCUMENTS

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(71) Applicant: **BELLA TECHNOLOGIES, LLC** [US/US]; 27906 Weld County Road 388, Kersey, Colorado 80644 (US).

(72) Inventors: **RETTEDAL, Nicholas, P.**; 1701 E 15th Street, Loverland, Colorado 80538 (US). **WEILNAU, Stephen, M.**; 1937 Montview Drive, Greeley, Colorado 80631 (US). **COCKROFT, Scott, R.**; 27712 County Road 62, Greeley, Colorado 80631 (US). **JANUS, Joseph, IV**; 125 E 23rd Street, Loverland, Colorado 80538 (US).

(74) Agent: **MILES, Craig, R.**; CR Miles P.C., 405 Mason Court, Suite 119, Fort Collins, CO 80524 (US).

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— *as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii))*

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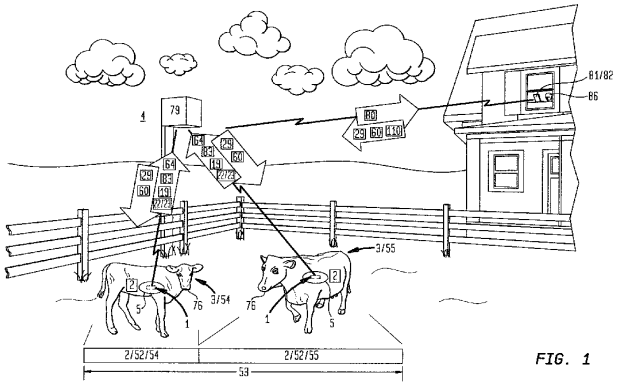


FIG. 1

(57) **Abstract**: Generally, an animal monitoring device configured as a bolus for oral administration to reside in the reticulorumen of a ruminant animal having a memory element, a processor in communication with the memory element and a computer code contained in the memory element including a power management module executable by the processor to regulate power use by the bolus based on determination of remaining energy stored in an energy source and the determined power requirements over a pre-determined life cycle of the bolus.

WO 2016/201242 A1

CALF BOLUS

This International Patent Cooperation Treaty Patent Application is a continuation of United States Non-Provisional Patent Application No. 14/738,789, filed June 12, 2015, hereby incorporated by reference herein.

I. TECHNICAL FIELD

Generally, an animal monitoring device configured as a bolus for oral administration to reside in the reticulorumen of a ruminant animal having a memory element, a processor in communication with the memory element and a computer code contained in the memory element including a power management module executable by the processor to regulate power use by the bolus based on determination of remaining energy stored in an energy source and the determined power requirements over a pre-determined life cycle of the bolus.

II. BACKGROUND

Conventional bolus orally administered to reside in the reticulorumen for monitoring of physiological parameters of ruminant animals may not have a configuration capable of oral administration at birth. Additionally, bolus, even when orally administered to adult ruminant animals, may not have an operational lifespan long enough to monitor useful physiological parameters over the remaining productive lifespan of the ruminant animal. Moreover, uncontrollable changes in the orientation of the bolus and correspondingly uncontrolled orientation of the bolus antenna in the reticulorumen of the ruminant animal may cause variable quality in radio signal transmission from the ruminant animal resulting in the loss of encoded physiological data.

III. DISCLOSURE OF THE INVENTION

Accordingly, a broad object of the invention can be to provide a bolus having an outer most surface configuration and a density which allows oral administration to a ruminant animal immediately after birth and prevents or substantially reduces the likelihood of being regurgitated or ejected from the reticulorumen of a ruminant animal over the entire lifespan or productive lifespan of the ruminant animal.

Another broad object of the invention can be to provide a bolus which can reside in the reticulorumen of a ruminant animal having an operational lifespan corresponding to the entire

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 224 of 607

lifespan or the productive lifespan of the ruminant animal. One aspect of this broad object of the invention involves a power management module including an activation element which maintains the bolus in a sleep mode in which one or more encoded sensor signals are compared to a pre-selected activation code and upon achieving a pre-selected activation match threshold between the encoded sensor signals and the pre-selected activation code causes the bolus to be activated for normal monitoring of one or more physiological parameters of the ruminant animal. As to particular embodiments, a first and second pre-selected activation match threshold can be met by comparison of a corresponding first and second encoded sensor signals and a first and second pre-selected activation code to provide assurance that environmental events to not inadvertently activate the bolus for normal monitoring. Another aspect of this broad object involves a power management module pre-programmed or re-programmable to reconfigure the operating parameters of the bolus during residence in the reticulorumen of a ruminant animal to collect only useful physiological data and encode and transmit such physiological data at intervals based upon the life stage of the ruminant animal. Another aspect of this broad object of the invention involves a power management module which functions to evaluate the remaining amount of energy stored in the power source of the bolus and compare the remaining amount of energy to the energy requirements of the bolus during a pre-determined period of time based on the existing programmed operational parameters of the bolus and further functions to employ power regulation events to offset the difference between the energy requirement of the bolus over the pre-determined period of time and the amount of energy remaining in the power source.

Another broad object of the invention can be to provide an antenna having a structure that alters the magnetic field and electrical field generation in a manner that reduces the impact of uncontrollable changes in the orientation of the bolus and correspondingly the orientation of the antenna during residence of the bolus in the reticulorumen of the ruminant animal.

Naturally, further objects of the invention are disclosed throughout other areas of the specification, drawings, photographs, and claims.

IV. BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a diagram which shows a particular method of using an embodiment of the animal monitoring system to monitor one or more physiological parameters of a ruminant animal.

Figure 2 is a block diagram of a particular embodiment of a bolus capable of being orally administered to a ruminant animal.

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 225 of 607

Figure 3 is a block diagram which shows a particular embodiment of an animal monitoring system including a specialized computer, a radio frequency reader and a bolus.

Figure 4 is an exploded view of a particular embodiment of a bolus capable of being orally administered to a ruminant animal.

Figure 5 is a diagram of a particular embodiment of the animal monitoring assembly of the bolus.

Figure 6 is an exploded view of a particular embodiment of an antenna included in the particular embodiment of the bolus shown in Figures 4 and 5.

Figure 7 is a top perspective view of the particular embodiment of the antenna shown in Figure 6 having first and second electrically conductive loops disposed on the opposed surfaces of a non-electrically conductive sheet material.

Figure 8 is top plan view of the particular embodiment of the antenna shown in Figure 6 with vias (shown in broken line) interconnecting a first and second electrically conductive loops without being disposed on opposed surfaces of a non-electrically conductive sheet material.

Figure 9 is a top plan view of the particular embodiment of the antenna shown in Figure 8.

Figure 10 is a first side elevation view of the particular embodiment of the antenna shown in Figure 8.

Figure 11 is a second side elevation view of the particular embodiment of the antenna shown in Figure 8.

Figure 12 is a first end elevation view of the particular embodiment of the antenna shown in Figure 8.

Figure 13 is a second end elevation view of the particular embodiment of the antenna shown in Figure 8.

V. MODE(S) FOR CARRYING OUT THE INVENTION

Now generally referring to Figures 1 through 13, which provide illustrative examples of an inventive bolus (1) and a method of using a bolus (1) to monitor one or more physiological parameters (2) of a ruminant animal (3) and a computer implemented animal monitoring system (4). The bolus (1) can be orally administered to reside in the reticulorumen (5) of the ruminant

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 226 of 607

animal (3). As to certain embodiments, the bolus (1) can include a bolus body (6) having an outer most external surface (7) configured to allow oral administration to a ruminant animal (3), with certain embodiments capable of being orally administered immediately after birth. As to certain embodiments, the bolus (1) can include a microcontroller (8) including a processor (9) in communication with a memory element (10) containing a program code (11) including a power management module (12) which allows the bolus (1) to operate in the reticulorumen (5) of the ruminant animal (3) during the entire life span of the ruminant animal from birth to death or from birth to the end of the productive lifespan of the ruminant animal (3).

For the purposes of this invention the term "ruminant animal (3)" means any mammal of the suborder Ruminantia (both wild and domestic) and, without limiting the breadth of the foregoing definition, includes as illustrative examples: cattle, buffalo, goats, sheep, deer, antelope, giraffes, yaks, okapi, chevotain or the like.

For the purposes of this invention the term "birth" means the emergence of the ruminant animal (3) from the body of its mother to begin life as a physically separate ruminant animal (3).

For the purposes of this invention the term "death" means the permanent cessation of vital bodily functions to end life of a ruminant animal (3).

For the purposes of this invention the term "life span" means the period of time between birth and death of a ruminant animal (3).

For the purposes of this invention the term "productive lifespan" means the period of time between birth and the age reached before being culled from production."

For the purposes of this invention the term "reticulorumen (5)" means the first chamber in the alimentary canal of a ruminant animal (3) composed of the rumen and reticulum. The reticulum differs from the rumen with regard to the texture of its lining. The rumen wall is covered in small, finger-like projections called papillae, whereas the reticulum is lined with ridges that form a hexagonal honeycomb pattern. Despite the differences in the texture of the lining of the two parts of the reticulorumen (5), it represents one functional space.

The bolus (1) and the animal monitoring system (4) are described herein in terms of functional block components and various process steps. It should be appreciated that such functional blocks may be realized by any number of hardware or software components configured to perform the specified functions. For example, the bolus (1) and the animal monitoring system (4) may employ various integrated circuit components which function as: memory elements,

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 227 of 607

processing elements, logic elements, look-up tables, or the like, which may carry out a variety of functions under the control of one or more processors or other control devices.

Now referring generally to Figure 2, the bolus (1) can include one or more sensors (13) each capable of generating a sensor signal (14)(whether analog or digital) which varies based on a corresponding change the one or more physiological parameters (2) of a ruminant animal (3). For the purposes of this invention the term "physiological parameter" means a measurable condition of a ruminant animal (3), and without limitation to the breadth of the foregoing, includes one or more of: movement (including one or more of the pitch, yaw, roll, tilt, vibration, jolt, impact or the like), temperature, sound (including one or more of reticulorumen digestive sounds, heartbeat sound, or the like), heart rate, or the like. Each of the one or more sensors (13) can generate a sensor signal (14) (whether analog or digital) which varies based upon occurrence or change in the sensed physiological parameter (2).

As illustrative examples, sensors (13) suitable for use in particular embodiments include: an omnidirectional tilt and vibration sensor (16)(also referred to as an "accelerometer")(PN SQ-SEN-200) distributed by Signal Quest Precision Microsensors; a temperature sensor (17) such as a Betachip Thermistor (PN 1K2OG3) distributed by BetaTHERM Sensors; a microphone (18) distributed by ST Microelectronics (PN MP34DT01); a humidity sensor (PN HCZ-D5) distributed by Ghitron Technology CO., Ltd; an ultra-miniature pressure transducer (PN COQ-062) distributed by Kulite, a proximity sensor (PN PY3-AN-3) distributed by Automation Direct.com., or similar or equivalent sensors. The illustrative examples and description of these sensors (13) are intended to provide a person of ordinary skill in the art sufficient information to make and use embodiments of the bolus including a numerous and wide variety of sensors whether or not specifically enumerated.

The microcontroller (8) includes a processor (9) in communication with the memory element (10) which contains a computer code (11). In part, the computer code (11) can be executed to continuously or intermittently transform the analog or digital sensor signal (14) from the one or more sensors (13) as encoded physiological data (19)(also referred to as "encoded sensor signals"). The encoded physiological data (19) varies based upon change in the sensor signal (14) which correspondingly varies based upon change in the sensed physiological parameter (2). As to particular embodiments, the computer code (11) can be executed to encode or recode from time to time an amount of sensor calibration data (19A) which allows calculation and output of a physiological parameter value (20) of the ruminant animal (3)(whether by the

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 228 of 607

bolus (1) or by operation of a remote computer (82)). The computer code (11) can be further executed to couple animal identification data (83) to the encoded physiological data (19).

The computer code (11) can be further executed to control a radio signal generator (21), for example, an oscillator to generate a stable radio signal (22). An oscillator suitable for use with the invention is available from Freescale Semiconductor, Part No. MC1319x, MC1320x, MC1321x, and MC1322x, and similar or equivalent components. In regard to the particular embodiment of the invention, the radio signal generator (21) can generate a radio signal (22) having a radio signal frequency (23) between about 410MHz and about 1Gz. As one particular embodiment of the invention, the radio signal generator (21) can generate a radio signal frequency (23) of about 433MHz. As to other particular embodiments, the radio signal generator (21) can generate a radio signal (22) having a radio signal frequency (23) of about between about 700 MHz to about 1GHz. The radio signal frequency (23) can be selected from the group including or consisting of: between about 700 MHz to about 800MHz, 750 MHz to about 850MHz, about 800 MHz to about 900MHz, 850 MHz to about 950MHz, 900 MHz to about 1GHz.

The computer code (11) can further function to control a radio frequency stabilizer (24)(shown in the example of Figure 2 as a low pass filter (24A) and a surface acoustic wave filter (24B)) which functions to offset changes in radio signal wave flux caused by changes in temperature or power to the radio signal generator (21). A radio frequency stabilizer (24) suitable for use with embodiments is available from Hope Microelectronics Co., Ltd, Part No. HF433E, RF Monolithics, Inc., Part No. RF1172C, and similar or equivalent parts.

Embodiments of the bolus (1) can further include matching elements (25) which function to match the input impedance of the electrical load or the output impedance of the loads corresponding signal source to maximize the power transfer or minimize signal reflection from the load. In an ideal situation, source impedance and load impedance should be equal to maximize power transfer.

Three elements influence the balance of impedance in radio design: the antenna (28) or "load", the radio signal generator (21) or "source", and the device's ground plane. Since each of these elements have different physical characteristics, their corresponding impedances are inherently different. The passive capacitors (26) and inductors (27) that make up the matching elements (25) of embodiments of the bolus (1) are used to mitigate these differences and rebalance the impedance for a given radio signal frequency (23).

Impedance for an inductor (27) is given by,

$$Z = iwL$$

where L is the inductance and w is angular frequency.

Impedance for a capacitor (26) is given by,

$$Z = \frac{1}{iwC}$$

where C is capacitance.

The reactance is,

$$X = -\frac{1}{wC}$$

The matching elements (25) (also referred to as the "resonant circuit") include an array of inductors (27) and capacitors (26) used in series or in parallel to balance the circuit impedance once the impedance of the antenna (28), the radio signal generator (21), and the ground plane (not shown) are known.

A series resonant circuit (25) has an impedance that is the sum of the impedances of the inductor(s)(27) and capacitor(s)(26),

$$Z = i\omega L + \frac{1}{i\omega C} = i\left(\omega L - \frac{1}{\omega C}\right)$$

The impedance of a Parallel Resonant Circuit is found as follows,

$$Z = i\left(\frac{\omega L}{1 - \omega^2 LC}\right)$$

Resonance in the resonant circuit (25) occurs when the resonant circuit (25) is driven at a frequency $w0$ at which the inductive and capacitive reactances are equal in magnitude. The frequency at which this equality holds for the resonant circuit is called the resonant frequency, and can be determined, as follows,

$$\omega_0 = \frac{1}{\sqrt{LC}}$$

This value can then be converted to hertz,

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 230 of 607

$$f_0 = \frac{\omega_0}{2\pi} = \frac{1}{2\pi\sqrt{LC}}$$

The calculations above can be used to identify the inductors (27) and capacitors (26) used as matching elements (25) in association with the radio signal generator (21) that operates at a specific radio signal frequency (23) to balance the impedance between the radio signal generator (21) and the antenna (28) and limiting the bandwidth to eliminate interference. After the signal passes through the matching elements (25) the resistance of the circuit can be altered to ensure an industry standard 50 ohm resistance in the transmission line to the antenna (28). The resistance of the circuit can be altered by inclusion of resistor (25A) to establish the standard 50 ohm resistance in the circuit.

These calculations, however, apply to a radio frequency generator (21) used in normal atmospheric air (also known as "free air"). Because the radio signal generator (23) included in embodiments of the bolus (1) operate within the mass of a ruminant animal (3), it has been discovered that the center frequency (the arithmetic mean of the lower cutoff frequency and the upper cutoff frequency) is shifted lower and may not have the maximum gain.

Accordingly, there can be a substantial advantage, by selection of the inductors (27) and capacitors (26) as well as their position in the resonant circuit (25) to increase the inductance and capacitance values to purposefully shift the center frequency upward and allowing the radio signal frequency (23) to be re-tuned to a desired radio signal frequency (23) by passing through the mass of the ruminant animal (3).

Embodiments of the bolus (1) further include an antenna (28) which converts electric power into radio signal (22). In transmission, the radio signal generator (21) supplies an electric current oscillating at one of the above described radio signal frequencies (23). In reception, the antenna (28) intercepts some of the power of an electromagnetic wave (29) in order to produce a tiny voltage at its terminals that is applied to a receiver (30). As to particular embodiments, the antenna (28) can, but need not necessarily, be a laid down electrically conductive path on a printed circuit board (31). An advantage of this configuration of antenna (28) can be that it does not require winding upon or interaction with a magnetic field of a magnet to transmit the radio signal (22). Accordingly, this configuration of antenna (28) can produce a lesser amount of interference from a magnetic field of a magnet (69) contained in the bolus (1) resulting a lower incidence of loss of the radio signal (22) or less modulation of the radio signal (22) which results in a greater

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 231 of 607

consistency (or lesser amount of lost data) in transmission of encoded physiological data (19) associated with the ruminant animal (3).

Now referring primarily to Figures 4 through 13, particular embodiments can, but need not necessarily, include an antenna (28) including a first electrically conductive loop (32) electrically interconnected to a second electrically conductive loop (33)(as shown in the example of Figures 6 through 13) electrically connected to the radio signal generator (21) or radio signal receiver (30)(or combined as a radio signal transceiver (21/30)). 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). Typically, the conductive sheet material will be a copper sheet material or a copper layer. As to particular embodiments, the antenna (28) can further include a non-electrically conductive substrate (38) such as a circuit board (31) (as shown in the example of Figure 6) disposed between the pair of electrically conductive loops (32)(33) with one or more vias (39) electrically interconnecting the first and second electrically conductive loops (32)(33) by one or more holes (40) through the non-electrically conductive substrate (38). The one or more holes (40) can be made electrically conductive by electroplating, or by lining the hole with a tube or a rivet thereby electrically interconnecting the pair of electrically conductive loops (32)(33). There can be substantial advantages in structuring the antenna (28) as above described and as shown in Figures 4 through 13. First, the structure increases the cross-section width of the antenna (28) which increases the stability of the radiated electrical field (41) of the antenna (28). Second, the structure increases the bandwidth of the antenna (28) allowing shift in radio signal frequency (23) or attenuation resulting from passing through the mass of the ruminant animal (3) to be more readily counteracted. Third, the structure alters the magnetic field and electrical field generation which reduces the impact of uncontrollable changes in the orientation of the bolus (1) and correspondingly the orientation of the antenna (28) in the reticulorumen (5) of the ruminant animal (3).

Again referring primarily to Figures 2, 4 and 5, embodiments of the bolus (3) further include a power source (46)(and associated power regulator (46A)) which supplies and adjusts energy (42)(electrical power) to the bolus (1). The power source (46) shown in Figures 2, 4 and 5 can take the form of a battery such as a AA battery, a AAA battery, or the like. The power source (42) provides power to the electronic components supported on the printed circuit board (31) including for example: the microcontroller (8), radio frequency generator (21) and one or more sensors (13). Because the power source (46) of a bolus (1) disposed in the reticulorumen

(5) of the ruminant animal (3) cannot be recharged, the operational lifespan of bolus (1) will depend upon capacity of the power source (46) in ampere-hours (Ah) and the load current of the circuit. Power source (46) life will be longer as the load current is reduced and vice versa. The calculation to find out the capacity of power source (46) in the form of a battery can be mathematically derived from the following formula:

Battery Life = Battery Capacity in amps per hour / load current in amps x 0.70

As to particular embodiments of the bolus (1), the computer code (11) can include a power management module (12) which functions to regulate energy use by the bolus (1) to extend the operational life of the bolus (1) disposed in the reticulorumen (5) of the ruminant animal (3). Embodiments of the bolus (1), including particular embodiments the power management module (12), can be operational within the reticulorumen (5) of the ruminant animal (3) for greater than three years and up to about ten years, a period of time substantially greater than that of conventional bolus.

As one illustrative example, embodiments of the inventive bolus (1) can be orally administered to a calf at, or immediately after birth, and remain operational over the entire productive lifespan (53) of the dairy cow, on average about 2.4 lactations, or about five to six years.

As another illustrative example, a ewe typically has a productive lifespan (53) of between about five years to about seven years of age. A ewe's productivity usually peaks between 3 and 6 years of age and begins to decline after the age of seven. As a result, most ewes are removed from a flock before they would reach their natural life expectancy. Accordingly, embodiments of the bolus (1) disposed in the reticulorumen (5) of the ewe at birth can be operational throughout the entire productive lifetime (53) of the ewe.

As to particular embodiments of the bolus (1), the power management module (12), can but need not necessarily include, an activation element (43) which functions to enable and encode the sensor signal(s)(14) from one or more sensors (13) and can further function to compare the one or more encoded sensor signals (19) against one or more preselected activation code(s)(44). If by comparison of the encoded sensor signal(s)(19) against the preselected activation code(s)(44), a pre-selected activation match threshold (45) is met, the activation element (43) can further function to cause activation of the bolus (1) for normal operation. This provides the advantage of avoiding inadvertent or premature activation of the bolus (1) and the corresponding unnecessary expenditure of energy (42) from the power source (46).

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 233 of 607

As one illustrative example of the function of the activation element (43), the bolus (1) can include a first sensor (13A) which can be an accelerometer (16). Accelerometers (16) in accordance with embodiments of the invention can sense the movement of the bolus (1)(whether within or without the ruminant animal), in a manner similar to accelerometers (16) used in tablet computers and digital cameras, such that images on display screens are always displayed upright, or as used in drones for flight stabilization. The accelerometer (16) can be enabled by the function of the activation element (43), and the activation element (43) can further function to encode the first sensor signal (14A) from the accelerometer (16) and compare the first encoded sensor signal (19A) against a first preselected activation code (44A). The first preselected activation code (44A), in the context of this illustrative embodiment, can correspond to a particular pre-activation movement (47) of the bolus (1) which can, but need not necessarily be, three serial reciprocal linear movements of the bolus (1) each terminating in an impact of the bolus (1) within a period of time of between about five seconds and ten seconds (also referred as "three bumps"). If the pre-activation movement (47) of the bolus (1) including "three bumps" meets the first pre-selected activation match threshold (45A) relating to the first preselected activation code (44A) corresponding to "three bumps" the activation element (43) can cause the bolus (1) to be activated for normal monitoring of the ruminant animal (3). As to particular embodiments, the bolus (1) can, but need not necessarily, include an illumination element (48), such as a light emitting diode (49). The illumination element (48) can be switched on by operation of the activation element (43) to provide an amount of light (50) as an indicator that the bolus (1) has been activated and can be orally administered to a ruminant animal (3).

As to particular embodiments, the bolus (1) can, but need not necessarily, include a second sensor (13B) which can be a temperature sensor (17)(also referred to as a "thermistor"). Thermistors (17) in accordance with embodiments of the invention can sense the temperature (57) of the bolus (1)(whether within or without of the ruminant animal) in a useful range of temperature and accuracy depending upon the ruminant animal (3) into which the bolus (1) is to be orally administered and the determinations to be made from the sensed temperature (57). For example, the useful temperature range in dairy cow will be between about 95°F (about 35°C) to about 115°F (about 46°C) with an accuracy of between about 0.1°C and about 0.3°C. The normal temperature of an adult cow will typically be about 101.5°F (about 38.5°C), but can vary throughout the estrous cycle with the lowest temperature being just before heat and highest temperature on the day of heat or due to being in milk, and a temperature of about 103.0°F (about 39.4°C) to about 104.0°F (about 40°C) and upward to about 108°F (about 42.2°C), typically indicative of a sick cow. However, this illustrative example is not intended to preclude the use

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 234 of 607

of thermistors (17) which may sense a wider temperature range, as one illustrative example, about -40°C to about +125°C, as long as the accuracy is not less than about 0.1°C to about 0.2°C of the actual temperature about the bolus (1) and the time constant to change from one temperature value to another temperature value is sufficiently short to support the sampling rate of the sensor signal (14) effected by the computer code (11) in regard to the thermistor (17). For example, thermistors (17) utilized with embodiments of the bolus (1) may have a time constant of about one minute or less and while the sampling rate may be once every 10 minutes to 20 minutes or longer depending upon the application.

As to particular embodiments, the activation element (43) having activated the bolus (1)(and as to particular embodiments, switched on the light illumination element (48)) can, but need not necessarily, further enable and encode a second sensor signal (14B) from a second sensor (13B) which can be a thermistor (17). The activation element (43) can further function to encode the second sensor signal (14B) from the second sensor (13B) such as thermistor (17) and compare the second encoded sensor signal (19B) against the second preselected activation code (44B). The second preselected activation code (44B), in the context of this illustrative embodiment, can correspond to a pre-activation temperature (51) of the bolus (3) which can, but need not necessarily be, three serial temperature reads of the bolus (1) each about 15 minutes apart within a period of time of about 45 minutes (also referred to as "three temperature reads"). If the pre-activation temperature (51) of the bolus (1) including "three temperature reads" meets the second pre-selected activation match threshold (45B) for the second preselected activation code (44B) corresponding to "three temperature reads" the activation element (43) can cause the bolus (1) to be activated for normal monitoring of a ruminant animal (3). In the illustrative example of a bolus (1) used in calves or cows, if the three temperature reads are between about 100°F (about 37.8°C) and about 105°F (about 40.6°C), this would be indicative that the bolus (1) resides in the reticulorumen (5) of a calf or cow, and the activation element (43) can then function to cause the bolus (1) to be activated for normal monitoring of the ruminant animal (3). This provides the advantage of avoiding inadvertent or premature activation of the bolus (1) and the corresponding unnecessary expenditure of energy (42).

As to particular embodiments, the power management module (12) can, but need not necessarily, further function to reconfigure the mode of operation of the bolus (1) or allow the mode of operation of the bolus (1) to be reconfigured while residing in the reticulorumen (5) of the ruminant animal (3) to regulate energy (42) use by the bolus (1) which can have the advantage of extending the operational life of the bolus (1).

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 235 of 607

As to particular embodiments, the power management module (12) can regulate energy (42) use by the bolus (1) by enabling or disabling one or more sensors (13) based upon a pre-determined set of physiological parameters (2) to be sensed during one or more stages (52) in a lifespan (53) of the ruminant animal (3). The encoded physiological data (19) useful in make determinations relating to a ruminant animal (3) may be different in a first stage (54) in the lifespan (53)(for example, the time period between birth and puberty) as compared to a second stage (55)(for example, the time period commencing with puberty until the end of reproductive age (or useful reproductive age))(as shown in the example of Figure 1). As one illustrative example in dairy cows, from the birth until puberty in dairy cows at about eight months to about seventeen months age depending upon the breed, the useful encoded physiological data (19) may only include encoded physiological data (19) relating to temperature (57). Accordingly, in a first stage (54) of the ruminant animal (3) lifespan (53) the power management module (12) can function upon activation of the bolus (1), as above described, to only enable and periodically read the sensor signal (14A) and generate encoded physiological data (19) for temperature (57) of the ruminant animal (3). Additionally, because the encoded physiological data (19) for temperature (57) may only be used to determine whether the ruminant animal (3) is sick, there may be a substantial period of time between reads of the temperature sensor signal (14), such as, once in a twenty four hour period. Similarly, there may be a substantial period of time between operational periods of the radio signal generator (22), such as twenty four hours, and the operational period of the radio signal generator (22) may be very short, such as, a few milliseconds (also referred to as a "transmission burst (56)"). Because the majority of energy (42) used by the bolus (1) is in operation of the radio signal generator (21), increasing the time period between transmission bursts (56) and limiting the duration of the transmission burst (56) only to that period of time necessary to transmit the limited amount of encoded physiological data (19) can substantially increase the operating lifespan of the bolus (1).

By comparison, in second stage (55) of the lifespan (53) of a ruminant animal (3) from puberty to the end of reproductive age of the ruminant animal (3), the useful encoded physiological data (19) may include both encoded physiological data (19) for temperature (57) and encoded physiological data (19) for movement (58). As above explained, the temperature (57) of ruminant animal (3) may vary throughout the estrous cycle with the lowest temperature being just before heat and highest temperature on the day of heat. Additionally, the activity of the cow can measurably change prior to or concurrent with heat.

Accordingly, as to particular embodiments, the power management module (12) can further include a timer element (59) which functions to assess elapsed time from activation of the

bolus (1) allowing regulation of energy use by the bolus (1) based on elapsed time which can be coordinated to one or more of the stages (52) in the lifespan (53) of the ruminant animal (3). As one illustrative example, if the bolus (1) is orally administered at birth the timer element (59) and the power management module (12) can function to enable a first sensor (13A)(or first set of sensors (13) providing useful encoded physiological data (19) during the first stage (54)) and encode physiological data (19) for temperature (57)(or first set of physiological parameters) for a period of time corresponding the first stage (54) of the lifespan (53) of the ruminant animal (3)(for example, between birth and puberty) and then function to further enable a second sensor (13B)(or second set of sensors (13) providing useful encoded physiological data (19) during a second stage (55) of the ruminant animal (3)) and encode physiological data (19) for both temperature (57) and movement (58).

Additionally, because the encoded physiological data (19) for movement (58) and temperature (57) may be used to determine whether the ruminant animal (3) is in estrus, the power management module (12) can function to reduce the period of time between reads of the sensor signal (14) temperature (57) and the sensor signal (14) for movement (58), such as, four times in a twenty four hour period. Similarly, there may be a lesser period of time between operational periods of the radio signal generator (21), such as every six hours, and the operational period of the radio signal generator (14) may be adjusted to a period of time to transmit the additional encoded physiological data (19).

As to particular embodiments, once the ruminant animal (3) becomes pregnant and during the pregnancy, the power management module (12) can further function to reconfigure the operation of the bolus (1) to disable the sensor (13) for movement (58) and read only the sensor (13) for temperature (57) and transmit encoded physiological data (19) at less frequent intervals.

As to particular embodiments, the program code (11) can be reprogrammed while the bolus (1) resides in the reticulorumen (5) of the ruminant animal (3) by receiving programming data (60) to reconfigure the power management module (12) to regulate energy (42) use by the bolus (1), as above described.

As to particular embodiments, the power management module (12) can, but need not necessarily, include a power sensor element (61) executable to determine the remaining amount of energy (42) in the power source (46). The power management module (12) can be further executed to determine the amount of energy (42) required to power the bolus (1) through a pre-determined period of time (62) based on the then existing program code (11) contained in the memory element (10) of the bolus (1). The power management module (12) can be further

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 237 of 607

executed to compare the remaining amount of energy (42) in the power source (46) with the amount of energy (42) required to power the bolus (1) through the pre-determined period of time (62) based on the then existing program code (11) to determine the difference in the amount of energy (42) remaining in the power source (46) and the amount of energy (42) required to power the bolus (1) through the pre-determined period of time (62). The power management module (12) can be further executed to perform one or more power regulation events (63) to make up the difference in the amount of energy (42) to allow operation of the bolus (1) through the pre-determined period of time (62). The power regulation events (63) can include or consist of one or more of: switching off the light illumination element (48), increasing the interval of time between operation of the radio signal generator (21), decreasing the operational time period of the radio signal generator (21), disabling one or more of the plurality of sensors (13), interrupt encoding of the sensor signal (14) from one or more of said plurality of sensors (13), or other re-programming that reduces energy (42) use.

As to particular embodiments, the power management module (12) can be pre-programmed to perform one or more of the power regulation events (63) in one or more pre-programmed priority orders based upon the magnitude of the difference in the amount of energy (42) remaining in the energy source (46) and the required amount of energy (42) to power the bolus through the remaining portion of a pre-programmed or re-programmed life cycle. Alternately, the power management module (12) can function to encode and transmit as part of a transmission burst (56) encoded power source data (64) from which the remaining amount of energy (42) in the energy source (46) can be calculated using a remote specialized computer (82) and the power management module (12) can be re-programmed to execute one more power regulation events (63) based on a priority order encoded in the programming data (60) received by the bolus (1).

Now referring primarily to Figures 4 and 5, embodiments of the bolus (1) which are orally administered to a ruminant animal (3) can, but need not necessarily, include an inert bolus body (6) having external dimensional relations adapted to allow oral administration and retention of the bolus (1) in the reticulorumen (5) of a ruminant animal (3). As one non-limiting example, the inert bolus body (6) can include an amount of plastic resin (65) cast about the animal monitoring assembly (66) ("AMA"), including one or more of the components above-described. The amount of plastic resin (65) can be, as an example, a plastic resin such as urethane resin, epoxy resin, polyester resin, or the like used in accordance with the manufacturer's instructions. As to other embodiments, the inert bolus body (6) can comprise a sealable housing (67) defining a hollow inside space (68) which receives the AMA (66). As to other embodiments, the sealable housing

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 238 of 607

(67) including the AMA (66) received in the hollow space (68)(and as to particular embodiments further including one or more magnets (69) received in the hollow space (68)) can have the amount of plastic resin (65) cast about the AMA (66) (and one or more magnets (69)) located inside said sealable housing (67).

Again referring primarily to Figure 4, configurations of the inventive bolus (1) suitable for oral administration to a ruminant animal (3) can have a generally cylindrical configuration with a diameter (77) in orthogonal cross section in the range of about one-half inch (about 13 millimeters ("mm")) to about one and one quarter inch (about 32 mm) and having a bolus length (70) disposed between a first bolus end (71) and a second bolus end (72) in the range of about two inches (about 50 mm) and about five inches (about 127 mm). Particular embodiments of the bolus (1) can have a length of about four inches (about 102 mm) and a diameter (77) in orthogonal cross section of about one inch (about 25 mm). While the example of Figure 4 shows the bolus (1) including a housing (67) having matable halves (73)(74) with an outer most external surface (7) configured as a cylinder; the bolus (1) can have numerous and varied outer most external surface (7) configurations capable of oral administration and retention within the reticulorumen (5) of a ruminant animal (3). The inert bolus body (6) can be molded, cast, or machined from biocompatible (or biologically inert) non-magnetic materials which allow transmission of the radio signal (22) from within the bolus (1) to outside of the ruminant animal (3). As examples, the inert bolus body (6) can be made from plastics such as nylon, fluorocarbon, polypropylene, polycarbonate, urethane, epoxy, polyethylene, or the like; or metals such as stainless steel; or other materials such as glass can be utilized. The bolus (1) having a hollow inside space (68) can be generated by a wide variety of procedures such as molding, casting, fabrication or the like. As one non-limiting example, a cylindrical tube having an external diameter and an internal diameter, as above described, can be divided into sections of suitable length to which end caps can be fitted. Alternately, a bore can be made in a cylindrical solid rod having an external diameter, as above described, to provide a closed end tube with the bore having sufficient dimension to provide the hollow inside space (68).

As to particular embodiments, the inert bolus body (1) can, but need not necessarily, include a translucent or transparent element (75) to allow viewing of the amount of light (50) generated by the illumination element (48) as a viewable indicator that the bolus is activated as above described. The translucent or transparent element (75) can include a portion or the entirety of the housing (67) of the inert bolus body (6).

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 239 of 607

As to particular embodiments of the bolus (1), the inert bolus body (1) can be configured for oral administration to ruminant animals (3) at birth. The digestive track between the mouth (76) and the reticulorumen (5) of a ruminant animal (3) at birth can have comparatively restrictive dimensions as compared to adult ruminant animals (3). Therefore, conventionally configured bolus (1) may not be orally administered to ruminant animals (3) at birth or when orally administered may cause injury or be regurgitated as the digestive track between the mouth (76) and the reticulorumen (5) enlarges due to growth of the ruminant animal (3).

The configuration of outer most external surface (7) of the housing (67) of the inert bolus body (6) or the bolus density (78), or combinations thereof, can be critical when a bolus (1) is orally administered to a ruminant animal (3) at birth. It has been discovered that while the bolus length (70) between the first and second bolus ends (71)(72) can be more variable bolus (1), it can be critical that the greatest bolus diameter (77) (or width) of the outer most external surface (7) along the length (70) between the pair of bolus ends (71)(72) should be between one half inch (about 13 mm) and not exceed three quarters of an inch (about 19 millimeters). The configuration of the outer most external surface (7) of the bolus (1) can have a bolus width (77) selected from the group including or consisting of: about 13 mm to about 15 mm, about 14 mm to about 16 mm, about 15 mm to about 17 mm, about 16 mm to about 18 mm, and about 17 mm to about 19mm.

As one illustrative example, a bolus (1) configured for oral administration to ruminant animals (3) at birth can have an outer most external surface (7) of the bolus body (6) having cylindrical configuration as shown in the example of Figure 4. The bolus length (70) can vary between about three inches (about 76 mm) and about six inches (about 152 mm) between the a pair of bolus ends (71)(72); however, the outer most external surface (7) at any cross section orthogonal to the bolus length (70) should not exceed about 19 millimeters. As a second illustrative example, the bolus body can be substantially spherical having an external diameter not exceeding about three quarters of an inch (about 19 mm).

Embodiments of the inventive bolus (1) can, but need not necessarily, have a bolus density (78) of between about 2.1 grams per cubic centimeter ("g/cm^3") to about 3.3 g/cm^3. However, there can be substantial advantages in configuring the bolus (1) to achieve a bolus density (78) in the range of between about 2.1 g/cm^3 to about 3.3 g/cm^3 in that the bolus (1) is substantially less likely to be regurgitated or ejected from reticulorumen (5) of a ruminant animal (1) as compared to conventional bolus. It can be critical to achieve a bolus density (78) of between about 2.1 g/cm^3 to about 3.3 g/cm^3 when dimensions of the outer most external surface (7) are reduced for

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 240 of 607

oral administration to ruminant animals (3) at birth or the bolus (1) resides in the reticulorumen (5) of the ruminant animal (1) for the entire lifespan (53) of the ruminant animal (3). Within the range of bolus density (78), the bolus density can be selected from the group including or consisting of: about 2.3 g/cm^3 to about 2.5 g/cm^3, about 2.4 g/cm^3 to about 2.6 g/cm^3, about 2. g/cm^3 to about 2.7 g/cm^3, about 2.6 g/cm^3 to about 2.8 g/cm^3, about 2.7 grams g/cm^3 to about 2.9 g/cm^3; about 2.8 g/cm^3 to about 3.0 g/cm^3, about 2.9 g/cm^3 to about 3. g/cm^3; about 3.0 g/cm^3 to about 3.2 g/cm^3, and about 3.1 g/cm^3 to about 3.3 g/cm^3.

Now referring primarily to Figure 3, the animal monitoring system (4) can, but need not necessarily, include one or more radio signal reader(s)(79) can be located to receive the radio signal (22) carrying the encoded physiological data (19) from one or more bolus (1). As to particular embodiments, the one or more radio signal readers (79)("RSR") can further operate to assemble the encoded physiological data (19) into one or more data packets (80) which can be transmitted and received by a wired or wireless reception device (81)(which can be integrated into a specialized computer (82)). The reception device (81) can transfer the data packets (80) to a specialized computer (82). The specialized computer (82) can operate to transform the encoded animal identification data (83) and encoded physiological data (19) to output an animal identification value (84)(an alpha or numeric or other animal identifier) and to output physiological parameter values (85)(an alpha or numeric or other symbols). A computer user (86) can access the animal identification value (84) and the physiological parameter values (85) by use of the specialized computer (82).

Now referring generally to Figure 3, the specialized computer (82) is described herein in terms of functional block components, screen shots, and various process steps. It should be appreciated that such functional blocks may be realized by any number of hardware or software components configured to perform the specified functions.

Similarly, the software elements of the present invention may be implemented with any programming or scripting language such as C, C++, Java, COBOL, assembler, PERL, Labview or any graphical user interface programming language, extensible markup language (XML), Microsoft's Visual Studio .NET, Visual Basic, or the like, with the various algorithms or Boolean Logic being implemented with any combination of data structures, objects, processes, routines or other programming elements. Further, it should be noted that the present invention might employ any number of conventional wired or wireless techniques for data transmission, signaling, data processing, network control, and the like

It should be appreciated that the particular computer implementations shown and

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 241 of 607

described herein are illustrative of the invention and its best mode and are not intended to otherwise limit the scope of the present invention in any way. Indeed, for the sake of brevity, conventional data networking, application development and other functional aspects of the systems (and components of the individual operating components of the systems) may not be described in detail herein. Furthermore, the connecting lines shown in the various figures contained herein are intended to represent exemplary functional relationships and/or physical couplings between the various elements. It should be noted that many alternative or additional functional relationships or physical connections may be present in a computer implemented animal monitoring system (4).

As will be appreciated by one of ordinary skill in the art, the present invention may be embodied in the alternative as a method, a data processing system, a device for data processing, a computer program product, or the like. Accordingly, the present invention may take the form of an entirely software embodiment, an entirely hardware embodiment, or an embodiment combining aspects of both software and hardware. Furthermore, the present invention may take the form of a computer program product on a computer-readable storage medium having computer-readable program code means embodied in the storage medium. Any suitable computer-readable storage medium may be utilized, including hard disks, CD-ROM, optical storage devices, magnetic storage devices, ROM, flash RAM, or the like.

It will be understood that each functional block of the block diagrams and the flowchart illustrations, and combinations of functional blocks in the block diagrams and flowchart illustrations, respectively, can be implemented by computer program instructions. These computer program instructions may be loaded onto a general purpose computer, special purpose computer or other programmable data processing apparatus to produce a machine, such that the instructions which execute on the computer or other programmable data processing apparatus for implementing the functions specified in the flowchart block or blocks.

These computer program instructions may also be stored in a computer-readable memory that can direct a computer or other programmable data processing apparatus to function in a particular manner, such that the instructions stored in the computer-readable memory produce an article of manufacture including instruction means which implement the function specified in the flowchart block or blocks. The computer program instructions may also be loaded onto a computer or other programmable data processing apparatus to cause a series of operational steps to be performed on the computer or other programmable apparatus to produce a computer-implemented process such that the instructions which execute on the computer or other

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 242 of 607

programmable apparatus provide steps for implementing the functions specified in the flowchart block or blocks.

Accordingly, functional blocks of the block diagrams and flowchart illustrations support combinations of elements for performing the specified functions, combinations of steps for performing the specified functions, and program instruction means for performing the specified functions. It will also be understood that each functional block of the block diagrams and flowchart illustrations, and combinations of functional blocks in the block diagrams and flowchart illustrations, can be implemented by either special purpose hardware based computer systems which perform the specified functions or steps, or suitable combinations of special purpose hardware and computer instructions.

Again referring to Figure 3, the computer implemented animal monitoring system (4) can include a specialized computer (82) for receiving, processing and transforming a radio signal (22) from a reception device (81) carrying animal identification data (83) and animal physiological parameter data (19) to generate animal identification values (84) and physiological parameter values (85) accessible by the computer user (86). The specialized computer (82) can include at least one processing unit (87), a memory unit (88), and a bus (89) which operably couples components of the computer (82), including, without limitation the memory unit (88) to the processing unit (87). The computer (82) may be a conventional computer, a distributed computer, or any other type of computer which may contain all or a part of the elements described or shown to accomplish the functions described herein; the invention is not so limited. The processing unit (87) can comprise without limitation one central-processing unit (CPU), or a plurality of processing units which operate in parallel to process digital information, or a digital signal processor (DSP) plus a host processor, or the like. The bus (89) can be without limitation any of several types of bus configurations such as a memory bus or memory controller, a peripheral bus, and a local bus using any of a variety of bus architectures. The memory element (88) can without limitation be a read only memory (ROM)(90) or a random access memory (RAM)(91), or both. A basic input/output system (BIOS)(92) containing routines that assist transfer of data between the components of the specialized computer (82), for example during start-up, can be stored in ROM (90). The computer (82) can further include a hard disk drive (93) for reading from and writing to a hard disk (94), a magnetic disk drive (95) for reading from or writing to a removable magnetic disk (96), and an optical disk drive (97) for reading from or writing to a removable optical disk (98) such as a CD ROM or other optical media.

The hard disk drive (93), magnetic disk drive (95), and optical disk drive (97) and the

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 243 of 607

reception device (81) can be connected to the bus (89) by a hard disk drive interface (99), a magnetic disk drive interface (100), and an optical disk drive interface (101), and a radio signal reception device interface (102), respectively. The drives and their associated computer-readable media provide nonvolatile storage of computer-readable instructions, data structures, program modules and other data for the computer (82). It can be appreciated by those skilled in the art that any type of computer-readable media that can store data that is accessible by a computer, such as magnetic cassettes, flash memory cards, digital video disks, Bernoulli cartridges, random access memories (RAMs), read only memories (ROMs), RFID devices or the like, may be used in the exemplary operating environment.

The computer (82) can further include an operating system (103) and an animal monitoring program (104)("AMP") which as to particular embodiments of the invention can include an animal monitoring assembly encoder-decoder module (105) ("AMA encoder-decoder") for programming the animal monitoring assembly (AMA)(66) with animal identification data (83). As to particular embodiments, programming of the AMA (66) can be accomplished using an animal monitoring assembly programmer (106) connected to the bus (89) by an AMA interface (107). The AMA encoder-decoder module (105) can be stored on or in the hard disk (94), magnetic disk (96), optical disk (98), ROM (90), in RAM (91) of the specialized computer (82) or alternately the functionalities of the AMA encoder-decoder module (105) may be implemented as an application specific integrated chip (ASIC) or file programmable gate array (FPGA), or the like.

As to particular embodiments, the specialized computer (82) can be further configured to generate programming data (60) based on computer user (86) interaction the AMP (104) which can be received by the RSR (79) over a local area network (108) over a wide area network (109). The RSR (79) can generate a second radio signal (110) to carry the programming data (60) to the radio signal receiver (30) contained in the AMA (66). The second radio signal (110) can be processed by the microcontroller (8) to reprogram the program code (11) and particularly the power management module (12) to correspondingly alter the operation of the AMA (66), regardless as to whether the bolus (1) containing the AMA (66) has a location outside of the ruminant animal (3) or has a location inside of the ruminant animal (3).

The computer user (86) can enter commands and information into the computer (82) through input devices such as a keyboard (111) and a pointing device (112) such as a mouse. Other input devices (not shown) may include for example: touch on a touch screen, a microphone, joystick, game pad, satellite dish, scanner, magnetic strip of a card, or the like. These and other

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 244 of 607

input devices are often connected to the processing unit (87) through a serial port interface (113) that can be coupled to the bus (89), but may be connected by other interfaces, such as a parallel port, game port, or a universal serial bus (USB). A monitor (114) or other type of display device can also be connected to the bus (89) via interfaces such as a video adapter (115), or the like. In addition to the monitor (114), the computer (82) can further include peripheral output devices (116), such as speakers and printers.

The computer (82) may operate in a networked environment using logical connections to one or a plurality of remote second computers (117). These logical connections can be achieved by a communication device (118) coupled to or a part of the computer (82). Each of the plurality of remote second computers (117) can include a part or all of the elements as included in the specialized computer (82) although only a single box has been illustrated in Figure 3 for the remote second computer (117).

When used in a LAN (108) networking environment, the computer (82) can be connected to the LAN (108) through a network interface (119). When used in a WAN (109)-networking environment, the computer (92) typically includes a modem (120), or other type of communications device, for establishing communications over the WAN (109), such as the Internet. The modem (120), which may be internal or external to the specialized computer (82), can be connected to the bus (89) via the serial port interface (113). In a networked environment, the AMP (104), or portions thereof, may be stored in any one or more of the plurality of remote second computers (117). It is appreciated that the logical connections shown are exemplary and other hardware elements and communications elements can be utilized for establishing a communications link between the specialized computer (82) and one or more of the a plurality of remote second computers (117).

While the computer elements and the network elements shown in Figure 3 can be utilized to practice the invention including the best mode, it is not intended that the description of the best mode of the invention or any preferred embodiment of the invention be limiting with respect to the utilization of a wide variety of similar, different, or equivalent computer elements or network elements to practice embodiments of the invention which include without limitation hand-held devices, such as personal digital assistants or camera/cell phone, tablet or slate computers, multiprocessor systems, microprocessor-based or programmable consumer electronics, network PCs, minicomputers, mainframe computers, PLCs, or the like.

Now referring primarily to Figures 1 and 3, the RSR (79) can receive the first radio signal (22) from the AMA (66) inside the bolus (1) whether inside or outside of the reticulorumen (5)

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 245 of 607

of the ruminant animal (3). The AMA (66) within the bolus (1) can send encoded animal identification data (83) and the encoded physiological data (19) using the first radio signal (22), as above described.

One illustrative embodiment of the RSR (79) as shown in Figures 1 and 3, provides a reader microcontroller (121) which includes a reader processor (122) which controls the functions of a variety of reader processor elements (123) stored in a reader memory element (124) each of which provides a response to events related to receiving the first radio signal (22) from the AMA (66) within the bolus (1) carrying encoded animal identification data (83) and encoded physiological data (19), or receiving reader sensor signals (125) from reader sensors (126) which monitor environmental parameters proximate the RSR (79) such as ambient temperature (127); or generating data packets (80) which include all or parts of such information, or sending data packets (80) to the computer (82) or a remote second computer (117) for access by a computer user (86). A reader microcontroller (121) suitable for use with embodiments of the RSR (79) can be obtained from Microchip Technology. Inc., 2355 West Chandler Blvd., Chandler, Arizona, Part No. PIC18F4620-I/PT, or similar or equivalent components can be suitable as a reader microcontroller (121) programmable to perform the above-described functions of the RSR (79).

Again referring primarily to Figure 3, a reader antenna (128) can receive encoded animal identification data (83) and encoded physiological data (19) and other information generated by operation of the AMA (66) within the bolus (1) within or without of the ruminant animal (3). The reader antenna (128) can be tuned to the first radio signal (22) generated by the AMA (66).

Again referring primarily to Figure 3, the reader sensor (126) can be located to sense the ambient temperature (127) surrounding the RSR (79). The reader sensor (126) can take the form of a thermistor. A suitable thermistor for use in embodiments of the RSR (79) is available from Microchip Technology, Inc., 2355 West Chandler Blvd., Chandler, Arizona, Part No. MCP98242, and similar and equivalent parts.

The reader sensor (126) can be operated under the control of a second reader processor (129) which functions to regulate power to the reader sensor (126) and converts the reader sensor signal (125) into a digital representation of the ambient temperature (127). The second reader processor (129) can further function to encode or re-encode from time to time an amount of reader temperature calibration data (130) which allows calculation and output of an ambient temperature value (131).

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 246 of 607

Again referring primarily to Figure 3, a reader clock element (132) can operate under the control of a third reader processor element (133) to generate a date and time signal (134) that represents a date and time value (135).

Again referring primarily to Figure 3, a fourth reader processor element (136) can function to assemble data packets (80) which as an example can include a representation of the ambient temperature value (141) and the date and time value (135) at which the information from the AMA (66) was received by the RSR (79). The assembled data packet (80) can be stored and retrieved from the reader memory element (124) under the control of the fourth reader processor element (136).

Again referring primarily to Figure 3, a fifth reader processor element (137) can function to provide an ether net interface (138) for an ether net controller (139) to receive instructions or requests from the computer (82)(or remote computer (117). The fifth reader processor (137) can further function to operate a second radio signal generator (140) and transmit the second radio signal (110) to reprogram the computer code (11) or the power management module (12) of the AMA (66) within the bolus (1). The fifth reader processor element (137) can further function to send the data packets (80) to the ether net controller (139) for transmission to the computer (82).

As can be easily understood from the foregoing, the basic concepts of the present invention may be embodied in a variety of ways. The invention involves numerous and varied embodiments of a reciprocally telescoping door stop and methods for making and using such door stops including the best mode.

As such, the particular embodiments or elements of the invention disclosed by the description or shown in the figures or tables accompanying this application are not intended to be limiting, but rather exemplary of the numerous and varied embodiments generically encompassed by the invention or equivalents encompassed with respect to any particular element thereof. In addition, the specific description of a single embodiment or element of the invention may not explicitly describe all embodiments or elements possible; many alternatives are implicitly disclosed by the description and figures.

It should be understood that each element of an apparatus or each step of a method may be described by an apparatus term or method term. Such terms can be substituted where desired to make explicit the implicitly broad coverage to which this invention is entitled. As but one example, it should be understood that all steps of a method may be disclosed as an action, a means for taking that action, or as an element which causes that action. Similarly, each element of an

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 247 of 607

apparatus may be disclosed as the physical element or the action which that physical element facilitates. As but one example, the disclosure of a "generator" should be understood to encompass disclosure of the act of "generating" -- whether explicitly discussed or not -- and, conversely, were there effectively disclosure of the act of "generating", such a disclosure should be understood to encompass disclosure of a "generator" and even a "means for generating." Such alternative terms for each element or step are to be understood to be explicitly included in the description.

In addition, as to each term used it should be understood that unless its utilization in this application is inconsistent with such interpretation, common dictionary definitions should be understood to be included in the description for each term as contained in the Random House Webster's Unabridged Dictionary, second edition, each definition hereby incorporated by reference.

All numeric values herein are assumed to be modified by the term "about", whether or not explicitly indicated. For the purposes of the present invention, ranges may be expressed as from "about" one particular value to "about" another particular value. When such a range is expressed, another embodiment includes from the one particular value to the other particular value. The recitation of numerical ranges by endpoints includes all the numeric values subsumed within that range. A numerical range of one to five includes for example the numeric values 1, 1.5, 2, 2.75, 3, 3.80, 4, 5, and so forth. It will be further understood that the endpoints of each of the ranges are significant both in relation to the other endpoint, and independently of the other endpoint. When a value is expressed as an approximation by use of the antecedent "about," it will be understood that the particular value forms another embodiment. The term "about" generally refers to a range of numeric values that one of skill in the art would consider equivalent to the recited numeric value or having the same function or result. Similarly, the antecedent "substantially" means largely, but not wholly, the same form, manner or degree and the particular element will have a range of configurations as a person of ordinary skill in the art would consider as having the same function or result. When a particular element is expressed as an approximation by use of the antecedent "substantially," it will be understood that the particular element forms another embodiment.

Moreover, for the purposes of the present invention, the term "a" or "an" entity refers to one or more of that entity unless otherwise limited. As such, the terms "a" or "an", "one or more" and "at least one" can be used interchangeably herein.

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 248 of 607

Thus, the applicant(s) should be understood to claim at least: i) each of the bolus or animal monitoring systems herein disclosed and described, ii) the related methods disclosed and described, iii) similar, equivalent, and even implicit variations of each of these devices and methods, iv) those alternative embodiments which accomplish each of the functions shown, disclosed, or described, v) those alternative designs and methods which accomplish each of the functions shown as are implicit to accomplish that which is disclosed and described, vi) each feature, component, and step shown as separate and independent inventions, vii) the applications enhanced by the various systems or components disclosed, viii) the resulting products produced by such systems or components, ix) methods and apparatuses substantially as described hereinbefore and with reference to any of the accompanying examples, x) the various combinations and permutations of each of the previous elements disclosed.

The background section of this patent application provides a statement of the field of endeavor to which the invention pertains. This section may also incorporate or contain paraphrasing of certain United States patents, patent applications, publications, or subject matter of the claimed invention useful in relating information, problems, or concerns about the state of technology to which the invention is drawn toward. It is not intended that any United States patent, patent application, publication, statement or other information cited or incorporated herein be interpreted, construed or deemed to be admitted as prior art with respect to the invention.

The claims set forth in this specification, if any, are hereby incorporated by reference as part of this description of the invention, and the applicant expressly reserves the right to use all of or a portion of such incorporated content of such claims as additional description to support any of or all of the claims or any element or component thereof, and the applicant further expressly reserves the right to move any portion of or all of the incorporated content of such claims or any element or component thereof from the description into the claims or vice-versa as necessary to define the matter for which protection is sought by this application or by any subsequent application or continuation, division, or continuation-in-part application thereof, or to obtain any benefit of, reduction in fees pursuant to, or to comply with the patent laws, rules, or regulations of any country or treaty, and such content incorporated by reference shall survive during the entire pendency of this application including any subsequent continuation, division, or continuation-in-part application thereof or any reissue or extension thereon.

Additionally, the claims set forth in this specification, if any, are further intended to describe the metes and bounds of a limited number of the preferred embodiments of the invention and are not to be construed as the broadest embodiment of the invention or a complete listing of

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 249 of 607

embodiments of the invention that may be claimed. The applicant does not waive any right to develop further claims based upon the description set forth above as a part of any continuation, division, or continuation-in-part, or similar application.

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 250 of 607

VI. CLAIMS

1. A bolus, comprising:

one or more sensors each capable of generating a sensor signal which varies based on a corresponding change in one or more physiological parameters of a ruminant animal;

a memory element;

a processor in communication with said memory element; and

a computer code contained in said memory element, said computer code containing a power management module executable by said processor to enable and disable one or more of said plurality of sensors.

2. The bolus of claim 1, wherein said power management module is further executable to enable or disable said one or more sensors based upon elapsed duration of time from activation of said bolus.

3. The bolus of claim 2, wherein said power management module is further executable to enable or disable said one or more sensors based upon a pre-determined set of said one or more physiological parameters to be sensed during a stage in a life cycle of said ruminant animal.

4. The bolus of claim 3, wherein said one or more sensors is selected from the group consisting of: a temperature sensor, an accelerometer, a microphone, an inductance sensor, or combinations thereof.

5. The bolus of claim 1, where said power management module further includes a bolus activation element executable to:

monitor said sensor signal from said one or more sensors;

compare said sensor signal from said one or more sensors to a first pre-selected activation code; and

activate said bolus upon generation of said sensor signal from said one or more sensors which by comparison to said first pre-selected activation code exceeds a first pre-selected activation match threshold.

6. The bolus of claim 5, where said bolus activation element is further executable to:

compare said sensor signal from said one or more sensors to a second pre-selected activation code; and

activate said bolus upon generation of said sensor signal from said one or more sensors which by comparison to said first and said second pre-selected activation codes exceeds said first and a second pre-selected activation match threshold.

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 251 of 607

7. The bolus of claim 5, wherein said computer code is further executable upon activation of said bolus to:

encode 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; and

store said encoded physiological data in said memory element.

8. The bolus of claim 6, further comprising a radio signal generator capable of generating a radio signal to carry said encoded physiological data, and wherein said power management module is further executable to:

enable said radio signal generator; and

activate said radio signal generator at pre-determined intervals to generate said radio signal to carry said encoded physiological data.

9. The bolus of claim 1, further comprising an energy source which supplies energy to operate said bolus, and wherein said power management module is further executable to periodically determine a remaining amount of energy stored in said energy source.

10. The bolus of claim 9, wherein said power management module further comprises a power sensor element executable to:

determine an amount of energy required by said bolus to operate through a pre-determined period of time based on current programming of said computer code;

compare said amount of energy required by said bolus to operate through said pre-determined period of time to said remaining amount of energy stored in said energy source; and

calculate a difference in said amount of energy remaining in the power source and said amount of energy required by said bolus to operate through said pre-determined period of time.

11. The bolus of claim 10, wherein said power management module is further executable to:

perform one or more power regulation events to offset said difference in said amount of energy remaining in the power source and said amount of energy required by said bolus to operate through said pre-determined period of time.

12. The bolus of claim 11, wherein said one or more power regulation events is selected from the group consisting of: disable one or more of said sensors; interrupt encoding of said sensor signal from said one or more sensors; deactivate said radio signal generator, adjust intervals of time between operational time periods of said radio signal generator, adjust operational time periods of said radio signal generator.

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 252 of 607

13. The bolus of claim 8, wherein said radio signal generator generates a radio signal having a frequency of between about 700MHz to about 1GHz.

14. The bolus of claim 13, wherein said frequency is selected from the group consisting of: between about 700 MHz to about 800MHz, 750 MHz to about 850MHz, about 800 MHz to about 900MHz, 850 MHz to about 950MHz, 900 MHz to about 1GHz.

15. The bolus of claim 13, further comprising a matching elements configured to adjust said frequency of said radio signal to compensate for change in said frequency upon passing through a mass of said animal.

16. The bolus of claim 13, wherein said radio signal generator generates said radio signal having only one frequency.

17. The bolus of claim 8, further comprising an antenna capable of transmitting said radio signal, wherein said antenna comprises a pair of electrically conductive loops disposed a distance apart.

18. The bolus of claim 17, wherein said pair of electrically conductive loops comprise a loop of conductive sheet material having an inner annular edge and an outer annular edge which join opposed loop faces.

19. The bolus of claim 18, further comprising one or more vias which interconnect said pair of electrically conductive loops.

20. The bolus of claim 19, further comprising a non-conductive sheet material disposed between said pair of loops.

21. The bolus of claim 1, further comprising an illumination element responsive to said power management module, said illumination element upon activation of said bolus generates an amount of light indicating activation of said bolus.

22. The bolus of claim 21, further comprising a housing providing an outer most external surface of said bolus, said housing sufficiently translucent or transparent to transmit said amount of light generated by said illumination element to said outer most external surface indicating activation of said bolus.

23. The bolus of claim 22, wherein said outermost external surface of said housing has a length disposed between a pair of ends and a width along said length of not greater than about 20 millimeters.

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 253 of 607

24. The bolus of claim 23, wherein said outermost external surface of said housing comprises a substantially spherical external surface having a diameter of not greater than about 20 millimeters.

25. The bolus of claim 23, wherein said outermost external surface of said housing comprises a substantially cylindrical external surface, said width along said length having a substantially circular cross section of not greater than about 20 millimeters.

26. The bolus of claim 25, further comprising an amount of thermoset resin disposed inside of said housing.

27. The bolus of claim 23, further comprising a bolus density of between about 2.3 grams per centimeter cubed to about 3.3 grams per centimeter cubed ("g/cm^3").

28. The bolus of claim 27, wherein said bolus density is selected from the group consisting of: about 2.3 g/cm^3 to about 2.5 g/cm^3, about 2.4 g/cm^3 to about 2.6 g/cm^3, about 2. g/cm^3 to about 2.7 g/cm^3, about 2.6 g/cm^3 to about 2.8 g/cm^3, about 2.7 grams g/cm^3 to about 2.9 g/cm^3; about 2.8 g/cm^3 to about 3.0 g/cm^3, about 2.9 g/cm^3 to about 3. g/cm^3; about 3.0 g/cm^3 to about 3.2 g/cm^3, and about 3.1 g/cm^3 to about 3.3 g/cm^3.

29. A bolus, comprising:

a radio signal generator capable of generating a radio signal;

an antenna electrically connected to said radio signal generator, said antenna having a pair of electrically conductive loops disposed a distance apart; and

one or more vias which interconnect said pair of loops.

30. The bolus of claim 29, wherein each of said pair of electrically conductive loops comprise a loop of conductive sheet material having an inner annular edge and an outer annular edge which join opposed loop faces.

31. The bolus of claim 30, wherein said loop of conductive sheet material comprises a laid down electrically conductive path on a printed circuit board.

32. A bolus, comprising:

one or more sensors each capable of generating a sensor signal which varies based on a corresponding change in a corresponding one or more physiological parameters of a ruminant animal;

a memory element;

a processor in communication with said memory element;

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 254 of 607

a computer code contained in said memory element, said computer code executable by said processor to:

encode 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;

activate a radio signal generator to generate a radio signal to carry said encoded physiological data; and

a housing providing an outer most external surface of said bolus, wherein said outermost external surface of said housing has a length disposed between a pair of ends and a width along said length of not greater than about 20 millimeters.

33. The bolus of claim 32, wherein said outermost external surface of said housing comprises a substantially spherical external surface having a diameter of not greater than about 20 millimeters.

34. The bolus of claim 32, wherein said outermost external surface of said housing comprises a substantially cylindrical external surface, said width along said length having a substantially circular cross section of not greater than about 20 millimeters.

35. The bolus of claim 34, further comprising a bolus density of between about 2.3 grams per centimeter cubed to about 3.3 grams per centimeter cubed ("g/cm^3").

36. The bolus of claim 35, wherein said bolus density is selected from the group consisting of: about 2.3 g/cm^3 to about 2.5 g/cm^3, about 2.4 g/cm^3 to about 2.6 g/cm^3, about 2. g/cm^3 to about 2.7 g/cm^3, about 2.6 g/cm^3 to about 2.8 g/cm^3, about 2.7 grams g/cm^3 to about 2.9 g/cm^3; about 2.8 g/cm^3 to about 3.0 g/cm^3, about 2.9 g/cm^3 to about 3. g/cm^3; about 3.0 g/cm^3 to about 3.2 g/cm^3, and about 3.1 g/cm^3 to about 3.3 g/cm^3.

37. A method of monitoring the physiological parameters of an animal, comprising:

obtaining a bolus configured for oral administration to a ruminant animal, said bolus including:

one or more sensors each capable of generating a sensor signal which varies based on a corresponding change in one or more physiological parameters of a ruminant animal;

a memory element;

a processor in communication with said memory element;

a computer code contained in said memory element, said computer code containing a power management module executable by said processor to enable and disable one or more of said plurality of sensors; and

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 255 of 607

a housing providing an outer most external surface of said bolus; and

orally administering said bolus to said ruminant animal to dispose said bolus in a reticulorumen of said ruminant animal.

38. The method of claim 37, further comprising enabling or disabling said one or more sensors based upon elapsed duration of time from activation of said bolus.

39. The method of claim 37, further comprising enabling or disabling said one or more sensors based upon a pre-determined set of said one or more physiological parameters to be sensed during a stage in a life cycle of said ruminant animal.

40. The method of claim 39, wherein said one or more sensors is selected from the group consisting of: a temperature sensor, an accelerometer, a microphone, an inductance sensor, or combinations thereof.

41. The method of claim 40, further comprising:

monitoring said sensor signal from said one or more sensors;

comparing said sensor signal from said one or more sensors to a first pre-selected activation code; and

activating said bolus upon generation of said sensor signal from said one or more sensors which by comparison to said first pre-selected activation code exceeds a first pre-selected activation match threshold.

42. The method of claim 41, further comprising:

comparing said sensor signal from said one or more sensors to a second pre-selected activation code; and

activating said bolus upon generation of said sensor signal from said one or more sensors which by comparison to said first and said second pre-selected activation codes exceeds said first and a second pre-selected activation match threshold.

43. The method of claim 42, further comprising:

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; and

storing said encoded physiological data in said memory element.

44. The method of claim 43, wherein said bolus further comprises a radio signal generator capable of generating a radio signal to carry said encoded physiological data, and further comprising:

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 256 of 607

enabling said radio signal generator; and

activating said radio signal generator at pre-determined intervals to generate said radio signal to carry said encoded physiological data.

45. The method of claim 44, wherein said bolus further comprises an energy source which supplies energy to operate said bolus, and further comprising:

determining a remaining amount of energy stored in said energy source;

determining an amount of energy required by said bolus to operate through a pre-determined period of time based on current programming of said computer code;

comparing said amount of energy required by said bolus to operate through said pre-determined period of time to said remaining amount of energy stored in said energy source; and

calculating a difference in said amount of energy remaining in the power source and said amount of energy required by said bolus to operate through said pre-determined period of time.

46. The method of claim 45, further comprising performing one or more power regulation events to offset said difference in said amount of energy remaining in the power source and said amount of energy required by said bolus to operate through said pre-determined period of time.

47. The method of claim 46, wherein said one or more power regulation events is selected from the group consisting of: disabling one or more of said sensors; interrupting encoding of said sensor signal from said one or more sensors; deactivating said radio signal generator, adjusting intervals of time between operational time periods of said radio signal generator, adjusting operational time periods of said radio signal generator.

48. The method of claim 47, further comprising generating a radio signal having a frequency of between about 700MHz to about 1GHz.

49. The method of claim 48, wherein said frequency is selected from the group consisting of: between about 700 MHz to about 800MHz, 750 MHz to about 850MHz, about 800 MHz to about 900MHz, 850 MHz to about 950MHz, 900 MHz to about 1GHz.

50. The method of claim 49, wherein said bolus further comprises matching elements configured to adjust said frequency of said radio signal, and further comprising adjusting said frequency to compensate for change in said frequency upon passing through a mass of said ruminant animal.

51. The method of claim 50, wherein said radio signal generator generates said radio signal having only one frequency.

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 257 of 607

52. The method of claim 51, wherein said bolus further comprises an antenna having a pair of electrically conductive loops disposed a distance apart and further comprising transmitting said radio signal through said antenna.

53. The method of claim 52, 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.

54. The method of claim 53, wherein said antenna further comprises one or more vias interconnecting said pair of electrically conductive loops.

55. The method of claim 54, wherein said antenna further comprises a non-conductive sheet material disposed between said pair of electrically conductive loops.

56. The method of claim 55, wherein said bolus further comprises an illumination element capable of generating an amount of light, and further comprising generating said amount of light upon activation of said bolus.

57. The method of claim 56, wherein said housing is translucent or transparent, and further comprising transmitting said amount of light generated by said illumination element to said outer most external surface indicating activation of said bolus.

58. The method of claim 57, wherein said outermost external surface of said housing has a length disposed between a pair of ends and a width along said length of not greater than about 20 millimeters.

59. The method of claim 58, wherein said outermost external surface of said housing comprises a substantially spherical external surface having a diameter of not greater than about 20 millimeters.

60. The method of claim 58, wherein said outermost external surface of said housing comprises a substantially cylindrical external surface, said width along said length having a substantially circular cross section of not greater than about 20 millimeters.

61. The method of claim 58, wherein said bolus further comprises an amount of thermoset resin disposed inside of said housing.

62. The method of claim 61, wherein said bolus further comprises a bolus density of between about 2.3 grams per centimeter cubed to about 3.3 grams per centimeter cubed ("g/cm^3").

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 258 of 607

63. The method of claim 62, wherein said bolus density is selected from the group consisting of: about 2.3 g/cm^3 to about 2.5 g/cm^3, about 2.4 g/cm^3 to about 2.6 g/cm^3, about 2. g/cm^3 to about 2.7 g/cm^3, about 2.6 g/cm^3 to about 2.8 g/cm^3, about 2.7 grams g/cm^3 to about 2.9 g/cm^3; about 2.8 g/cm^3 to about 3.0 g/cm^3, about 2.9 g/cm^3 to about 3. g/cm^3; about 3.0 g/cm^3 to about 3.2 g/cm^3, and about 3.1 g/cm^3 to about 3.3 g/cm^3.

64. The method of claim 46, wherein said bolus further comprises a radio signal receiver and further comprising:

receiving radio signal containing programming data; and

re-programming said computer code contained within said memory element.

65. The method of claim 64, further comprising re-programming said computer code based upon based upon said pre-determined set of said plurality of physiological parameters to be sensed during said stage in said life cycle of said ruminant animal.

66. The method of claim 65, further comprising re-programming said computer code to offset said difference in said amount of energy remaining in the power source and said amount of energy required by said bolus to operate through said pre-determined period of time.

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 259 of 607

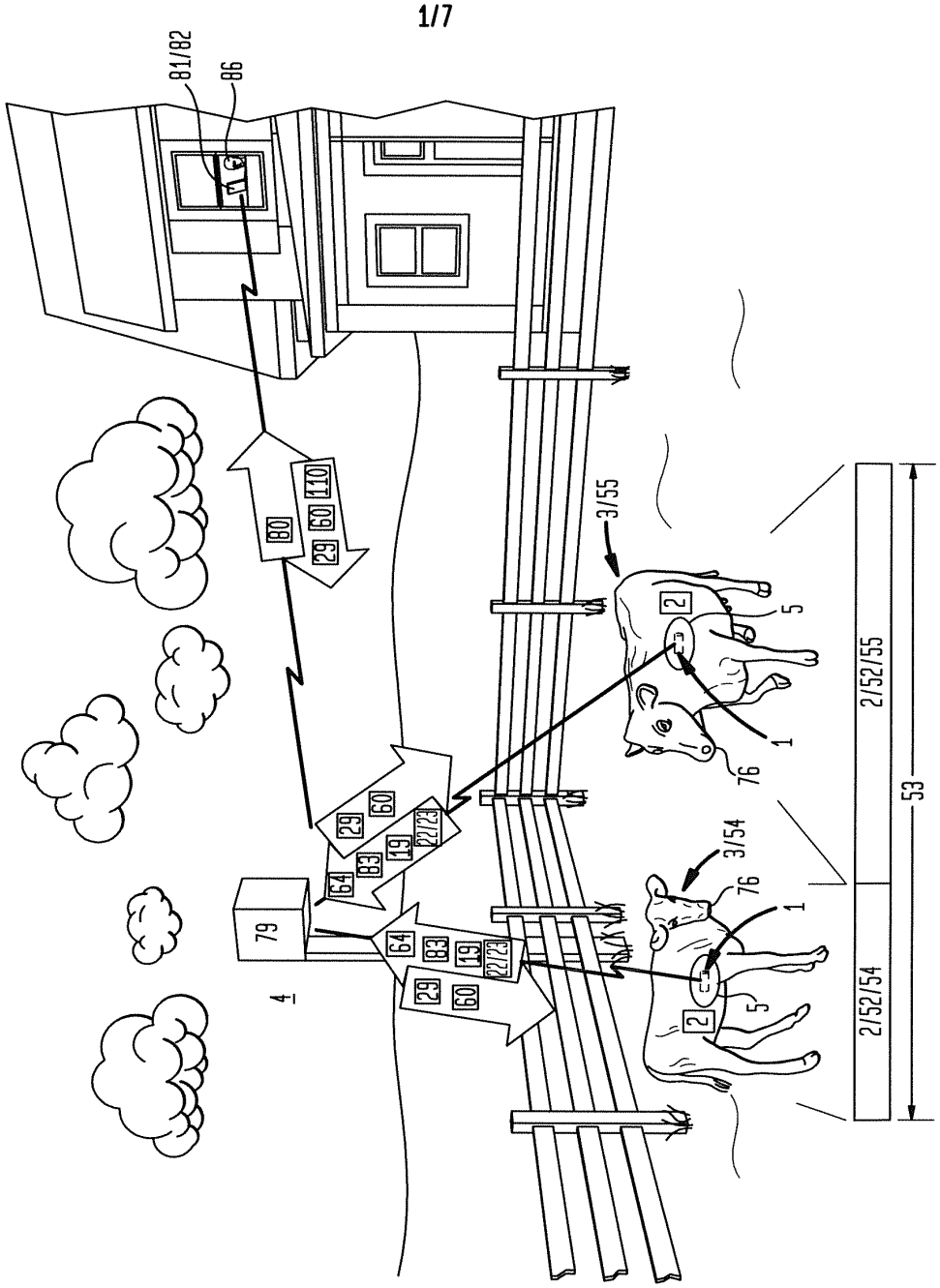
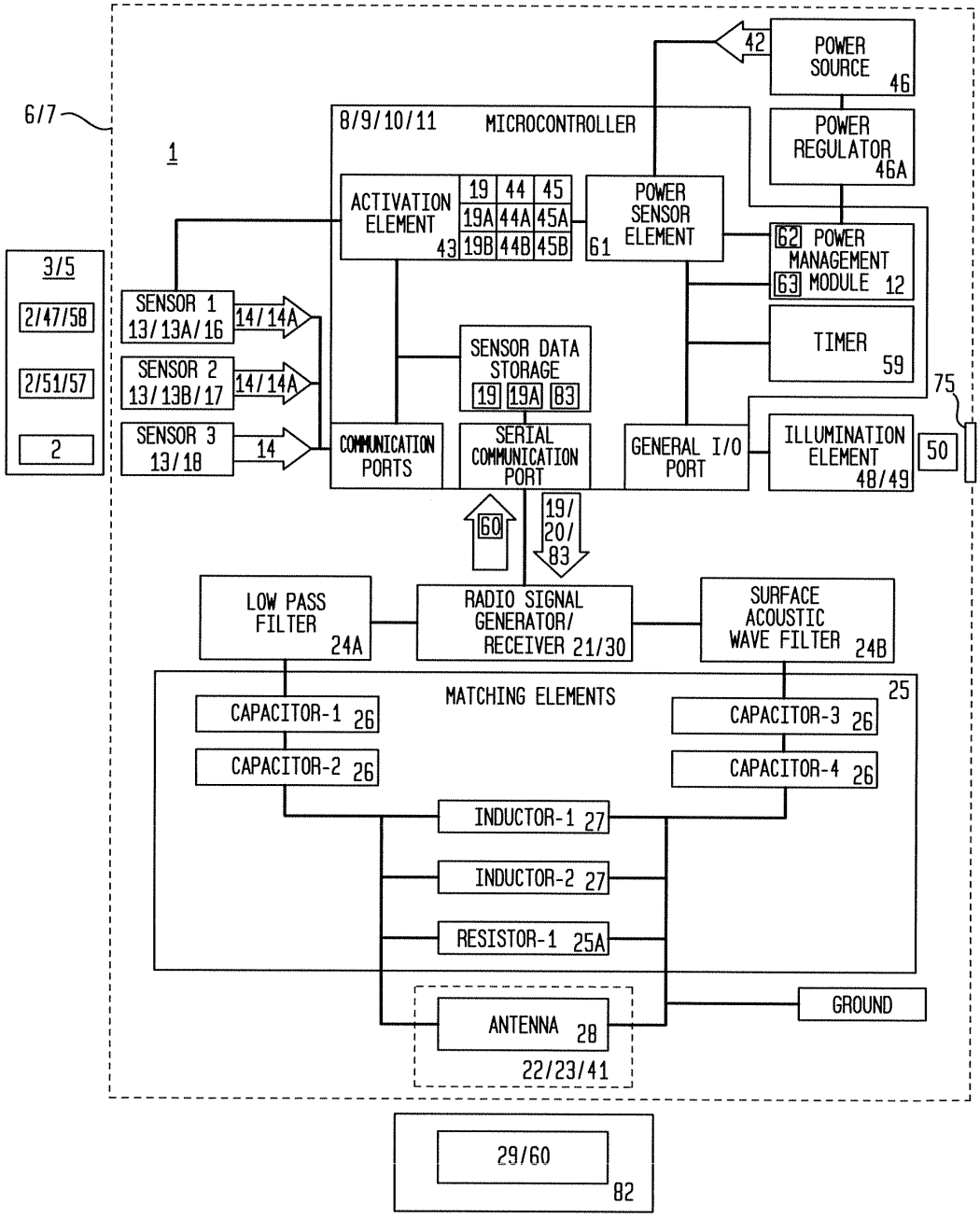

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FIG. 1

FIG. 2


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8/9/10/11 MICROCONTROLLER
42
POWER SOURCE 46
POWER REGULATOR 46A
ACTIVATION ELEMENT 43
19 44 45
19A 44A 45A
19B 44B 45B
POWER SENSOR ELEMENT 61
62 POWER MANAGEMENT 63 MODULE 12
TIMER 59
75
3/5
2/47/58
2/51/57
2
SENSOR 1 13/13A/16
SENSOR 2 13/13B/17
SENSOR 3 13/18
14/14A
14/14A
14
SENSOR DATA STORAGE 19 19A 83
COMMUNICATION PORTS
SERIAL COMMUNICATION PORT
GENERAL I/O PORT
ILLUMINATION ELEMENT 48/49
50
60
19/20/83
LOW PASS FILTER 24A
RADIO SIGNAL GENERATOR/ RECEIVER 21/30
SURFACE ACOUSTIC WAVE FILTER 24B
MATCHING ELEMENTS
25
CAPACITOR-1 26
CAPACITOR-2 26
CAPACITOR-3 26
CAPACITOR-4 26
INDUCTOR-1 27
INDUCTOR-2 27
RESISTOR-1 25A
ANTENNA 28
22/23/41
GROUND
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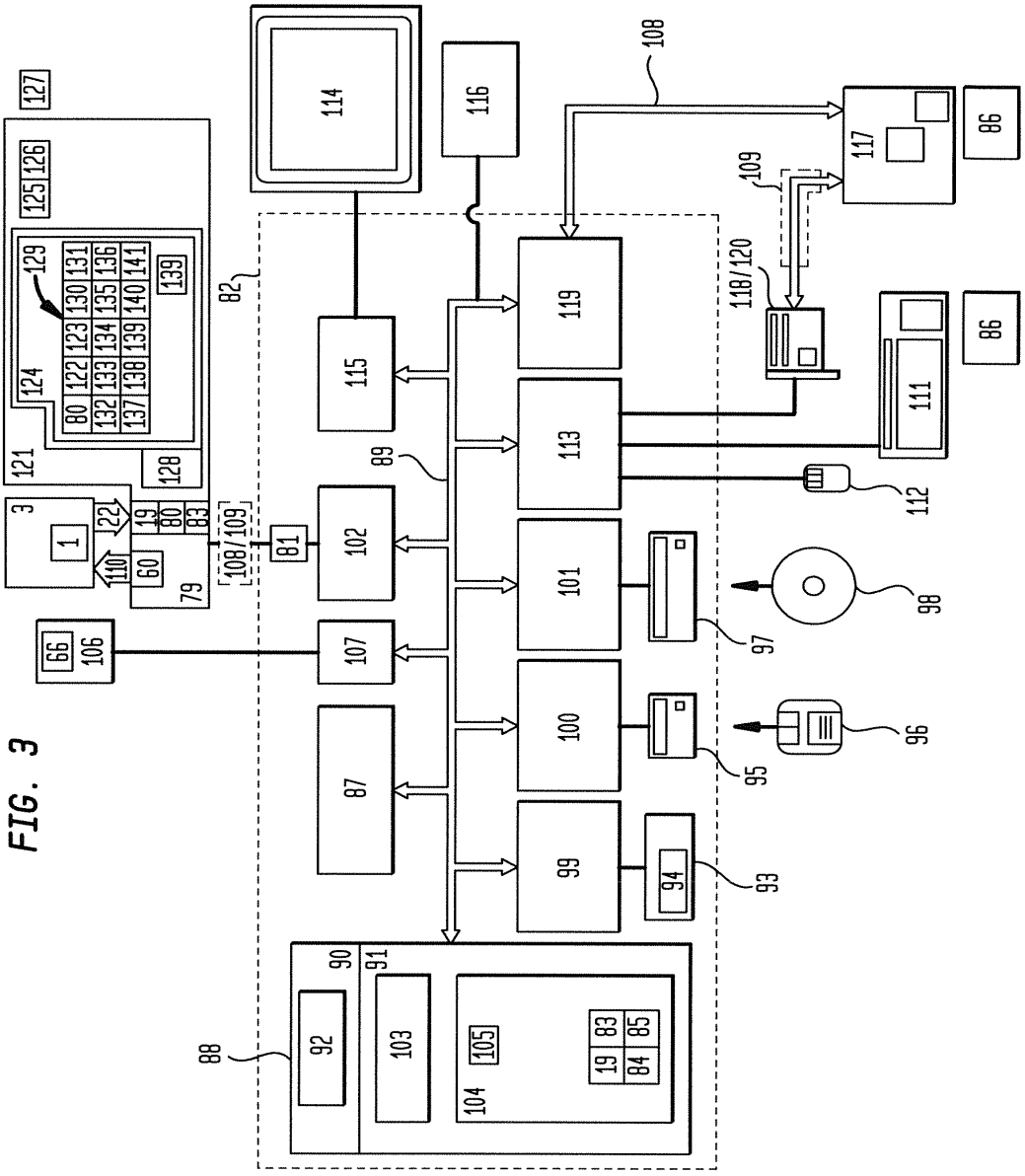

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FIG. 3

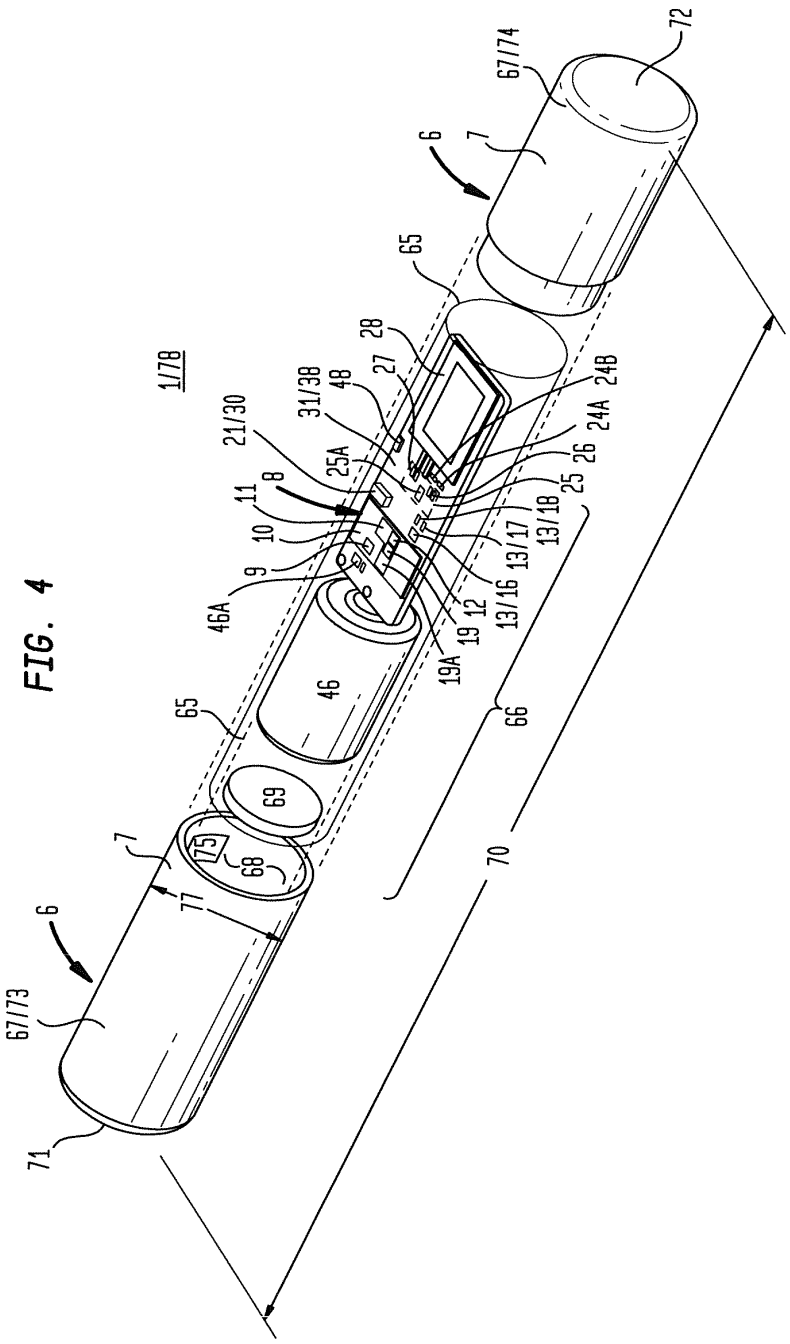

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FIG. 4

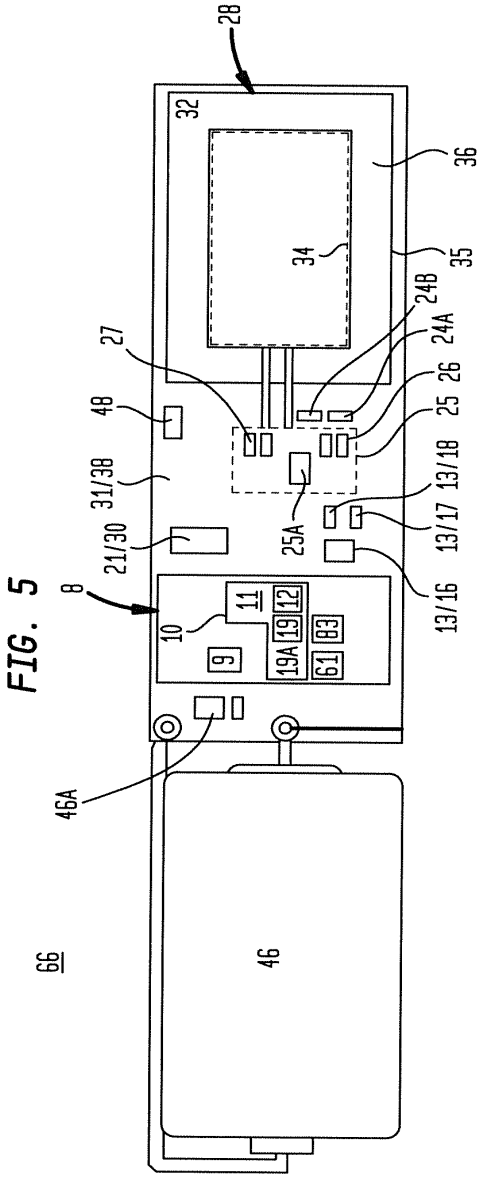

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FIG. 5

FIG. 6

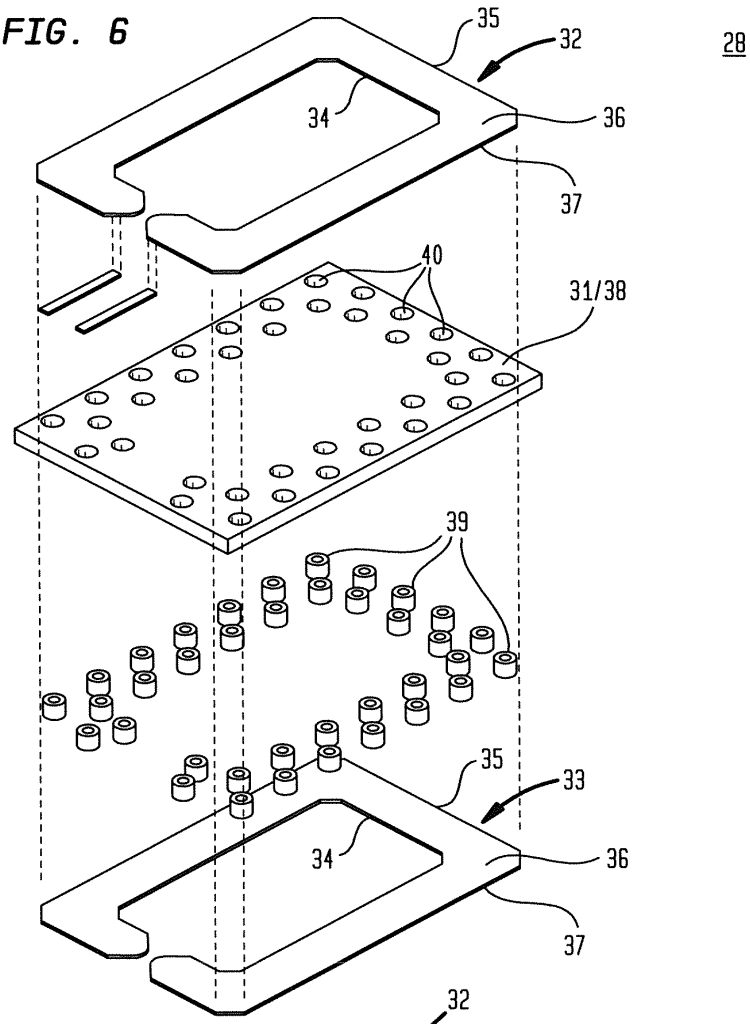


FIG. 7

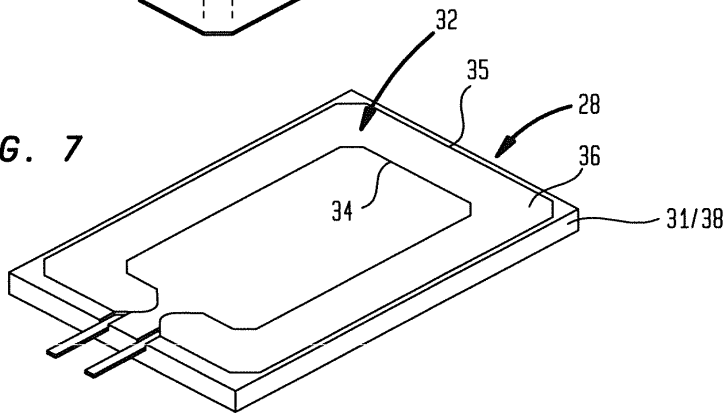


FIG. 8

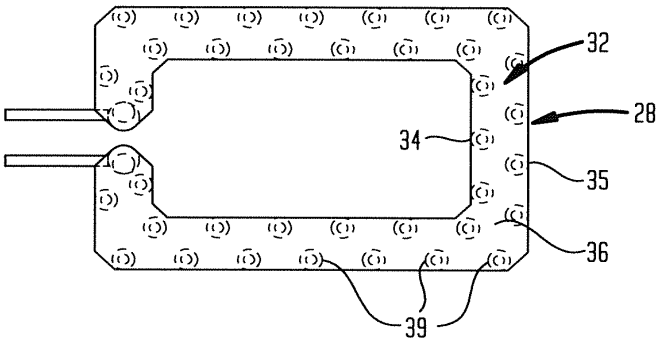


FIG. 9

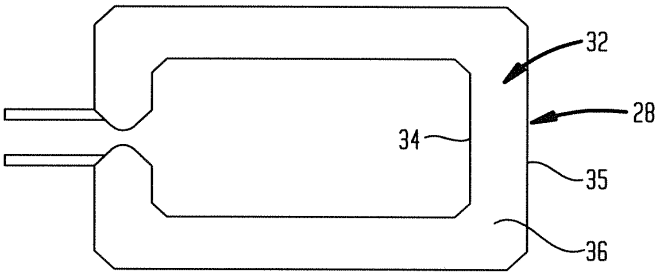


FIG. 10

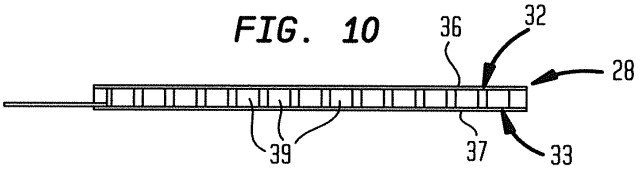


FIG. 11

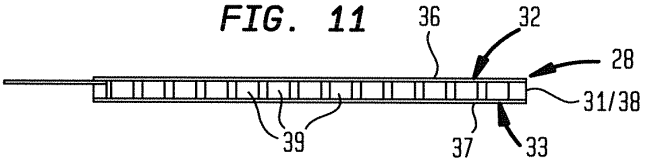


FIG. 12

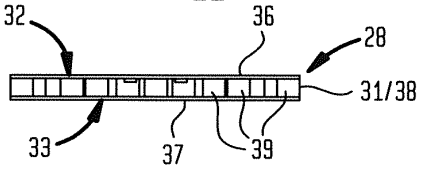
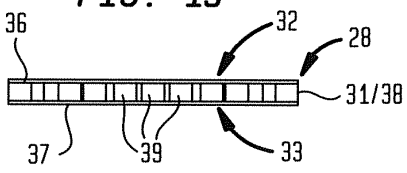


FIG. 13



INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2016/036911

A. CLASSIFICATION OF SUBJECT MATTER
IPC(8) - A61B 5/07; A61D 99/00; G08B 23/00 (2016.01)
CPC - A61B 5/07; A61B 5/073; A61B 5/076; A61D 99/00; G08B 23/00 (2016.05)
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC - 340/573.100; 340/573.300; 600/301; 600/302
CPC - A61B 5/07; A61B 5/073; A61B 5/076; A61D 99/00; G08B 23/00

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
USPC - 340/573.1, 573.3; 600/301, 302 (keyword delimited)

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
PatBase, Orbit, Google Patents, Google Scholar
Search terms used: bolus, sensor, ruminant, animal, reticulorumen, temperature, accelerometer

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2009/0182207 A1 (RISKEY et al.) 16 July 2009 (16.07.2009) entire document	1-14, 16, 37-49, 64-66
---		---
Y		15, 17-28, 32-36, 50-63
Y	US 2013/0197323 A1 (RETTEDAL et al.) 01 August 2013 (01.08.2013) entire document	15, 50-63
Y	US 2010/0302039 A1 (GOTO et al.) 02 December 2010 (02.12.2010) entire document	17-20, 52-63
Y	US 2002/0128542 A1 (VAN OVER) 12 September 2002 (12.09.2002) entire document	21-28, 56-63
Y	US 6,416,782 B1 (MAAS) 09 July 2002 (09.07.2002) entire document	23-28, 32-36, 58-63
A	US 2001/0001176 A1 (CAJA LOPEZ et al.) 17 May 2001 (17.05.2001) entire document	1-28, 32-66

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
07 October 2016	26 OCT 2016
Name and mailing address of the ISA/ Mail Stop PCT, Attn: ISA/US, Commissioner for Patents P.O. Box 1450, Alexandria, VA 22313-1450 Facsimile No. 571-273-8300	Authorized officer Blaine R. Copenheaver PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774

Form PCT/ISA/210 (second sheet) (January 2015)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2016/036911

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:
See supplemental page

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.

2. ☐ As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:
1-28, 32-66

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.

☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.

☐ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2016/036911

Continued from Box No. III Observations where unity of invention is lacking

This application contains the following inventions or groups of inventions which are not so linked as to form a single general inventive concept under PCT Rule 13.1. In order for all inventions to be examined, the appropriate additional examination fees must be paid.

Group I, claims 1-28, 32-66 , drawn to a bolus for measuring change in one or more physiological parameters of a ruminant animal.
Group II, claims 29-31, drawn to a bolus comprising a radio signal generator and antenna with electrically conductive loops.

The inventions listed as Groups I-II do not relate to a single general inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, they lack the same or corresponding special technical features for the following reasons:
the special technical feature of the Group I invention: bolus comprising: one or more sensors each capable of generating a sensor signal which varies based on a corresponding change in one or more physiological parameters of a ruminant animal; a computer code contained in said memory element to enable and disable one or more of said plurality of sensors, a housing providing an outer most external surface of said bolus, as claimed therein is not present in the invention of Group II.
The special technical feature of the Group II invention: bolus comprising: an antenna electrically connected to said radio signal generator, said antenna having a pair of electrically conductive loops disposed a distance apart; and one or more vias which interconnect said pair of loops as claimed therein is not present in the invention of Group I.

Groups I and II lack unity of invention because even though the inventions of these groups require the technical feature of a bolus comprising: a radio signal generator capable of generating a radio signal, this technical feature is not a special technical feature as it does not make a contribution over the prior art. Specifically, US 2013/0197323 A1 (RETTEDAL et al.) 01 August 2013 (01.08.2013) teaches a bolus (An animal monitoring device configured as a bolus for oral administration to reside in an animal's stomach, abstract) comprising: a radio signal generator capable of generating a radio signal (the animal monitoring device (6) can further include a radio frequency signal receiver (23) capable of receiving a second radio frequency signal (24) carrying programming data (24A) generated by a second radio frequency generator (25) having a location outside of the monitored animal (3). The second radio frequency signal (24) carrying programming data (24A) can be processed by the microcontroller (7) to reprogram a programmable module (26) to correspondingly alter the operation of the animal monitoring device (6), para 0025; radio frequency signal generator which generates a first radio frequency signal, claim 69).

Since none of the special technical features of the Group I or II inventions are found in more than one of the inventions, unity of invention is lacking.

Electronic Acknowledgement Receipt

EFS ID:	28146824
Application Number:	14738789
International Application Number:	
Confirmation Number:	8986
Title of Invention:	Calf Bolus
First Named Inventor/Applicant Name:	Nicholas P. Rettedal
Customer Number:	39208
Filer:	Craig R. Miles/Jill Smith Buck
Filer Authorized By:	Craig R. Miles
Attorney Docket Number:	bellaUScalf (280-10)
Receipt Date:	24-JAN-2017
Filing Date:	12-JUN-2015
Time Stamp:	11:31:12
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Transmittal Letter	Transmittal_ltr.pdf	39421 bed08aaf7ad3e449b53e817445f51239f5d2e8aa	no	2
Warnings:					

Information:					
2	Information Disclosure Statement (IDS) Form (SB08)	Statement.pdf	42417 df3a238a1c1f9d12f44cc338416b4cba4b057193	no	1
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Information:					
		Total Files Size (in bytes):	2913671		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the application of: Nicholas P. Rettedal, Stephen M. Weilnau, Scott R. Cockroft, and Joseph Janus IV

Application No.: 14/738,789

Filed: June 12, 2015

For: Calf Bolus

Attorney Docket No.: bellaUScalf (280-10)

Confirmation No.: 8986

Group Art Unit: 3766

Examiner: Heller, Tammie K.

Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

LETTER OF TRANSMITTAL

Sir/Madam:

Please find attached for entry into the above-identified patent application, documents as follow:

1. a Supplemental Information Disclosure Statement under 37 C.F.R. § 1.97 (c) and 37 C.F.R. §1.97(e)(1) (1 page(s));

2. a Supplemental Information Disclosure Statement (1 page(s)) along with copies of each cited reference not already available at the PTO; and

3. this firm Letter of Transmittal (2 page(s)).

I have this 24 day of January, 2017, either myself personally, or through my direction of staff at this office, deposited all of the items listed in this Letter of Transmittal with the United States Patent and Trademark Office via EFS-Web.

Please enter the submitted documents into the above-identified patent application.

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 272 of 607

Direct all correspondence to:

CR MILES P.C.
405 Mason Court, Suite 119
Fort Collins, CO 80524

Customer No.: 39208

Dated this 24 day of January, 2017

Respectfully Submitted,

CR MILES P.C.

By: _____

Craig R. Miles
ATTORNEY FOR APPLICANT
USPTO Reg. No. 45,954
405 Mason Court, Suite 119
Fort Collins, CO 80524
(970) 492-0000
(970) 492-0003 facsimile

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the application of: Nicholas P. Rettedal, Stephen M. Weilnau, Scott R. Cockroft, and Joseph Janus IV

Application No.: 14/738,789

Filed: June 12, 2015

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Confirmation No.: 8986

Group Art Unit: 3766

Examiner: Heller, Tammie K.

Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

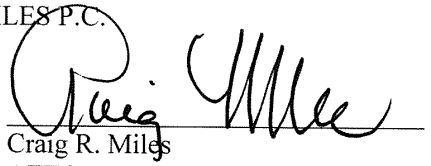
SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT UNDER 37 C.F.R. §1.97(c)(2)

Applicant respectfully requests entry of this Supplemental Information Disclosure Statement under 37 C.F.R. §1.97(c)(2). Applicant claims small entity status under 37 C.F.R. § 1.27, therefore Applicant submits the fee of $90.00 because the supplemental information disclosure statement was made after the mailing date of the first official action on the merits.

Dated this 13 day of February, 2017

Respectfully Submitted,

CR MILES P.C.

By: 

Craig R. Miles
ATTORNEY FOR APPLICANT
USPTO Reg. No. 45,954
405 Mason Court, Suite 119
Fort Collins, CO 80524
(970) 492-0000
(970) 492-0003 facsimile

SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT BY APPLICANT	Application Number	14/738,789
	Filling Date	June 12, 2015
	First Named Inventor	Nicholas P. Rettedal
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	Examiner Name	Heller, Tammie K.
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EXAMINER INITIALS	DOCUMENT NUMBER	DATE	COUNTRY	NAME OF PATENTEE OR APPLICANT OF CITED DOCUMENT
	2007089892, with English Abstract	04-12-2007	JP	Mori et al.

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APPARATUS INTRODUCED INTO SUBJECT, APPARATUS USED OUTSIDE OF SUBJECT, AND SYSTEM INTRODUCED INTO SUBJECT

Inventor(s): MORI TAKESHI; FUJIMORI NORIYUKI ± (MORI TAKESHI, ; FUJIMORI NORIYUKI)

Applicant(s): OLYMPUS CORP ± (OLYMPUS CORP)

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Abstract of JP2007089892 (A)

PROBLEM TO BE SOLVED: To provide an apparatus introduced into a subject, such as a capsule endoscope or the like, which eliminates the need to prepare plural kinds of apparatuses having different transmission frequencies by regions of use. ;SOLUTION: A receiver 50 searches an unused channel by sweeping reception frequencies of radio signals at a location of use by means of an unused channel search section 52, and the transmission frequency of the capsule endoscope is determined by a transmission frequency determination section 54 on the basis of the searched unused channel. Because the transmission frequency of the capsule endoscope is varied and set according to the determined unused channel, a transmission frequency having a frequency band that does not interfere with the other electronic devices is used. With such a configuration, capsule endoscopes having various structures and different transmission frequencies by destinations considering the regions are no longer necessary to be produced, and capsule endoscopes having an identical structure can be used at various regions. ;COPYRIGHT: (C)2007,JPO&INPIT

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 276 of 607

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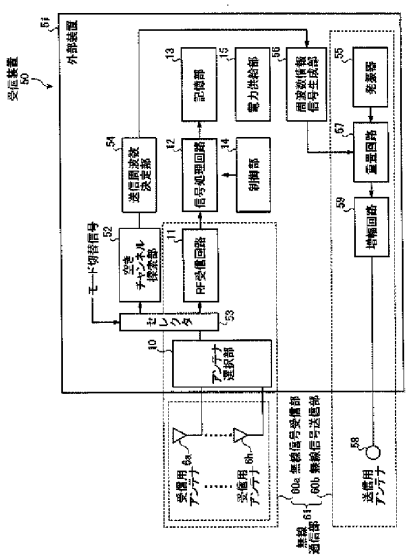
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(71)出願人　000000376
オリンパス株式会社
東京都渋谷区幡ヶ谷２丁目４３番２号
(74)代理人　100089118
弁理士　酒井　宏明
(72)発明者　森　健
東京都渋谷区幡ヶ谷２丁目４３番２号　オリンパス株式会社内
(72)発明者　藤森　紀幸
東京都渋谷区幡ヶ谷２丁目４３番２号　オリンパス株式会社内

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(54)【発明の名称】被検体内導入装置、被検体外装置および被検体内導入システム

(57)【要約】
【課題】使用する地域別に送信周波数を変えた複数種類の構造のものを用意する必要のないカプセル型内視鏡等の被検体内導入装置を提供する。
【解決手段】受信装置５０自身が、空きチャンネル探索部５２によって使用場所での無線信号の受信周波数をスイープして空きチャンネルを探索し、探索された空きチャンネルに基づき送信周波数決定部５４によってカプセル型内視鏡用の送信周波数を決定するようにしたので、カプセル型内視鏡を、決定されたこの空きチャンネル対応の送信周波数に可変設定して用いることで、他の電子機器等との間で相互に干渉しない周波数帯域の送信周波数の利用が可能となり、使用地域を考慮した仕向地別に送信周波数を変えた複数種類の構造のカプセル型内視鏡を製造する必要がなく、同一構造のカプセル型内視鏡を複数の地域で使用できるようにした。
【選択図】　図７



Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 277 of 607

【特許請求の範囲】
【請求項1】
被検体の内部に導入された状態で使用され、前記被検体の内部において所定機能を実行するとともに外部と無線通信を行う被検体内導入装置であって、
前記被検体の内部において所定機能を実行する機能実行手段と、
通信に使用する無線信号の送信周波数を変更自在に設定する周波数設定手段と、
通信に使用する無線信号の送信周波数が可変自在で、前記周波数設定手段によって設定された送信周波数の無線信号を用いて、外部と無線通信を行う無線通信手段と、
を備えたことを特徴とする被検体内導入装置。
【請求項2】
前記周波数設定手段は、外部入力に基づいて通信に使用する無線信号の送信周波数を設定することを特徴とする請求項１に記載の被検体内導入装置。
【請求項3】
前記無線通信手段は、外部から送信され、通信に使用する無線信号の送信周波数の情報を含む無線信号を少なくとも受信する無線信号受信手段を備え、
前記周波数設定手段は、前記無線信号受信手段によって受信された無線信号に基づいて通信に使用する無線信号の送信周波数を設定することを特徴とする請求項２に記載の被検体内導入装置。
【請求項4】
前記機能実行手段は、前記被検体の内部の画像を撮像する撮像手段を備え、
前記無線通信手段は、前記撮像手段によって撮像された画像データを含み、前記周波数調整手段によって設定された送信周波数の無線信号を外部に送信する無線信号送信手段を備えたことを特徴とする請求項１～３のいずれか一つに記載の被検体内導入装置。
【請求項5】
被検体の外部に配置され、通信に使用する無線信号の送信周波数が可変自在で前記被検体の内部に導入された状態で使用される被検体内導入装置との間で無線通信を行う被検体外装置であって、
当該被検体外装置の使用場所において無線信号の受信周波数をスイープして空きチャンネルを探索する空きチャンネル探索手段と、
該空きチャンネル探索手段により探索された空きチャンネルに基づき無線通信に使用する送信周波数を決定する送信周波数決定手段と、
決定された送信周波数の情報を含む無線信号を前記被検体内導入装置に対して送信する無線信号送信手段と、
を備えたことを特徴とする被検体外装置。
【請求項6】
被検体の内部に導入された状態で使用する被検体内導入装置と、前記被検体の外部に配置され、前記被検体内導入装置との間で無線通信を行う被検体外装置とを備えた被検体内導入システムであって、
前記被検体外装置は、
当該被検体外装置の使用場所において無線信号の受信周波数をスイープして空きチャンネルを探索する空きチャンネル探索手段と、
該空きチャンネル探索手段により探索された空きチャンネルに基づき無線通信に使用する送信周波数を決定する送信周波数決定手段と、
決定された送信周波数の情報を含む無線信号を前記被検体内導入装置に対して送信する無線信号送信手段と、
を備え、
前記被検体内導入装置は、
前記無線信号送信手段から送信される、決定された送信周波数の情報を含む無線信号に基づいて通信に使用する無線信号の送信周波数を変更自在に設定する周波数設定手段と、

通信に使用する無線信号の送信周波数が可変自在で、前記周波数設定手段によって設定された送信周波数の無線信号を用いて、前記被検体外装置と無線通信を行う無線通信手段と、

【発明の詳細な説明】とする被検体内導入システム。

【技術分野】

【0001】

本発明は、被検体の内部に導入された状態で使用されるカプセル型内視鏡等の被検体内導入装置、被検体の外部に配置されて被検体内導入装置との間で無線通信を行う受信装置等の被検体外装置、および、これらの被検体内導入装置と被検体外装置とを備える被検体内導入システムに関するものである。

【背景技術】

【0002】

近年、内視鏡の分野においては、飲込み型のカプセル型内視鏡が登場している。このカプセル型内視鏡には、撮像機能と無線通信機能とが設けられている。カプセル型内視鏡は、観察（検査）のために患者の口から飲込まれた後、人体から自然排出されるまでの間、体腔内、例えば胃、小腸などの臓器の内部をその蠕動運動に従って移動し、順次撮像する機能を有する。

【0003】

体腔内を移動する間、カプセル型内視鏡によって体内で撮像された画像データは、順次無線通信により外部に送信され、外部に設けられた受信用アンテナを介して受信される。そして、受信した無線信号に基づいて被検体の外部に設けられた受信装置によってデータが再生されることによって、患者の体腔内画像を取得することが可能である。患者がこの無線通信機能とメモリ機能とを備えた受信装置を携帯することにより、患者は、カプセル型内視鏡を飲み込んだ後、排出されるまでの期間であっても、自由に行動できる。この後、医者もしくは看護師においては、メモリに蓄積された画像データに基づいて臓器の画像をディスプレイに表示させて診断を行うことができる（例えば、特許文献１参照。）。

【0004】

ところで、カプセル型内視鏡と受信装置との間で通信される無線信号の周波数は、例えば被検体周囲において用いられる他の電子機器等で使用される周波数によって限定される。すなわち、カプセル型内視鏡と受信装置との間で、他の電子機器等で使用される周波数帯を用いた無線通信を行った場合には、他の電子機器等の誤動作を誘発するおそれがあるのみならず、他の電子機器等の通信等に用いられる無線信号が受信装置に受信され、カプセル型内視鏡との間の無線通信において情報伝達エラー等の障害が生じることとなる。

【0005】

従って、従来のカプセル型内視鏡システムでは、一例として、他の無線機器等が使用しない空きチャンネル周波数帯に属する周波数を用いて無線通信を行うことが考えられる。また、従来のカプセル型内視鏡システムでは、他の例として、あらかじめ規格化された周波数帯を用いて無線通信を行うこととし、かかる周波数帯における他の電子機器の使用を禁止することも考えられる。

【0006】

【特許文献1】特開２００１－２３１１８６号公報

【特許文献2】特表２００３－５２６２６８号公報

【特許文献3】特開２００１－３５３１２４号公報

【発明の開示】

【発明が解決しようとする課題】

【0007】

しかしながら、従来のカプセル型内視鏡システムは、病院所在地、被検者所在地等の使用地域に応じて送信周波数の異なるカプセル型内視鏡を用意する必要があるという課題を有する。

【0008】

すなわち、電子機器の使用周波数帯は、例えばテレビ放送の送信周波数を考えれば明らかなように地域依存性を有する場合が多いことから、空きチャンネル周波数帯の具体的な範囲も地域によって異なることとなる。また、規格としてカプセル型内視鏡の使用周波数帯を定める場合には、例えば異なる国においては規格化を行う主体が相違することから、使用周波数帯が全世界に渡って同一のものとなる保証はなく、現実には国毎にカプセル型内視鏡に割り当てられる送信周波数帯は異なる帯域となることが予想される。以上のことから、従来のカプセル型内視鏡を使用する場合には、カプセル型内視鏡に備わる無線通信手段について、使用地域に応じて送信に用いる送信周波数を異ならせた構造のものを製造する必要があり、煩雑であるとともに製造コストの増加を招くこととなる。

【0009】

本発明は、上記に鑑みてなされたものであって、使用する地域別に送信周波数を変えた複数種類の構造のものを用意する必要のないカプセル型内視鏡等の被検体内導入装置、被検体内導入装置と通信可能な被検体外装置、および被検体内導入システムを提供することを目的とする。

【課題を解決するための手段】

【0010】

上述した課題を解決し、目的を達成するために、請求項１に係る被検体内導入装置は、被検体の内部に導入された状態で使用され、前記被検体の内部において所定機能を実行するとともに外部と無線通信を行う被検体内導入装置であって、前記被検体の内部において所定機能を実行する機能実行手段と、通信に使用する無線信号の送信周波数を変更自在に設定する周波数設定手段と、通信に使用する無線信号の送信周波数が可変自在で、前記周波数設定手段によって設定された送信周波数の無線信号を用いて、外部と無線通信を行う無線通信手段と、を備えたことを特徴とする。

【0011】

請求項２に係る被検体内導入装置は、上記発明において、前記周波数設定手段は、外部入力に基づいて通信に使用する無線信号の送信周波数を設定することを特徴とする。

【0012】

請求項３に係る被検体内導入装置は、上記発明において、前記無線通信手段は、外部から送信され、通信に使用する無線信号の送信周波数の情報を含む無線信号を少なくとも受信する無線信号受信手段を備え、前記周波数設定手段は、前記無線信号受信手段によって受信された無線信号に基づいて通信に使用する無線信号の送信周波数を設定することを特徴とする。

【0013】

請求項４に係る被検体内導入装置は、上記発明において、前記機能実行手段は、前記被検体の内部の画像を撮像する撮像手段を備え、前記無線通信手段は、前記撮像手段によって撮像された画像データを含み、前記周波数調整手段によって設定された送信周波数の無線信号を外部に送信する無線信号送信手段を備えたことを特徴とする。

【0014】

請求項５に係る被検体外入装置は、被検体の外部に配置され、通信に使用する無線信号の送信周波数が可変自在で前記被検体の内部に導入された状態で使用される被検体内導入装置との間で無線通信を行う被検体外装置であって、当該被検体外装置の使用場所において無線信号の受信周波数をスイープして空きチャンネルを探索する空きチャンネル探索手段と、該空きチャンネル探索手段により探索された空きチャンネルに基づき無線通信に使用する送信周波数を決定する送信周波数決定手段と、決定された送信周波数の情報を含む無線信号を前記被検体内導入装置に対して送信する無線信号送信手段と、を備えたことを特徴とする。

【0015】

請求項６に係る被検体内導入システムは、被検体の内部に導入された状態で使用する被検体内導入装置と、前記被検体の外部に配置され、前記被検体内導入装置との間で無線通信を行う被検体外装置とを備えた被検体内導入システムであって、前記被検体外装置は、

当該被検体外装置の使用場所において無線信号の受信周波数をスイープして空きチャンネルを探索する空きチャンネル探索手段と、該空きチャンネル探索手段により探索された空きチャンネルに基づき無線通信に使用する送信周波数を決定する送信周波数決定手段と、決定された送信周波数の情報を含む無線信号を前記被検体内導入装置に対して送信する無線信号送信手段と、を備え、前記被検体内導入装置は、前記無線信号送信手段から送信される、決定された送信周波数の情報を含む無線信号に基づいて通信に使用する無線信号の送信周波数を変更自在に設定する周波数設定手段と、通信に使用する無線信号の送信周波数が可変自在で、前記周波数設定手段によって設定された送信周波数の無線信号を用いて、前記被検体外装置と無線通信を行う無線通信手段と、を備えたことを特徴とする。

【発明の効果】

【0016】

本発明に係る被検体内導入装置によれば、通信に使用する無線信号の送信周波数が可変自在であって、周波数設定手段によって変更自在に設定されるので、使用する地域を考慮した仕向地別に送信周波数を変えた複数種類の構造の被検体内導入装置を製造する必要がなく、同一構造の被検体内導入装置を複数の地域で適宜使用することができるという効果を奏する。

【0017】

また、本発明に係る被検体外装置および被検体内導入システムによれば、使用場所での無線信号の受信周波数をスイープすることで、使用場所によって異なる空きチャンネルを探索し、探索された空きチャンネルに基づき被検体内導入装置用の送信周波数を決定するようにしたので、被検体内導入装置は決定されたこの空きチャンネル対応の送信周波数を用いることで、他の電子機器等へ干渉せずに、かつ、他の電子機器等から干渉されない周波数帯域の送信周波数の利用が可能となり、使用する地域を考慮した仕向地別に送信周波数を変えた複数種類の構造の被検体内導入装置を製造する必要がなく、同一構造の被検体内導入装置を複数の地域で適宜使用することができるという効果を奏する。

【発明を実施するための最良の形態】

【0018】

以下に、本発明に係る被検体内導入装置、被検体外装置および被検体内導入システムの実施の形態を図面に基づいて詳細に説明する。なお、本発明は、以下の実施の形態に限定されるものではなく、本発明の要旨を逸脱しない範囲で種々の変更実施の形態が可能である。

【0019】

（実施の形態１）

図１は、本実施の形態１に係る被検体内導入システムの全体構成を示す模式図である。図１に示すように、被検体内導入システムは、無線受信機能を有する受信装置２と、被検体１の体内に導入され、被検体内画像を撮像して受信装置２に対してデータ送信を行うカプセル型内視鏡３とを備える。また、被検体内導入システムは、受信装置２が受信したデータに基づいて被検体内画像を表示する表示装置４と、受信装置２と表示装置４との間のデータ受け渡しを行うための携帯型記録媒体５とを備える。受信装置２は、受信用アンテナ６ａ～６ｈと、受信用アンテナ６ａ～６ｈを介して受信された無線信号に対して所定処理を行う外部装置７とによって構成される。

【0020】

表示装置４は、カプセル型内視鏡３によって取得された被検体１内の画像等を表示するためのものであり、携帯型記録媒体５を介して供給されるデータに基づいて画像表示を行うワークステーション等のような構成を有する。具体的には、表示装置４は、ＣＲＴディスプレイ、液晶ディスプレイ等によって直接画像を表示する構成としても良いし、プリンタ等のように、他の媒体に画像を出力する構成としても良い。

【0021】

携帯型記録媒体５は、受信装置２および表示装置４に対して着脱可能であって、両者に対する装着時に情報の出力および記録が可能な構造を有する。具体的には、携帯型記録媒

体５は、カプセル型内視鏡３が被検体１の体腔内を移動している間は受信装置２に装着されてカプセル型内視鏡３の位置に関する情報を記録する。具体的には、受信装置２に備わる記憶ユニット（図示せず）に対して装着し、記憶ユニットを介して情報の取得を行う。そして、携帯型記録媒体５は、カプセル型内視鏡３が被検体１から排出された後に受信装置２から取り出されて表示装置４に装着され、記録したデータが表示装置４によって読み出される構成を有する。受信装置２と表示装置４との間のデータの受け渡しをコンパクトフラッシュ（登録商標）メモリ等の携帯型記録媒体５によって行うことで、受信装置２と表示装置４との間が有線接続された場合と異なり、カプセル型内視鏡３が被検体１内部を移動中であっても、被検体１が自由に行動することが可能となる。

【0022】

受信装置２は、カプセル型内視鏡３との間で無線通信、本実施の形態ではカプセル型内視鏡３から送信される無線信号の受信を行うためのものであって、被検体外装置の一例として機能するものである。図２は、受信装置２の構成を示すブロック図である。図２に示すように、受信装置２は、受信用アンテナ６ａ～６ｈと、外部装置７とによって構成されている。

【0023】

受信用アンテナ６ａ～６ｈは、外部装置７と電気的に接続された状態で使用されるものであり、使用時に被検体１の体表面上に配置され、カプセル型内視鏡３が被検体１内に導入されている間、カプセル型内視鏡３から送信される無線信号を受信するためのものである。なお、本実施の形態１では、一例として８個の受信用アンテナ６ａ～６ｈを備えることとしたが、受信用アンテナの個数については特に限定して解釈する必要はなく、複数であれば任意の個数の受信用アンテナを用いることとして良い。

【0024】

外部装置７は、受信用アンテナ６ａ～６ｈと接続され、複数存在する受信用アンテナ６ａ～６ｈの中から受信に適したものを選択するアンテナ選択部１０と、アンテナ選択部１０によって選択された受信用アンテナを介して受信された無線信号に復調処理等を行う受信回路１１と、受信回路１１から出力された信号に対して所定の処理を施す信号処理回路１２と、信号処理回路１２によって処理されたデータを記憶する記憶部１３と、これらの各構成要素を制御する制御部１４とを備える。また、外部装置７は、上記した各構成要素に対して駆動電力を供給する電力供給部１５を備える。

【0025】

アンテナ選択部１０は、複数の受信用アンテナ６ａ～６ｈのそれぞれと接続され、受信用アンテナ６ａ～６ｈのいずれかを選択し、選択した受信用アンテナを介して受信された無線信号を受信回路１１に出力するためのものである。具体的には、例えばアンテナ選択部１０は、受信用アンテナ６ａ～６ｈのそれぞれを介して受信された無線信号の強度を比較し、最も高い強度の無線信号を受信した受信用アンテナを選択する機能を有する。

【0026】

受信回路１１は、アンテナ選択部１０から出力された無線信号に対して復調処理等を行うためのものである。記憶部１３は、カプセル型内視鏡３から送信され、受信用アンテナ６ａ～６ｈを介して受信された無線信号に基づいて生成された所定の情報、本実施の形態１の例では被検体１内部の画像を記憶するためのものである。具体的には、記憶部１３は、携帯型記録媒体５に対してデータを出力する機能を有する。なお、本実施の形態１では、受信用アンテナ６ａ～６ｈ、アンテナ選択部１０および受信回路１１を総称して無線通信部１８と称する。

【0027】

次に、カプセル型内視鏡３について説明する。カプセル型内視鏡３は、被検体内導入装置の一例として機能するためのものであり、被検体１内に導入されて被検体１に対して所定機能を実行する機能と、被検体１外部に配置される受信装置２との間で無線通信するためのものである。具体的には、カプセル型内視鏡３は、所定機能として撮像機能を有するとともに、撮像したデータを受信装置２に対して無線送信する機能を有する。

【0028】
図３は、カプセル型内視鏡の構成を示すブロック図である。カプセル型内視鏡３は、図３に示すように、被検体１の内部を撮影する際に撮像領域を照射するための照明手段として機能するＬＥＤ１９と、ＬＥＤ１９の駆動状態を制御するＬＥＤ駆動回路２０と、ＬＥＤ１９によって照射された領域からの反射光像の撮像を行う撮像手段として機能するＣＣＤ２１と、ＣＣＤ２１の駆動状態を制御するＣＣＤ駆動回路２２とを備える。ＬＥＤ１９、ＬＥＤ駆動回路２０、ＣＣＤ２１およびＣＣＤ駆動回路２２は、全体として所定の機能を果たす機能実行部として動作する。また、カプセル型内視鏡３は、ＣＣＤ２１によって撮像された画像データを変調して無線信号を生成する送信回路２３と、送信回路２３から出力されたＲＦ信号を無線送信する送信用アンテナ２４と、送信回路２３が出力する無線信号の送信周波数を変更自在に設定する送信周波数選択部２５と、ＬＥＤ駆動回路２０、ＣＣＤ駆動回路２２、送信回路２３および送信周波数選択部２５の駆動を制御する制御部２６と、各構成要素に対して駆動電力を供給する電力供給部２７とを備える。なお、本実施の形態１において、ＬＥＤ１９、ＬＥＤ駆動回路２０、ＣＣＤ２１およびＣＣＤ駆動回路２２を総称して、機能実行部２８と称する。また、送信回路２３と送信用アンテナ２４とを総称して、無線通信部２９中の無線信号送信部２９ａと称する。
【0029】
送信回路２３は、ＣＣＤ２１によって撮像された画像データに基づいて所定の送信周波数を有する無線信号を生成するためのものである。ここで、送信回路２３は、通信に使用する無線信号の送信周波数が可変自在であり、送信周波数選択部２５からの選択信号に応じて変更設定される構成を有する。図４は、送信回路２３の構成例を示すブロック図である。送信回路２３は、図４に示すように、送信周波数を異ならせるための複数、例えばＶＣＯ１～ＶＣＯ３で示す３個の電圧制御発振器３０ａ，３０ｂ，３０ｃと、電圧制御発振器３０ａ～３０ｃの入力側に位置してＣＣＤ２１からの画像信号をいずれに入力させるかを選択信号に応じて切替えるセレクタ３１と、電圧制御発振器３０ａ～３０ｃの出力側に位置していずれの送信周波数のものを出力させるかを選択信号に応じて切替えるセレクタ３２と、セレクタ３２により選択された送信周波数の画像信号を増幅するアンプ３３とを備える。なお、本実施の形態１では、説明を簡単にするため、例えば３個の電圧制御発振器３０ａ～３０ｃを備えることとしたが、電圧制御発振器の個数については特に限定して解釈する必要はなく、複数であれば任意の個数の電圧制御発振器を用いることとして良い。
【0030】
周波数設定手段として機能する送信周波数選択部２５は、送信回路２３が出力する無線信号の送信周波数を電圧制御発振器３０ａ～３０ｃにより規定されるいずれかに選択設定するためのものであり、本実施の形態１では、カプセル型内視鏡３毎に使用地域等に応じてあらかじめ設定された選択信号をセレクタ３１，３２に対して出力する。従って、或る使用地域では、送信周波数選択部２５は、セレクタ３１，３２に対して電圧制御発振器（ＶＣＯ１）３０ａを選択するように選択信号を出力し、カプセル型内視鏡３は、電圧制御発振器（ＶＣＯ１）３０ａによって決定される送信周波数の無線信号として、ＣＣＤ２１からの画像信号を送信用アンテナ２４から送信出力する。同様に、別の或る使用地域では、送信周波数選択部２５は、セレクタ３１，３２に対して電圧制御発振器（ＶＣＯ２）３０ｂを選択するように選択信号を出力し、カプセル型内視鏡３は、電圧制御発振器（ＶＣＯ２）３０ｂによって決定される送信周波数の無線信号として、ＣＣＤ２１からの画像信号を送信用アンテナ２４から送信出力する。さらに別の或る使用地域では、送信周波数選択部２５は、セレクタ３１，３２に対して電圧制御発振器（ＶＣＯ３）３０ｃを選択するように選択信号を出力し、カプセル型内視鏡３は、電圧制御発振器（ＶＣＯ３）３０ｃによって決定される送信周波数の無線信号として、ＣＣＤ２１からの画像信号を送信用アンテナ２４から送信出力する。
【0031】
このように、本実施の形態１のカプセル型内視鏡３は、通信に使用する無線信号の送信

周波数が可変自在であって、送信周波数選択部２５によって変更自在に設定されるので、送信周波数選択部２５が選択する選択信号を使用地域等に応じてあらかじめ設定しておけばよく、使用する地域を考慮した仕向地別に送信周波数を変えた複数種類の構造のカプセル型内視鏡３を製造する必要がなく、同一構造のカプセル型内視鏡３を複数の地域で適宜使用することができるという利点を有する。

【0032】

（変形例１）

本実施の形態１では、カプセル型内視鏡３は、複数の電圧制御発振器３０ａ～３０ｃを利用して送信周波数を可変自在としたが、このような方式によらず、送信周波数を可変させるようにしてもよい。図５は、カプセル型内視鏡３の送信周波数可変のための変形例１を示す概略ブロック図であり、図６は、その可変方式を示す変換特性図である。本変形例１のカプセル型内視鏡３は、入力電圧のレベルに応じた送信周波数で無線信号を出力する送信回路４０と、この送信回路４０の前段に設けられて送信周波数選択部４１からの周波数範囲を示す選択信号に応じて送信回路４０に対する入力電圧のレベルを変更させるレベル変換回路４２とを備える。

【0033】

本変形例１では、例えば図６に示すように、送信周波数選択部４１に対して周波数範囲１～４で示す４段階の離散的な周波数選択信号が用意され、それぞれの周波数選択信号に応じてレベル変換回路４２は送信回路４０に対する入力電圧のレベルをレベル範囲１～４で示す４段階の離散的な値となるように可変させるように設定されている。本変形例１では、送信周波数選択部４１は、カプセル型内視鏡３毎に使用地域等に応じてあらかじめ設定された周波数選択信号をレベル変換回路４２に対して出力する。

【0034】

（変形例２）

カプセル型内視鏡３が出力する無線信号の送信周波数を可変させるためには、送信用アンテナ２４をコイルと静電容量値が変更可能な可変容量コンデンサとからなる並列共振回路により構成し、可変容量コンデンサの静電容量値を周波数設定部の制御に基づいて可変設定するようにしてもよい。可変容量コンデンサの静電容量値を変化させることによって、コイルと可変容量コンデンサとによって形成される並列共振回路の共振周波数が変化することから、可変容量コンデンサの静電容量値を調整することによって、周波数設定部７によって設定された送信周波数の無線信号を送信することができる。

【0035】

（実施の形態２）

次に、実施の形態２に係る被検体内導入システムについて説明する。本実施の形態２に係る被検体内導入システムは、受信装置が使用場所における受信周波数のスイープにより空きチャンネルを探索し探索された空きチャンネルに基づいてカプセル型内視鏡用の送信周波数を決定してカプセル型内視鏡に送信する機能と、決定されたこの送信周波数を受信することによってカプセル型内視鏡が無線信号の送信周波数を変更する構成を有する。

【0036】

図７は、本実施の形態２に係る被検体内導入システムに備わる受信装置の構成を示すブロック図である。受信装置５０は、図７に示すように、実施の形態１と同様に受信用アンテナ６ａ～６ｈを備え、外部装置５１は、実施の形態１と同様にアンテナ選択部１０、受信回路１１、信号処理回路１２、記憶部１３、制御部１４および電力供給部１５を備えた構成を有する。一方で、本実施の形態２における受信装置５０は、この受信装置５０の使用場所における受信周波数のスイープにより空きチャンネルを探索して空きチャンネルに基づいてカプセル型内視鏡３用の送信周波数を決定してカプセル型内視鏡３に送信する機能を有する。

【0037】

具体的には、外部装置５１は、上記の構成に加え、受信装置５０の使用場所において無線信号の受信周波数をスイープして空きチャンネルを探索する空きチャンネル探索部５２

と、アンテナ選択部１０を通した受信信号をＲＦ受信回路１１に出力するか空きチャンネル探索部５２に出力するかをモード切替信号に基づいて選択するセレクタ５３と、空きチャンネル探索部５２により探索された空きチャンネルに基づいてカプセル型内視鏡３が無線通信に使用する送信周波数を決定する送信周波数決定部５４と、送信周波数を規定する信号を生成する発振器５５と、決定された送信周波数に基づいてカプセル型内視鏡３に送信する無線信号に含まれる周波数情報信号を生成する周波数情報信号生成部５６と、生成された周波数情報信号を、発振器５５によって生成された信号と合成する重畳回路５７と、重畳回路５７によって合成された信号の強度を増幅して送信用アンテナ５８に対して出力する増幅回路５９とを備える。なお、本実施の形態２において、受信用アンテナ６ａ～６ｈ、アンテナ選択部１０および受信回路１１を総称して無線信号受信部６０ａと称し、発振器５５、重畳回路５７、増幅回路５９および送信用アンテナ５８を総称して無線信号送信部６０ｂと称する。さらに、無線受信部６０ａと無線送信部６０ｂとを総称して無線通信部６１と称する。

【0038】

次に、本実施の形態２に係るカプセル型内視鏡の構成について説明する。図８は、本実施の形態２に係るカプセル型内視鏡の構成を示すブロック図である。図８に示すように、カプセル型内視鏡７０は、実施の形態１と同様に機能実行部２８を備えるとともに、無線信号の送受信機能を有する無線通信部７１を備えた構成を有する。無線通信部７１は、実施の形態１の構成に加えて、外部入力に基づいて送信周波数を設定するために無線信号受信部７２を新たに備えた構成を有し、無線信号受信部７２は、受信用アンテナ７３および受信用アンテナ７３を介して受信された無線信号に対して復調処理等を行う受信回路７４を備える。

【0039】

また、カプセル型内視鏡７０は、受信回路７４から出力された信号に所定の処理を施すことによって無線信号に含まれる送信周波数に関する周波数情報信号を抽出し、抽出した周波数情報信号を制御部２６に出力する信号処理部７５と、制御部２６に入力された周波数情報信号に基づいて送信回路２３が出力する送信周波数を選択するための選択信号を出力する送信周波数選択部２５とを備える。すなわち、本実施の形態２の送信周波数選択部２５は、外部入力である受信装置５０側からの指示に基づいて、送信周波数を設定すべく選択信号を送信回路２３に対して出力する構成とされている。送信回路２３は、送信周波数選択部２５からの選択信号に応じて選択される送信周波数の無線信号を送信出力するように周波数の可変動作を行う。

【0040】

次に、本実施の形態２に係る被検体内導入システムにおける、カプセル型内視鏡７０の送信周波数の決定並びに設定動作について説明する。図９は、制御部１４による制御の下に、空きチャンネル探索部５２、送信周波数決定部５４、周波数情報信号生成部５６並びに無線信号送信部６０ｂにより実行される送信周波数の決定並びに送信動作を説明するための概略フローチャートである。

【0041】

この処理は、当該被検体内導入システムの実際の使用に先立ち、その使用場所（例えば、病院所在地）において、受信装置５０をスイープモードに設定することにより行われる（ステップＳ１，Ｙｅｓ）。スイープモードに設定されると、制御部１４は、セレクタ５３の出力側を空きチャンネル探索部５２側に切替える（ステップＳ２）。そして、空きチャンネル探索部５２による空きチャンネル探索動作を実行させ（ステップＳ３）、当該受信装置５０の受信周波数を所定の周波数ステップで可変させる周波数スキャンを実行させる（ステップＳ４）ことで、受信周波数のスイープにより空きチャンネルを探索する（ステップＳ５）。この処理をカプセル型内視鏡７０の送信周波数として設定可能な空きチャンネル対応の周波数が見つかるまで繰り返す（ステップＳ６）。適正な空きチャンネル対応の周波数が見つかったら（ステップＳ６，Ｙｅｓ）、送信周波数決定部５４によりカプセル型内視鏡７０が当該場所で使用する送信周波数として決定する（ステップＳ７）。そ

して、周波数情報信号生成部５６および無線信号送信部６０ｂは、決定された送信周波数の情報を含む周波数情報信号を送信用アンテナ５８からカプセル型内視鏡７０側に送信出力する（ステップＳ８）。

【0042】

カプセル型内視鏡７０側では、受信装置５０の送信用アンテナ５８から送信される周波数情報信号を含む無線信号を受信用アンテナ７３により受信し、信号処理部７５で無線信号に含まれる決定された送信周波数に関する周波数情報信号を抽出する。そして、制御部２６は、この周波数情報信号に対応する選択信号を送信周波数選択部２５に設定し、送信周波数選択部２５は、送信回路２３が受信装置５０側で決定された送信周波数の無線信号を出力するように送信周波数の選択動作を行わせる。

【0043】

このように、本実施の形態２の被検体内導入システムは、実際の使用場所での無線信号の受信周波数をスイープすることで、使用場所によって異なる空きチャンネルを探索し、探索された空きチャンネルに基づきカプセル型内視鏡７０用の送信周波数を決定するようにしたので、カプセル型内視鏡７０は決定されたこの空きチャンネル対応の送信周波数を用いることで、他の電子機器等へ干渉せずに、かつ、他の電子機器等から干渉されない周波数帯域の送信周波数の利用が可能となり、使用する地域を考慮した仕向地別に送信周波数を変えた複数種類の構造のカプセル型内視鏡を製造する必要がなく、同一構造のカプセル型内視鏡７０を複数の地域で適宜使用することができるという利点を有する。

【図面の簡単な説明】

【0044】

【図1】本実施の形態１に係る被検体内導入システムの全体構成を示す模式図である。

【図2】受信装置の構成を示すブロック図である。

【図3】カプセル型内視鏡の構成を示すブロック図である。

【図4】送信回路の構成例を示すブロック図である。

【図5】カプセル型内視鏡の送信周波数可変のための変形例１を示す概略ブロック図である。

【図6】図５の可変方式を示す変換特性図である。

【図7】本実施の形態２に係る被検体内導入システムに備わる受信装置の構成を示すブロック図である。

【図8】本実施の形態２に係るカプセル型内視鏡の構成を示すブロック図である。

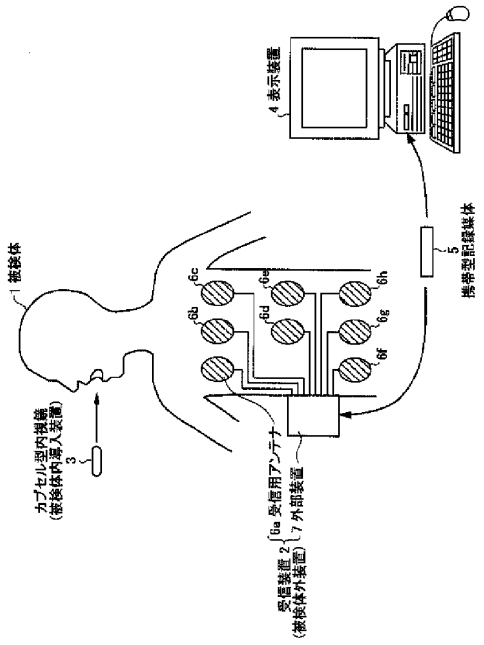
【図9】送信周波数の決定並びに送信動作を説明するための概略フローチャートである。

【符号の説明】

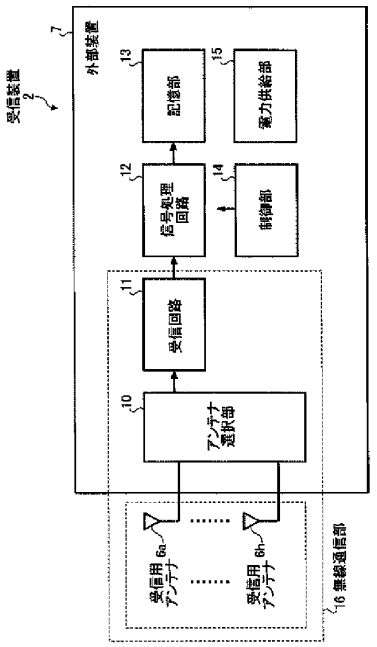
【0045】

１　被検体
２　受信装置
３　カプセル型内視鏡
２１　ＣＣＤ
２５　送信周波数選択部
２８　機能実行部
２９　無線通信部
２９ａ　無線信号送信部
５０　受信装置
５２　空きチャンネル探索部
５４　送信周波数決定部
６０ｂ　無線信号送信部
６１　無線通信部
７２　無線信号受信部

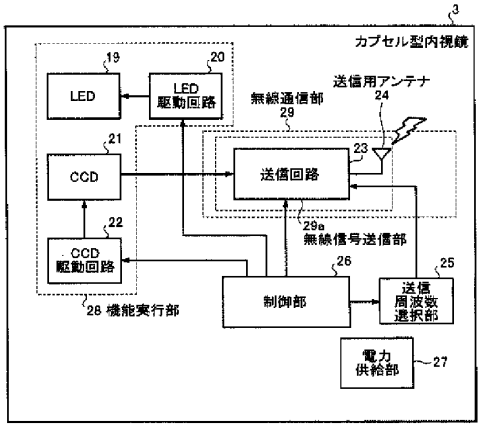
【図1】


4 表示装置
1 被検体
5 携帯型記録媒体
6c
6a
6b
6d
6e
6f
6g
6h
カプセル型内視鏡
(被検体内導入装置)
3
6a 受信用アンテナ
7 外部装置
受信装置 2
(被検体外装置)

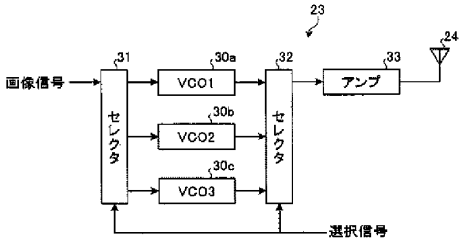
【図2】


受信装置
2
7 外部装置
13 記憶部
15 電力供給部
12 信号処理回路
14 制御部
11 受信回路
10 アンテナ選択部
6a 受信用アンテナ
6h 受信用アンテナ
16 無線通信部

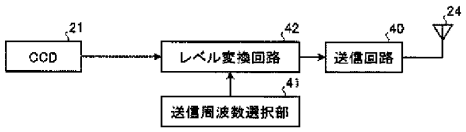
【図3】


3
カプセル型内視鏡
19 LED
20 LED駆動回路
無線通信部
29
送信用アンテナ
24
21 CCD
23 送信回路
22 CCD駆動回路
29a 無線信号送信部
26 制御部
25 送信周波数選択部
28 機能実行部
電力供給部
27

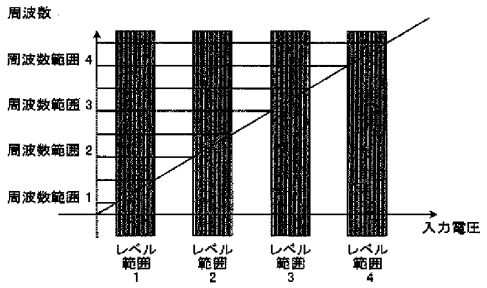
【図4】


23
24
画像信号
31 セレクタ
30a VCO1
30b VCO2
30c VCO3
32 セレクタ
33 アンプ
選択信号

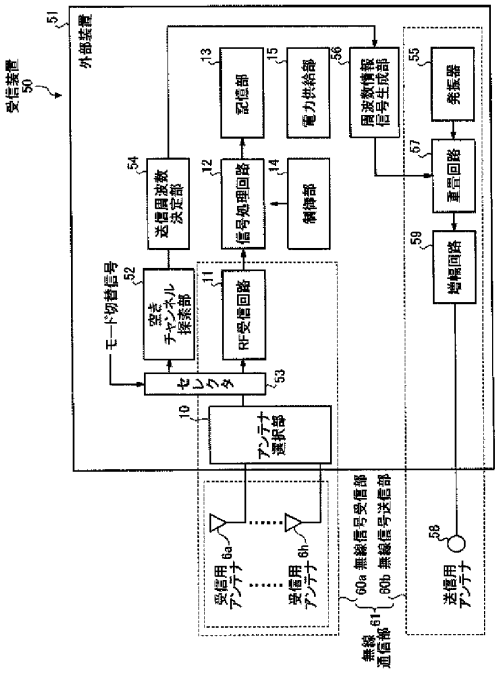
【図5】


CCD
21
レベル変換回路
42
送信回路
40
24
送信周波数選択部
41

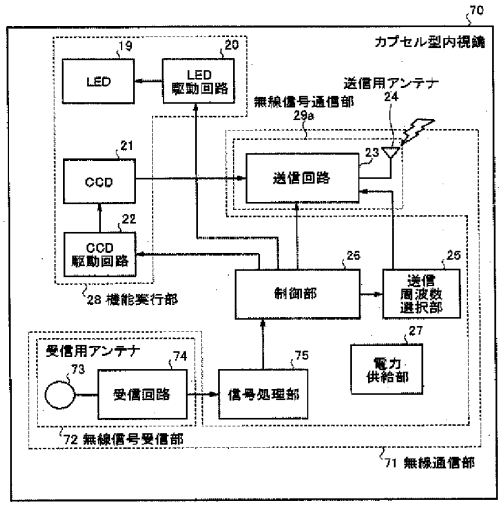
【図6】


周波数
周波数範囲 4
周波数範囲 3
周波数範囲 2
周波数範囲 1
入力電圧
レベル範囲 1
レベル範囲 2
レベル範囲 3
レベル範囲 4

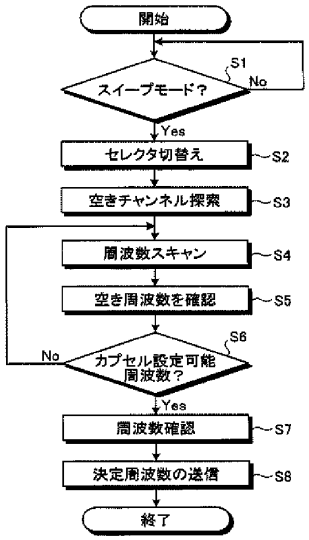
【図7】


外部装置
51
受信装置
50
記憶部
13
電力供給部
15
周波数情報信号生成部
56
発振器
55
送信周波数決定部
54
信号処理回路
12
制御部
14
通信回路
67
増幅回路
59
モード切替信号
空きチャンネル探索部
52
RF受信回路
11
セレクタ
53
アンテナ選択部
10
受信用アンテナ
8a
受信用アンテナ
8b
無線信号受信部
60a
無線信号送信部
60b
無線通信部
61
送信用アンテナ
58

【図8】


70
カプセル型内視鏡
LED
19
LED駆動回路
20
送信用アンテナ
無線信号通信部
24
29a
CCD
21
送信回路
23
CCD駆動回路
22
制御部
26
送信周波数選択部
25
28 機能実行部
受信用アンテナ
73
受信回路
74
信号処理部
75
電力供給部
27
72 無線信号受信部
71 無線通信部

【図9】


開始
スイープモード？
S1
No
Yes
セレクタ切替え
S2
空きチャンネル探索
S3
周波数スキャン
S4
空き周波数を確認
S5
カプセル設定可能周波数？
S6
No
Yes
周波数確認
S7
決定周波数の送信
S8
終了

Electronic Patent Application Fee Transmittal

Application Number:	14738789
Filing Date:	12-Jun-2015
Title of Invention:	Calf Bolus
First Named Inventor/Applicant Name:	Nicholas P. Rettedal
Filer:	Craig R. Miles/Lioudmila Townsend
Attorney Docket Number:	bellaUScalf (280-10)

Filed as Small Entity

Filing Fees for Utility under 35 USC 111(a)

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Miscellaneous:				
SUBMISSION- INFORMATION DISCLOSURE STMT	2806	1	90	90
		Total in USD ($)		**90**

Electronic Acknowledgement Receipt	
EFS ID:	28336175
Application Number:	14738789
International Application Number:	
Confirmation Number:	8986
Title of Invention:	Calf Bolus
First Named Inventor/Applicant Name:	Nicholas P. Rettedal
Customer Number:	39208
Filer:	Craig R. Miles/Lioudmila Townsend
Filer Authorized By:	Craig R. Miles
Attorney Docket Number:	bellaUScalf (280-10)
Receipt Date:	13-FEB-2017
Filing Date:	12-JUN-2015
Time Stamp:	13:35:39
Application Type:	Utility under 35 USC 111(a)

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Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	$90
RAM confirmation Number	021317INTEFSW13360700
Deposit Account	
Authorized User	
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New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the application of: Nicholas P. Rettedal, Stephen M. Weilnau, Scott R. Cockroft, and Joseph Janus IV

Application No.: 14/738,789

Filed: June 12, 2015

For: Calf Bolus

Attorney Docket No.: bellaUScalf (280-10)

Confirmation No.: 8986

Group Art Unit: 3766

Examiner: Heller, Tammie K.

Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

LETTER OF TRANSMITTAL

Sir/Madam:

Please find attached for entry into the above-identified patent application, documents as follow:

1. a Supplemental Information Disclosure Statement under 37 C.F.R. § 1.97 (c)(2) (1 page(s));

2. a Supplemental Information Disclosure Statement (1 page(s)) along with copies of each cited reference not already available at the PTO; and

3. this firm Letter of Transmittal (2 page(s)).

I have this 13 day of February, 2017, either myself personally, or through my direction of staff at this office, deposited all of the items listed in this Letter of Transmittal with the United States Patent and Trademark Office via EFS-Web.

Please enter the submitted documents into the above-identified patent application.

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 295 of 607

Direct all correspondence to:

CR MILES P.C.
405 Mason Court, Suite 119
Fort Collins, CO 80524

Customer No.: 39208

Dated this 13 day of February, 2017

Respectfully Submitted,

CR MILES P.C.

By: _____

Craig R. Miles
ATTORNEY FOR APPLICANT
USPTO Reg. No. 45,954
405 Mason Court, Suite 119
Fort Collins, CO 80524
(970) 492-0000
(970) 492-0003 facsimile

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

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Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT UNDER 37 C.F.R. §1.97(c)(2)

Applicant respectfully requests entry of this Supplemental Information Disclosure Statement under 37 C.F.R. §1.97(c)(2). Applicant claims small entity status under 37 C.F.R. § 1.27, therefore Applicant submits the fee of $90.00 because the supplemental information disclosure statement was made after the mailing date of the first official action on the merits.

Dated this 3 day of March, 2017

Respectfully Submitted,

CR MILES P.C.

By: _____

Craig R. Miles
ATTORNEY FOR APPLICANT
USPTO Reg. No. 45,954
405 Mason Court, Suite 119
Fort Collins, CO 80524
(970) 492-0000
(970) 492-0003 facsimile

SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT BY APPLICANT	Application Number	14/738,789
	Filling Date	June 12, 2015
	First Named Inventor	Nicholas P. Rettedal
	Art Unit	3766
	Examiner Name	Heller, Tammie K.
	Attorney Docket Number	bellaUScalf (280-10)
Sheet 1 of 1	Express Mail Label No.:	-

NON-PATENT LITERATURE DOCUMENTS

EXAMINER INITIALS	CITE NO.	AUTHOR, title of article, title of item, date, page(s), volume-issue number(s), publisher, city and /or country where published	T2
		CARNÉ et al. Modeling the retention of rumen boluses for the electronic identification of goats. J Dairy Sci, February 2011, 94(2), pp. 716-726 (abstract only, 2 pages total).	
		GHIRARDI et al. Retention of different sizes of electronic identification boluses in the forestomachs of sheep. J Anim Sci, November 2006, 84(10), pp. 2865-2872.	

EXAMINER SIGNATURE:	DATE CONSIDERED:

Electronic Patent Application Fee Transmittal

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Filing Date:	12-Jun-2015
Title of Invention:	Calf Bolus
First Named Inventor/Applicant Name:	Nicholas P. Rettedal
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Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
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Patent-Appeals-and-Interference:				
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Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Miscellaneous:				
SUBMISSION- INFORMATION DISCLOSURE STMT	2806	1	90	90
		Total in USD ($)		**90**

Electronic Acknowledgement Receipt	
EFS ID:	28533646
Application Number:	14738789
International Application Number:	
Confirmation Number:	8986
Title of Invention:	Calf Bolus
First Named Inventor/Applicant Name:	Nicholas P. Rettedal
Customer Number:	39208
Filer:	Craig R. Miles/Lioudmila Townsend
Filer Authorized By:	Craig R. Miles
Attorney Docket Number:	bellaUScalf (280-10)
Receipt Date:	03-MAR-2017
Filing Date:	12-JUN-2015
Time Stamp:	17:59:05
Application Type:	Utility under 35 USC 111(a)

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Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	$90
RAM confirmation Number	030617INTEFSW17595300
Deposit Account	
Authorized User	
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File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Transmittal Letter	Transmittal_Letter.pdf	39191 96fde157e6fac9636f303b21a9370c2b12aa7a1f	no	2
Warnings:					
Information:					
2	Information Disclosure Statement (IDS) Form (SB08)	Statement.pdf	30070 fb00482a2f0d532bf8869528bc3943136e8bc05d	no	1
Warnings:					
Information:					
This is not an USPTO supplied IDS fillable form					
3	Information Disclosure Statement (IDS) Form (SB08)	Citation.pdf	29034 342bf34b24cc03782aa279f46252ac47a36da159	no	1
Warnings:					
Information:					
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4	Non Patent Literature	CARNE.pdf	103049 5b121118c1e5b6f8c00b34aa6eace22378ede828	no	2
Warnings:					
Information:					
5	Non Patent Literature	GHIRARDI.pdf	782139 97d0fb764b26d722481eb6f76783ee75c5ee5300	no	8
Warnings:					
Information:					
6	Fee Worksheet (SB06)	fee-info.pdf	30729 d99a10c7eb857ff86a3fcf864ea05ccecac5d589	no	2

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New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the application of: Nicholas P. Rettedal, Stephen M. Weilnau, Scott R. Cockroft, and Joseph Janus IV

Application No.: 14/738,789

Filed: June 12, 2015

For: Calf Bolus

Attorney Docket No.: bellaUScalf (280-10)

Confirmation No.: 8986

Group Art Unit: 3766

Examiner: Heller, Tammie K.

Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

LETTER OF TRANSMITTAL

Sir/Madam:

Please find attached for entry into the above-identified patent application, documents as follow:

1. a Supplemental Information Disclosure Statement under 37 C.F.R. § 1.97 (c)(2) (1 page(s));

2. a Supplemental Information Disclosure Statement (1 page(s)) along with copies of each cited reference not already available at the PTO; and

3. this firm Letter of Transmittal (2 page(s)).

I have this 3 day of March, 2017, either myself personally, or through my direction of staff at this office, deposited all of the items listed in this Letter of Transmittal with the United States Patent and Trademark Office via EFS-Web.

Please enter the submitted documents into the above-identified patent application.

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 304 of 607

Direct all correspondence to:

CR MILES P.C.
405 Mason Court, Suite 119
Fort Collins, CO 80524

Customer No.: 39208

Dated this 3 day of March, 2017

Respectfully Submitted,

CR MILES P.C.

By: _____

Craig R. Miles
ATTORNEY FOR APPLICANT
USPTO Reg. No. 45,954
405 Mason Court, Suite 119
Fort Collins, CO 80524
(970) 492-0000
(970) 492-0003 facsimile

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the application of: Nicholas P. Rettedal, Stephen M. Weilnau, Scott R. Cockroft, and Joseph Janus IV	**Confirmation No.:** 8986
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Mail Stop Amendment
Commissioner for Patents
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Alexandria, VA 22313-1450

RESPONSE AND REQUEST FOR RECONSIDERATION UNDER 37 C.F.R.§ 1.111

This paper is submitted in response to the non-final Office Action mailed on November 1, 2016. Applicant believes that this response addresses each concern raised by the Examiner in the Office Action and each of the claims without amendment is now in condition for allowance. A two (2) month extension of time from February1, 2017 to and including April 1, 2017, is submitted herewith. Please amend the above-identified United States patent application as follows.

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 306 of 607

SUBSTITUTE SPECIFICATION

A Substitute Specification in compliance with 37 CFR 1.125(c) is herewith submitted. Following, Applicant submits a Substitute Specification including a "marked up" version of the Specification and a "clean" version of the Specification. The Substitute Specification contains no new matter. Applicant respectfully requests that the Substitute Specification be entered into the file.

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 307 of 607

AMENDMENTS TO THE DRAWINGS

It is respectfully requested that Drawing Sheets 1, 2 and 4, Figures 1, 2 and 4 be amended without prejudice, without admission, without surrender of subject matter, and without intention of creating any estoppel as to equivalents.

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 308 of 607

ABSTRACT AMENDMENT

It is respectfully requested that the Abstract be amended without prejudice, without admission, without surrender of subject matter, and without intention of creating any estoppel as to equivalents, as follows.

Please replace the Abstract on Page 43 to read as follows:

~~--Generally, an~~ An animal monitoring device configured as a bolus for oral administration to reside in the reticulorumen of a ruminant animal. The animal monitoring device ~~having~~ includes a memory element, a processor in communication with the memory element and a computer code contained in the memory element. The computer code includes ~~including~~ a power management module executable by the processor to regulate power use by the bolus based on determination of remaining energy stored in an energy source and the determined power requirements over a pre-determined life cycle of the bolus.--

Applicant provides a substitute Abstract on a separate sheet, as the Abstract has been substantially rewritten and the amended abstract bears little or no resemblance to the previously filed version of the abstract. Accordingly, a substitute Abstract is provided in clean form, whereby the substitute Abstract replaces the previous version of the Abstract.

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 309 of 607

CLAIM AMENDMENTS

It is respectfully requested that the claims be amended without prejudice, without admission, without surrender of subject matter, and without intention of creating any estoppel as to equivalents, as follows. This listing of claims will replace all prior versions, and listings, of claims in the application.

Listing of Claims:

1-36 (canceled).

37 (currently amended). A method of monitoring ~~the~~ physiological parameters of [[an]] a ruminant animal, comprising:

obtaining a bolus configured for oral administration to [[a]] said ruminant animal, said bolus including:

one or more sensors each capable of generating a sensor signal which varies based on a corresponding change in one or more physiological parameters of [[a]] said ruminant animal;

a processor;

a non-transitory computer readable medium containing a computer code including a power management module executable by said processor to enable or disable said one or more sensors ~~memory element~~;

~~a processor in communication with said memory element;~~

~~a computer code contained in said memory element, said computer code containing a power management module executable by said processor to enable and or disable said one or more of said plurality of sensors~~, said power management module enabling or disabling said one more sensors coordinated with a plurality of stages in the lifespan of said ruminant animal; and

a housing providing an outer most external surface of said bolus; and

orally administering said bolus to said ruminant animal, ~~to dispose~~ said bolus retained in a reticulorumen of said ruminant animal.

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 310 of 607

38 (canceled).

39 (currently amended). The method of claim 37, further comprising enabling or disabling said one or more sensors based upon a pre-determined set of said one or more physiological parameters to be sensed during said [[a]] stage in [[a]] said life cycle of said ruminant animal.

40 (canceled).

41 (currently amended). The method of claim 37, further comprising:

monitoring said sensor signal from said one or more sensors outside of said ruminant animal;

comparing said sensor signal from ~~said one or more~~ a first sensors to a first pre-selected activation code having a first pre-selected activation match threshold; and

activating said bolus ~~from said one or more sensors which by comparison to said first~~ upon occurrence of said pre-selected activation code which exceeds [[a]] said first pre-selected activation match threshold.

42 (currently amended). The method of claim [[41]] 37, further comprising:

monitoring said sensor signal from said one or more sensors;

comparing a first sensor signal from a first sensor to a first pre-selected activation code having a first pre-selected activation match threshold;

comparing ~~said~~ a second sensor signal from ~~said one or more sensors~~ a second sensor to a second pre-selected activation code having a second pre-selected activation match threshold; and

activating said bolus upon generation of said first and second sensor signals from said ~~one or more~~ first and second sensors which by comparison to said first and said second pre-selected activation codes exceeds said first and said second pre-selected activation match threshold.

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 311 of 607

43 (currently amended). The method of claim 42, further comprising:

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; and

storing said encoded physiological data in said non-transitory computer readable medium ~~memory element~~.

44 (original). The method of claim 43, wherein said bolus further comprises a radio signal generator capable of generating a radio signal to carry said encoded physiological data, and further comprising:

enabling said radio signal generator; and

activating said radio signal generator at pre-determined intervals to generate said radio signal to carry said encoded physiological data.

45 (original). The method of claim 44, wherein said bolus further comprises an energy source which supplies energy to operate said bolus, and further comprising:

determining a remaining amount of energy stored in said energy source;

determining an amount of energy required by said bolus to operate through a pre-determined period of time based on current programming of said computer code;

comparing said amount of energy required by said bolus to operate through said pre-determined period of time to said remaining amount of energy stored in said energy source; and

calculating a difference in said amount of energy remaining in the power source and said amount of energy required by said bolus to operate through said pre-determined period of time.

46 (original). The method of claim 45, further comprising performing one or more power regulation events to offset said difference in said amount of energy remaining in the power source and said amount of energy required by said bolus to operate through said pre-determined period of time.

47 (canceled).

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 312 of 607

48 (previously presented). The method of claim 46, further comprising generating a radio signal having a frequency of between about 700MHz to about 1GHz.

49 (original). The method of claim 48, wherein said frequency is selected from the group consisting of: between about 700 MHz to about 800MHz, 750 MHz to about 850MHz, about 800 MHz to about 900MHz, 850 MHz to about 950MHz, 900 MHz to about 1GHz.

50 (currently amended). The method of claim 49, wherein said bolus further comprises matching elements ~~configured to~~ which adjusts said frequency of said radio signal ~~, and further comprising adjusting said frequency~~ to compensate for change in said frequency of said radio signal upon passing through a mass of said ruminant animal.

51 (original). The method of claim 50, wherein said radio signal generator generates said radio signal having only one frequency.

52 (original). The method of claim 51, wherein said bolus further comprises an antenna having a pair of electrically conductive loops disposed a distance apart and further comprising transmitting said radio signal through said antenna.

53 (original). The method of claim 52, 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.

54 (original). The method of claim 53, wherein said antenna further comprises one or more vias interconnecting said pair of electrically conductive loops.

55 (original). The method of claim 54, wherein said antenna further comprises a non-conductive sheet material disposed between said pair of electrically conductive loops.

56-63 (canceled).

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 313 of 607

64 (currently amended). The method of claim 46, wherein said bolus further comprises a radio signal receiver and further comprising:

receiving radio signal containing programming data; and

re-programming said computer code contained within said non-transitory computer readable medium ~~memory element~~.

65 (currently amended). The method of claim 64, ~~further comprising~~ wherein said re-programming said computer code is based upon ~~based upon said~~ a pre-determined set of said ~~plurality of~~ physiological parameters to be sensed during ~~said~~ a stage in ~~said~~ a life cycle of said ruminant animal.

66 (currently amended). The method of claim [[65]] 64, ~~further comprising~~ wherein said re-programming said computer code to offset said difference in said amount of energy remaining in the power source and said amount of energy required by said bolus to operate through said pre-determined period of time.

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 314 of 607

REMARKS

Applicant provides the following remarks to the non-final action mailed November 1, 2016.

1. Status Of The Claims. Claims 37-39, 41-46, 48-55 and 64-66 are pending in the subject application. Claim 65 is objected to due to informalities. Claim 39 is rejected under 35 U.S.C. Section 112(a) as failing to comply with the enablement requirement. Claims 37-39, 41-46, 48-55 and 64-66 are rejected under 35 U.S.C. Section 112(b) as being indefinite for failing to particularly point out and distinctly claim the subject matter which the inventor regards as the invention. Claims 37-39, 41-46, 48-55 and 64-66 are rejected under 35 U.S.C. Section 101 because the claimed invention is directed to non-statutory subject matter. Claims 37-39 are rejected under 35 U.S.C. Section 102 (a)(1) as being anticipated by United States Patent No. 6,371,927 to Brune et al. ("*Brune*"). Claims 37-39 and 41-46 are rejected under 35 U.S.C. Section 102 (a)(1) as being anticipated by or, in alternative, under 35 U.S.C. Section 103 as being obvious over, United States Patent Publication No. 2009/0030279 of Zander et al. ("*Zander*").

Claims 37, 39, 41-43, 50, and 64-66 have been amended without the addition of any new matter. Claims 1-36, 38, 40, 47, and 56-63 have been without prejudice canceled. Applicant respectfully reserves the right to pursue any non-elected claims, canceled or otherwise unclaimed subject matter in one or more continuation, continuation-in-part, or divisional applications.

2. Specification.

Examiner objects to the Abstract because it is a single run on sentence. Applicant submits a substitute Abstract consistent with *MPEP § 608.01(b)* on a separate sheet without the addition of any new matter.

Examiner also object to informalities in the disclosure. Accordingly, Applicant herewith submits a Substitute Specification in compliance with 37 CFR 1.125(c), without the addition of any new matter, to address the informalities indicated by the Examiner.

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 315 of 607

3. **Drawings**. The Examiner objects to the drawings because Figures 1-3 consist of blocks without a functional description of what they represent. Applicant believes that drawings should not contain text matter, except a single word or words, when absolutely indispensable. *MPEP* §1825. Accordingly, it is preferred to have blocks that do not contain words. Applicant has reviewed the Specification to ascertain that the number associated with each block in Figures 1-3 is also associated with a corresponding element described in the specification such that one of ordinary skill reading the description in review of the Figures would have sufficient information regarding the subject matter of each block to make and use the claimed invention. Accordingly, Applicant understands the Examiner's concern as being one of enablement as opposed to an informality in the drawing sheets. Applicant has reviewed the specification for informalities as Examiner suggests to make certain that the correct numerical identifiers are included in the specification in correspondence to the correspondingly numbered blocks in the Figures.

Applicant submits replacement Drawing Sheets 1, 2 and 4 including Figures 1, 2 and 4 without the addition of new matter. Figure 1 has been amended to add element "56" which is supported by the specification at page 16:3. Figure 2 has been amended to replace "14A" with "14B" which is supported by the specification at page 14:21. Figure 4 has been amended to add elements "49" and "50" which is supported by the specification at 13:21-23 and to add element "32" which is supported by the specification at 10:27-30.

4. **The Claim Objections Are Overcome.** The Examiner objects to Claim 65 as including "based upon" repeated twice. Applicant has deleted the first use of "based upon." Applicant respectfully requests that the objection be withdrawn.

5. **The Rejections Under 35 U.S.C. Section 112 (a) Are Overcome.** Examiner asserts that the specification fails to adequately describe how the one or more sensors are enabled or disabled based on a pre-determined set of parameters sensed to enable Claim 39 including the language "enabling or disabling said one or more sensors based upon a pre-determined set of said one or more physiological parameters to be sensed during a stage in a life cycle of said ruminant animal." *Office Action* at Page 4.

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 316 of 607

Applicant believes that this language of claim 39 is fully enabled by the specification. The specification first describes that:

> "the power management module (12), can but need not necessarily include, an activation element (43) which functions to enable and encode the sensor signal(s)(14) from one or more sensors (13)"
>
> *Specification* 12:23-27.

At least one working example is set out at page 15, lines 11-25, as follows:

> As to particular embodiments, the power management module (12) can regulate energy (42) use by the bolus (1) by enabling or disabling one or more sensors (13) based upon a pre-determined set of physiological parameters (2) to be sensed during one or more stages (52) in a lifespan (53) of the ruminant animal (3). The encoded physiological data (19) useful in make determinations relating to a ruminant animal (3) may be different in a first stage (54) in the lifespan (53)(for example, the time period between birth and puberty) as compared to a second stage (55)(for example, the time period commencing with puberty until the end of reproductive age (or useful reproductive age))(as shown in the example of Figure 1). As one illustrative example in dairy cows, from the birth until puberty in dairy cows at about eight months to about seventeen months age depending upon the breed, the useful encoded physiological data (19) may only include encoded physiological data (19) relating to temperature (57). Accordingly, in a first stage (54) of the ruminant animal (3) lifespan (53) the power management module (12) can function upon activation of the bolus (1), as above described, to only enable and periodically read the sensor signal (14A) and generate encoded physiological data (19) for temperature (57) of the ruminant animal (3).

Accordingly, a person of ordinary skill would readily understand that based upon a pre-determined set of one or more physiological parameters to be sensed during a stage in a life cycle of a ruminant animal one more sensors can be correspondingly enabled or disabled.

6. **<u>The Rejections Under 35 U.S.C. Section 112 (b) Are Overcome</u>.** Examiner rejects Claims 37-39, 41-46, 48-55 and 64-66 as being indefinite.

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 317 of 607

In regard to Claim 37, Applicant has deleted "the" before "physiological parameters."

In regard to Claim 37, Applicant has made consistent the use of "ruminant animal" so that it is clear that each use refers to the same ruminant animal.

In regard to Claim 37, Applicant has deleted "of said plurality of" before "sensors" to provide antecedent basis for "said one or more sensors."

In regard to Claim 38, Claim 38 has been canceled making any response moot.

In regard to Claim 41, Applicant has amended Claim 41 to recite:

> "monitoring said sensor signal from said one or more sensors outside of said ruminant animal;
> comparing said sensor signal from a first sensor to a first pre-selected activation code having a first pre-selected activation match threshold; and
> activating said bolus upon occurrence of said pre-selected activation code which exceeds said first pre-selected activation match threshold."

This amendment is supported by the specification at page 12:23-31 and page 13:1-22. Applicant believes this addresses the concern raised in Items 17. and 18. of the Action.

In regard to Claim 42, Applicant has amended Claim 42 to recite:

> "monitoring said sensor signal from said one or more sensors;
> comparing a first sensor signal from a first sensor to a first pre-selected activation code having a first pre-selected activation match threshold;
> comparing a second sensor signal from a second sensor to a second pre-selected activation code having a second pre-selected activation match threshold; and
> activating said bolus upon generation of said first and second sensor signals from said first and second sensors which by comparison to said first and said second pre-selected activation codes exceeds said first and said second pre-selected activation match threshold."

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 318 of 607

The amendment is supported by the Specification at 14:1-31 and 15:1-4.

Applicant believes this addresses the concern raised in Items 19. through 22. of the *Action.*

In regard to Claim 50, Applicant has amended Claim 50 to make clear that the frequency of the radio signal is adjusted to compensate for a change in the frequency passing through the ruminant animal.

In regard to Claim 51, Applicant believes that "said radio signal generator" has antecedent basis in Claim 44.

In regard to Claim 65, Applicant has amended Claim 65 to recite:

> "wherein said re-programming said computer code is based upon a pre-determined set of said physiological parameters to be sensed during a stage in a life cycle of said ruminant animal."

Applicant believes this addresses each concern raised in Items 26. - 30. of the *Action.*

In regard to Claim 66, Applicant has replaced "further comprising" with -- wherein said -- to make clear the term "re-programming."

Applicant believes that the above remarks and fully address the Section 112(b) concerns raised by Examiner. Applicant respectfully requests that Examiner withdraw each of the rejections based on Section 112(b).

7. **The Rejections Under 35 U.S.C. Section 101 Is Overcome.** The Examiner has rejected Claims 37-39, 41-46. 48-55, and 64-66 as being directed to non-statutory subject matter. Applicant has amended Claim 37 to recite "a non-transitory computer readable medium containing a computer code including a power management module executable by said processor to enable or disable said one or more sensors." To be clear, the use of the term

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 319 of 607

"*non-transitory* computer-readable media" comprises all computer-readable media, with the sole exception being a transitory, propagating signal.

8. The Rejections Under 35 U.S.C. Section 102 As Anticipated by *Brune* Are Overcome. In the present application, the Examiner rejected Claims 37-39 as being anticipated by *Brune*.

A claim is anticipated only if "each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference." *Verdegaal Bros. v. Union Oil Co. of California, 814 F.2d 628, 631 (Fed. Cir. 1987); MPEP 2131.* "The identical invention must be shown in as complete detail as is contained. . .in the claim." *Richardson v. Suzuki Motor Co., 868 F.2d 1225, 1236 (Fed. Cir. 1989).* Moreover, the elements must be arranged as required by the claim. *En re Bond, 910 F.2d 831 (Fed.Cir. 1990); MPEP 2131.*

Claim 37. Applicant has amended claim 37 to further include the elements of "said power management module enabling or disabling said one more sensors coordinated with a plurality of stages in the lifespan of said ruminant animal." This amendment is supported by the original language of Claim 38, now canceled, and the specification at page 16:14-26 which for the convenience of the Examiner is set forth, as follows:

> "the power management module (12) can further include a timer element (59) which functions to assess elapsed time from activation of the bolus (1) allowing regulation of energy use by the bolus (1) based on elapsed time which can be coordinated to one or more of the stages (52) in the lifespan (53) of the ruminant animal (3). As one illustrative example, if the bolus (1) is orally administered at birth the timer element (59) and the power management module (12) can function to enable a first sensor (13A)(or first set of sensors (13) providing useful encoded physiological data (19) during the first stage (54)) and encode physiological data (19) for temperature (57)(or first set of physiological parameters) for a period of time corresponding the first stage (54) of the lifespan (53) of the ruminant animal (3)(for example, between birth and puberty) and then function to further enable a second sensor (13B)(or second set of sensors (13) providing useful encoded physiological data (19) during a second stage (55) of the ruminant animal (3)) and encode physiological data (19) for both temperature (57) and movement (58)."

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 320 of 607

Brune teaches "bolus in sleeping mode until data bursts cycles are triggered." *Brune* 6:47. *Brune* also teaches that "[u]pon receipt of the positive transition of the clock, the microprocessor "wakes up". . .at which time microprocessor U1 will query the temperature sensor." 7:35-43. *Brune* does not contemplate nor teach or suggest enabling or disabling sensors based upon a stage in a life cycle of the ruminant animal.

Claim 38. Claim 38 has been canceled making any response moot.

Claim 39. Based upon the same reasoning as for Claim 37, *Brune* does not teach all the elements of Claim 39 including at least "enabling or disabling said one or more sensors based upon a pre-determined set of said one or more physiological parameters to be sensed during said stage in said life cycle of said ruminant animal."

9. The Rejections Under 35 U.S.C. Section 102 As Anticipated by *Zander* Are Overcome.

In the present application, Examiner rejected Claims 37-39 and 41-44 as being anticipated by *Zander*.

Claim 37. Applicant claims "orally administering said bolus to said ruminant animal, said bolus retained in a reticulorumen of said ruminant animal." Applicant discloses that "a bolus which can reside in the reticulorumen of a ruminant animal having an operational lifespan corresponding to the entire lifespan or the productive lifespan of the ruminant animal." Specification 2:1-3. By way of differentiation, *Zander* teaches "endoscopic pills. . .support the image capture and transmission needs of the pill as it passes through the entire gastrointestinal (GI) tract. Unfortunately, it can take up to seventy-two hours or longer for the endoscopic pill to pass through the GI tract." *Zander* at ¶0005. "Figure 1. . .designed for human or animal use and such is preferably sized to pass through the alimentary canal with little or no discomfort." Id. at ¶0033. *Zander* does not even contemplate any capsule that is retained in the reticulorumen of a ruminant animal.

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 321 of 607

Accordingly, *Zander* does not teach all the elements of Claim 37 and therefore does not anticipate Claim 37. Claims 38-39 and 41-44 are made ultimately dependent on Claim 37. Claims in dependent form shall be construed to include all the limitations of the claim incorporated by reference into the dependent claim. MPEP 608.01 (n). Accordingly, Claims 38-39 and 41-44 are also not anticipated by *Zander*.

10. The Rejections Under 35 U.S.C. Section 103 as being obvious over, *Zander* Are Overcome.

Examiner rejects Claims 37-39 and 41-44 as being obvious over *Zander*.

To reject a claim based on combining prior art elements according to known methods, the office must resolve the Graham factual inquires and provide a finding that the prior art included each element claimed. *MPEP §2143 A (1).* Basic knowledge or common sense cannot replace documentary evidence to provide a finding that the prior art included each element. *K/S HIMPP v. Hear-Wear Techs., LLC*, 751 F.3d 1362, 1366 (Fed. Cir. 2014). One skilled in the art could have combined the elements as claimed by known methods, and that in combination, each element performs the same function as it does separately. *MPEP §2143 A (2).* The combination yielded nothing more than predictable results to one of ordinary skill in the art. *MPEP §2143 A (3).* If any these findings cannot be made, then this rationale cannot be used to support a conclusion that the claim would have been obvious to one of ordinary skill in the art. *MPEP §2143 A (1).*

The Examiner bears the initial burden of factually supporting any *prima facie* conclusion of obviousness. *MPEP 2142.* If the Examiner does not produce a *prima facie* case, the Applicant is under no obligation to submit evidence of nonobviousness. *Id.*

Claims 45-46, 48-55, and 64-66 Have Not Been Examined For Every Statutory Requirement.

"It is essential that patent applicants obtain a prompt yet complete examination of their applications. Under the principles of compact prosecution, each claim should be reviewed for compliance with every statutory requirement for patentability in the initial review of the application, even if one or more claims are found to be deficient with respect to some statutory

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 322 of 607

requirement. Thus, USPTO personnel should state all reasons and bases for rejecting claims in the first Office action. Deficiencies should be explained clearly, particularly when they serve as a basis for a rejection. Whenever practicable, USPTO personnel should indicate how rejections may be overcome and how problems may be resolved. A failure to follow this approach can lead to unnecessary delays in the prosecution of the application."
MPEP § 2103.

In the instant matter, Examiner does not appear to have examined Claims 45-46, 48-55, and 64-66 for either anticipation under Section 102 or obviousness under Section 103. Accordingly, Applicant respectfully request an examination of these claims and a second non-final action in consideration of Claims 45-46, 48-55, and 64-66 in view of the following Remarks.

Applicant Claims More Than The Mere Use Of A Particular Structure.

On page 12, Examiner asserts that the phrase "obtaining a bolus configured for oral administration to said ruminant animal" has not been given patentable weight because it is preceded by the phrase "configured for," and, therefore, is merely descriptive of an intended use. Applicant respectfully submits that this interpretation is improper.

It is well established that a claim term is to be accorded "the meaning that the term would have to a person of ordinary skill in the art in question at the time of the invention" (see *Phillips v. AWH Corp.*, 415 F.3d 1303, 1313 (Fed. Cir. 2005)). *Phillips* also indicated that evidence for the meaning of a term may be derived from "the words of the claims themselves, the remainder of the specification, the prosecution history, and extrinsic evidence concerning relevant scientific principles, the meaning of technical terms, and the state of the art" (see *Id.* at 1314).

Applicant respectfully submits that the present specification supports an interpretation where the phrase "obtaining a bolus configured for oral administration to said ruminant animal" denotes an actual state of configuration that fundamentally ties "oral administration to said ruminant animal" to the physical characteristics of the "bolus" preceding the phrase

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 323 of 607

"configured for." As a result, the disputed claim language reaches well beyond merely describing an intended use since the claims actively recite an actual state of configuration.

Examiner presented no evidence or reasoning why one of ordinary skill in the art would interpret the phrase "obtaining a bolus configured for oral administration to said ruminant animal" as merely denoting an intended use. Similarly, Applicant found no evidence or reasoning supporting this position in the claims, specification, prosecution history and extrinsic evidence. A person of ordinary skill having read the specification would readily understand that that the phrase "obtaining a bolus configured for oral administration to said ruminant animal" recites the characteristics related to the actual configuration of the bolus.

As one example, the specification makes that:

> "the bolus (1), the inert bolus body (1) can be configured for oral administration to ruminant animals (3) at birth. The digestive track between the mouth (76) and the reticulorumen (5) of a ruminant animal (3) at birth can have comparatively restrictive dimensions as compared to adult ruminant animals (3). Therefore, conventionally configured bolus (1) may not be orally administered to ruminant animals (3) at birth or when orally administered may cause injury or be regurgitated as the digestive track between the mouth (76) and the reticulorumen (5) enlarges due to growth of the ruminant animal (3)."

Specification 20:1-7.

Applicant respectfully asserts, therefore, that the rejection is improper based on an "intended use" rationale. Indeed, Applicant respectfully submits that the lack of evidence and reasoning alone renders this rejection improper. Accordingly, it is respectfully requested that either additional evidence be provided or that this rejection be withdrawn.

Zander Does Not Teach Or Suggest All The Elements of Claims 37-39 and 41-44 As Required By *MPEP §2143 A (1)*

Claim 37.

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 324 of 607

Firstly, Examiner makes the conclusory statement that "obtaining a bolus. . .is not dependent upon the animal. . .thus the method of Zander would be applicable to ruminant animals." *Office Action* at Page 13. Examiner does not provide an explanation or rationale for this conclusory statement and it appears Examiner is substituting personal knowledge or common sense to replace documentary evidence to provide a finding that the prior art included each element.

If the Examiner's statement is to be interpreted as the Examiner taking official notice that *Zander* in view of common knowledge or facts not in the record teaches that the bolus of *Zander* would be applicable to a ruminant animal, then the Examiner is respectfully requested by Applicant to:

i) provide an explicit basis on which the Examiner regards the matter as subject to official notice; and

ii) if the statement is of the Examiner's own personal knowledge the Applicant respectfully requests an Affidavit of the Examiner.

Traverse. *Zander* teaches "a diagnostic capsule. . .sized to pass through the alimentary canal with little or no discomfort." *Zander* at ¶ 0033. Claim 37 makes clear that the configuration of the bolus is "retained in reticulorumen of said ruminant animal" and provides a "power management module enabling or disabling said one more sensors coordinated with a plurality of stages in the lifespan of said ruminant animal." Accordingly, when Claim 37 is read as a whole, and not improperly dissected, a bolus obtained for oral administration to a ruminant animal as recited of Claim 37 would be both structurally and functionally different than the diagnostic capsule described by *Zander* which passes "through the alimentary canal."

Secondly, Examiner asserts that "it would be obvious to one of ordinary skill in the art to apply Zander to ruminant animals." *Office Action* at Page 13. Examiner does not provide an explanation or rationale for this statement and it appears Examiner is substituting personal knowledge or common sense to replace documentary evidence to provide a finding that the prior art included each element.

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 325 of 607

If the Examiner's statement is to be interpreted as the Examiner taking official notice that *Zander* in view of common knowledge or facts not in the record teaches that the bolus of *Zander* would be applicable to a ruminant animal, then the Examiner is respectfully requested by Applicant to:

i) provide an explicit basis on which the Examiner regards the matter as subject to official notice; and

ii) if the statement is of the Examiner's own personal knowledge the Applicant respectfully requests an Affidavit of the Examiner.

Traverse. Again, when Claim 37 is read as whole as required by MPEP 2103 I. C., it would not make any sense to apply the method of *Zander* in which a diagnostic pill is sized to pass through the alimentary canal when to meet the elements of Claim 37 the bolus is configured to be retained in the reticulorumen of the ruminant animal and the "power management module enabling or disabling said one more sensors coordinated with a plurality of stages in the lifespan of said ruminant animal."

Secondly, Applicant incorporates by reference herein the Remarks made above in reply to the anticipation rejection of Claims 37-39 and 41-44 based on *Zander*. As above explained in the Remarks, *Zander* does not teach a bolus "retained in a reticulorumen of said ruminant animal." Accordingly, a finding that the prior art included each element claimed has not been met as required by *MPEP §2143 A (1).*

Thirdly, Claim 37 includes the language "said power management module enabling or disabling said one more sensors coordinated with a plurality of stages in the lifespan of said ruminant animal." *Zander* teaches that it "takes up to 72 hours longer for an endoscopic pill to pass through the GI tract. *Zander* at ¶0005. *Zander* does not contemplate coordinating "enabling or disabling said one or more sensors with a plurality of stages in the lifespan of said ruminant animal." Accordingly, a finding that the prior art included each element claimed has not been met as required by *MPEP §2143 A (1).*

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 326 of 607

Claim 38. Claim 38 has been canceled making any response moot.

Claim 39. Applicant claims "enabling or disabling said one or more sensors based upon a pre-determined set of said one or more physiological parameters to be sensed during said stage in said life cycle of said ruminant animal." Examiner maps this to "enablement of the diagnostic sensors after the target condition is met." *Office Action* Page 13. *Zander* teaches that:

> "system 330 enables management of the power requirements on-board the diagnostic capsule 332 so that the entire alimentary canal may be examined, and substantially complete or entirely complete images or other data corresponding to the target regions is captured without gaps."
>
> *Zander* at ¶ 0055.

Accordingly, *Zander* enables or disables sensors based physiological or anatomical parameters of target regions and not based upon based upon physiological parameters to be sensed during a stage of a life cycle as claimed.

Claim 41. Applicant has amended Claim 41 to recite:

> monitoring said sensor signal from said one or more sensors outside of said ruminant animal;
>
> comparing said sensor signal from said one or more sensors to a first pre-selected activation code having a first pre-selected activation match threshold; and
>
> activating said bolus upon occurrence of said pre-selected activation code which exceeds said first pre-selected activation match threshold.
>
> Claim 41 (emphasis added).

This amendment is supported by the Specification at page 12:23-31 and page 13:1-22.

In comparison, *Zander* does not teach monitoring of a sensor signal outside of any animal. Accordingly, a finding that the prior art included each element claimed has not been met as required by *MPEP §2143 A (1)*.

Claim 42. Applicant has amended claim 42 to recite:

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 327 of 607

"monitoring said sensor signal from said one or more sensors;

comparing a first sensor signal from a first sensor to a first pre-selected activation code having a first pre-selected activation match threshold;

comparing ~~said~~ a second sensor signal from a second sensor to a second pre-selected activation code having a second pre-selected activation match threshold; and

activating said bolus upon generation of said first and second sensor signals from said first and second sensors which by comparison to said first and said second pre-selected activation codes exceeds said first and said second pre-selected activation match threshold."

The amendment is supported by the Specification at 14:1-31 and 15:1-4.

Examiner maps the elements of Claim 42 to *Zander*, Figure 5. However, *Zander*, Figure 5 only includes one sensor and one target condition. In comparison, Applicant claims a first and second sensor, first and said second pre-selected activation codes, and first and second pre-selected activation match thresholds. Accordingly, a finding that the prior art included each element claimed has not been met as required by *MPEP §2143 A (1).*

Claims 43 and 44. Claims 43 and 44 depend on Claim 42. Claims in dependent form shall be construed to include all the limitations of the claim incorporated by reference into the dependent claim. *MPEP 608.01 (n)*. Accordingly, Claims 43 and 44 also include elements which are not taught or suggested by *Zander*. Accordingly, a finding that the prior art included each element claimed has not been met as required by *MPEP §2143 A (1).*

11. Request For Telephonic Interview. Applicant respectfully requests a telephonic interview to address any remaining concerns of the Examiner.

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 328 of 607

CONCLUSION

Claims 1-36, 38, 40, 47, and 56-63 have been without prejudice canceled. Claims 37, 39, 41-43, 50, and 64-66 have been amended without the addition of any new matter. Applicant believes that the amendment to Claims 37, 39, 41-43, 50, and 64-66 places Claims 37, 39, 41-46, 48-55 and 64-6 6in condition for allowance and Applicant respectfully requests allowance of same.

Dated this 22 day of March, 2017

Respectfully Submitted,

By: _____

Susan F. Hudachek
PATENT AGENT FOR APPLICANT
USPTO Reg. No. 70,013
CR MILES P.C.
405 Mason Court, Suite 119
Fort Collins, CO 80524
(970) 492-0000 telephone
(970) 492-0003 facsimile

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 329 of 607

SUBSTITUTE SPECIFICATION

"MARKED UP" VERSION

CALF BOLUS

I. FIELD OF THE INVENTION

~~Generally, an~~ An animal monitoring device configured as a bolus for oral administration to reside in the reticulorumen of a ruminant animal. The animal monitoring device ~~having~~ includes a memory element, a processor in communication with the memory element and a computer code contained in the memory element. The computer code includes ~~including~~ a power management module executable by the processor to regulate power use by the bolus based on determination of remaining energy stored in an energy source and the determined power requirements over a pre-determined life cycle of the bolus.

II. BACKGROUND OF THE INVENTION

Conventional boluses orally administered to reside in the reticulorumen for monitoring of physiological parameters of ruminant animals may not have a configuration capable of oral administration at birth. Additionally, boluses [[,]] even when orally administered to adult ruminant animals[[,]] may not have an operational lifespan long enough to monitor useful physiological parameters over the remaining productive lifespan of the ruminant animal. Moreover, uncontrollable changes in the orientation of the bolus and correspondingly uncontrolled orientation of the bolus antenna in the reticulorumen of the ruminant animal may cause variable quality in radio signal transmission from the ruminant animal resulting in the loss of encoded physiological data.

III. SUMMARY OF THE INVENTION

Accordingly, a broad object of the invention can be to provide a bolus having an outer most surface configuration and a density which allows oral administration to a ruminant animal immediately after birth and prevents or substantially reduces the likelihood of being regurgitated or ejected from the reticulorumen of a ruminant animal over the entire lifespan or productive lifespan of the ruminant animal.

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 331 of 607

Another broad object of the invention can be to provide a bolus which can reside in the reticulorumen of a ruminant animal having an operational lifespan corresponding to the entire lifespan or the productive lifespan of the ruminant animal. One aspect of this broad object of the invention involves a power management module including an activation element which maintains the bolus in a sleep mode in which one or more encoded sensor signals are compared to a pre-selected activation code and upon achieving a pre-selected activation match threshold between the encoded sensor signals and the pre-selected activation code causes the bolus to be activated for normal monitoring of one or more physiological parameters of the ruminant animal. As to particular embodiments, a first and second pre-selected activation match threshold can be met by comparison of a corresponding first and second encoded sensor signals and a first and second pre-selected activation code to provide assurance that environmental events to not inadvertently activate the bolus for normal monitoring. Another aspect of this broad object of the invention involves a power management module pre-programmed or re-programmable to reconfigure the operating parameters of the bolus during residence in the reticulorumen of a ruminant animal to collect only useful physiological data and encode and transmit such physiological data at intervals based upon the life stage of the ruminant animal. Another aspect of this broad object of the invention involves a power management module which functions to evaluate the remaining amount of energy stored in the power source of the bolus and compare the remaining amount of energy to the energy requirements of the bolus during a pre-determined period of time based on the existing programmed operational parameters of the bolus and further functions to employ power regulation events to offset the difference between the energy requirement of the bolus over the pre-determined period of time and the amount of energy remaining in the power source.

Another broad object of the invention can be to provide an antenna having a structure that alters the magnetic field and electrical field generation in a manner that reduces the impact of uncontrollable changes in the orientation of the bolus and correspondingly the orientation of the antenna during residence of the bolus in the reticulorumen of the ruminant animal.

Naturally, further objects of the invention are disclosed throughout other areas of the specification, drawings, photographs, and claims.

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 332 of 607

IV. BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a diagram which shows a particular method of using an embodiment of the animal monitoring system to monitor one or more physiological parameters of a ruminant animal.

Figure 2 is a block diagram of a particular embodiment of a bolus capable of being orally administered to a ruminant animal.

Figure 3 is a block diagram which shows a particular embodiment of an animal monitoring system including a specialized computer, a radio frequency reader and a bolus.

Figure 4 is an exploded view of a particular embodiment of a bolus capable of being orally administered to a ruminant animal.

Figure 5 is a diagram of a particular embodiment of the animal monitoring assembly of the bolus.

Figure 6 is an exploded view of a particular embodiment of an antenna included in the particular embodiment of the bolus shown in Figures 4 and 5.

Figure 7 is a top perspective view of the particular embodiment of the antenna shown in Figure 6 having first and second electrically conductive loops disposed on the opposed surfaces of a non-electrically conductive sheet material.

Figure 8 is top plan view of the particular embodiment of the antenna shown in Figure 6 with vias (shown in broken line) interconnecting a first and second electrically conductive loops without being disposed on opposed surfaces of a non-electrically conductive sheet material.

Figure 9 is a top plan view of the particular embodiment of the antenna shown in Figure 8.

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 333 of 607

Figure 10 is a first side elevation view of the particular embodiment of the antenna shown in Figure 8.

Figure 11 is a second side elevation view of the particular embodiment of the antenna shown in Figure 8.

Figure 12 is a first end elevation view of the particular embodiment of the antenna shown in Figure 8.

Figure 13 is a second end elevation view of the particular embodiment of the antenna shown in Figure 8.

V. DETAILED DESCRIPTION OF THE INVENTION

Now generally referring to Figures 1 through 13, which provide illustrative examples of an inventive bolus (1) and a method of using a bolus (1) to monitor one or more physiological parameters (2) of a ruminant animal (3) and a computer implemented animal monitoring system (4). The bolus (1) can be orally administered to reside in the reticulorumen (5) of the ruminant animal (3). As to certain embodiments, the bolus (1) can include a bolus body (6) having an outer most external surface (7) configured to allow oral administration to a ruminant animal (3), with certain embodiments capable of being orally administered immediately after birth. As to certain embodiments, the bolus (1) can include a microcontroller (8) including a processor (9) in communication with a memory element (10) containing a program code (11) including a power management module (12) which allows the bolus (1) to operate in the reticulorumen (5) of the ruminant animal (3) during the entire life span of the ruminant animal from birth to death or from birth to the end of the productive lifespan of the ruminant animal (3).

For the purposes of this invention the term "ruminant animal (3)" means any mammal of the suborder Ruminantia (both wild and domestic) and, without limiting the breadth of the foregoing definition, includes as illustrative examples: cattle, buffalo, goats, sheep, deer, antelope, giraffes, yaks, okapi, chevotain or the like.

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 334 of 607

For the purposes of this invention the term "birth" means the emergence of the ruminant animal (3) from the body of its mother to begin life as a physically separate ruminant animal (3).

For the purposes of this invention the term "death" means the permanent cessation of vital bodily functions to end life of a ruminant animal (3).

For the purposes of this invention the term "life span" means the period of time between birth and death of a ruminant animal (3).

For the purposes of this invention the term "productive lifespan" means the period of time between birth and the age reached before being culled from production.[["]]

For the purposes of this invention the term "reticulorumen (5)" means the first chamber in the alimentary canal of a ruminant animal (3) composed of the rumen and reticulum. The reticulum differs from the rumen with regard to the texture of its lining. The rumen wall is covered in small, finger-like projections called papillae, whereas the reticulum is lined with ridges that form a hexagonal honeycomb pattern. Despite the differences in the texture of the lining of the two parts of the reticulorumen (5), it represents one functional space.

The bolus (1) and the animal monitoring system (4) are described herein in terms of functional block components and various process steps. It should be appreciated that such functional blocks may be realized by any number of hardware or software components configured to perform the specified functions. For example, the bolus (1) and the animal monitoring system (4) may employ various integrated circuit components which function as: memory elements, processing elements, logic elements, look-up tables, or the like, which may carry out a variety of functions under the control of one or more processors or other control devices.

Now referring generally to Figure 2, the bolus (1) can include one or more sensors (13) each capable of generating a sensor signal (14)(whether analog or digital) which varies based on a corresponding change the one or more physiological parameters (2) of a ruminant animal (3). For

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 335 of 607

the purposes of this invention the term "physiological parameter" means a measurable condition of a ruminant animal (3), and without limitation to the breadth of the foregoing, includes one or more of: movement (including one or more of the pitch, yaw, roll, tilt, vibration, jolt, impact, or the like), temperature, sound (including one or more of reticulorumen digestive sounds, heartbeat sound, or the like), heart rate, or the like. Each of the one or more sensors (13) can generate a sensor signal (14) (whether analog or digital) which varies based upon occurrence or change in the sensed physiological parameter (2).

As illustrative examples, sensors (13) suitable for use in particular embodiments include: an omnidirectional tilt and vibration sensor (16)(also referred to as an "accelerometer")(PN SQ-SEN-200) distributed by Signal Quest Precision Microsensors; a temperature sensor (17) such as a Betachip Thermistor (PN 1K2OG3) distributed by BetaTHERM Sensors; a microphone (18) distributed by ST Microelectronics (PN MP34DT01); a humidity sensor (PN HCZ-D5) distributed by Ghitron Technology CO., Ltd; an ultra-miniature pressure transducer (PN COQ-062) distributed by Kulite, a proximity sensor (PN PY3-AN-3) distributed by Automation Direct.com., or similar or equivalent sensors. The illustrative examples and description of these sensors (13) are intended to provide a person of ordinary skill in the art sufficient information to make and use embodiments of the bolus including a numerous and wide variety of sensors whether or not specifically enumerated.

The microcontroller (8) includes a processor (9) in communication with the memory element (10) which contains a computer code (11). In part, the computer code (11) can be executed to continuously or intermittently transform the analog or digital sensor signal (14) from the one or more sensors (13) as encoded physiological data (19)(also referred to as "encoded sensor signals"). The encoded physiological data (19) varies based upon change in the sensor signal (14) which correspondingly varies based upon change in the sensed physiological parameter (2). As to particular embodiments, the computer code (11) can be executed to encode or recode from time to time an amount of sensor calibration data (19A) which allows calculation and output of a physiological parameter value (20) of the ruminant animal (3)(whether by the bolus (1) or by operation of a remote computer (82)). The computer code (11) can be further executed to couple animal identification data (83) to the encoded physiological data (19).

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 336 of 607

The computer code (11) can be further executed to control a radio signal generator (21), for example, an oscillator to generate a stable radio signal (22). An oscillator suitable for use with the invention is available from Freescale Semiconductor, Part No. MC1319x, MC1320x, MC1321x, and MC1322x, and similar or equivalent components. In regard to the particular embodiment of the invention, the radio signal generator (21) can generate a radio signal (22) having a radio signal frequency (23) between about 410MHz and about 1Gz. As one particular embodiment of the invention, the radio signal generator (21) can generate a radio signal frequency (23) of about 433MHz. As to other particular embodiments, the radio signal generator (21) can generate a radio signal (22) having a radio signal frequency (23) of about between about 700 MHz to about 1GHz. The radio signal frequency (23) can be selected from the group including or consisting of: between about 700 MHz to about 800MHz, 750 MHz to about 850MHz, about 800 MHz to about 900MHz, about 850 MHz to about 950MHz, and about 900 MHz to about 1GHz.

The computer code (11) can further function to control a radio frequency stabilizer (24)(shown in the example of Figure 2 as a low pass filter (24A) and a surface acoustic wave filter (24B)) which functions to offset changes in radio signal wave flux caused by changes in temperature or power to the radio signal generator (21). A radio frequency stabilizer (24) suitable for use with embodiments is available from Hope Microelectronics Co., Ltd, Part No. HF433E, RF Monolithics, Inc., Part No. RF1172C, and similar or equivalent parts.

Embodiments of the bolus (1) can further include matching elements (25) which function to match the input impedance of the electrical load or the output impedance of the loads corresponding signal source to maximize the power transfer or minimize signal reflection from the load. In an ideal situation, source impedance and load impedance should be equal to maximize power transfer.

Three elements influence the balance of impedance in radio design: the antenna (28) or "load", the radio signal generator (21) or "source", and the device's ground plane. Since each of these elements have different physical characteristics, their corresponding impedances are inherently different. The passive capacitors (26) and inductors (27) that make up the matching

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 337 of 607

elements (25) of embodiments of the bolus (1) are used to mitigate these differences and rebalance the impedance for a given radio signal frequency (23).

Impedance for an inductor (27) is given by,

$$Z = iwL$$

where L is the inductance and w is angular frequency.

Impedance for a capacitor (26) is given by,

$$Z = \frac{1}{iwC}$$

where C is capacitance

The reactance is,

$$X = -\frac{1}{wC}$$

The matching elements (25) (also referred to as the "resonant circuit") include an array of inductors (27) and capacitors (26) used in series or in parallel to balance the circuit impedance once the impedance of the antenna (28), the radio signal generator (21), and the ground plane (not shown) are known.

A series resonant circuit (25) has an impedance that is the sum of the impedances of the inductor(s)(27) and capacitor(s)(26),

$$Z = i\omega L + \frac{1}{i\omega C} = i\left(\omega L - \frac{1}{\omega C}\right)$$

The impedance of a Parallel Resonant Circuit is found as follows,

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 338 of 607

$$Z = i\left(\frac{\omega L}{1-\omega^2 LC}\right)$$

Resonance in the resonant circuit (25) occurs when the resonant circuit (25) is driven at a frequency *w0* at which the inductive and capacitive reactances are equal in magnitude. The frequency at which this equality holds for the resonant circuit is called the resonant frequency, and can be determined, as follows,

$$\omega_0 = \frac{1}{\sqrt{LC}}$$

This value can then be converted to hertz,

$$f_0 = \frac{\omega_0}{2\pi} = \frac{1}{2\pi\sqrt{LC}}$$

The calculations above can be used to identify the inductors (27) and capacitors (26) used as matching elements (25) in association with the radio signal generator (21) that operates at a specific radio signal frequency (23) to balance the impedance between the radio signal generator (21) and the antenna (28) and limiting the bandwidth to eliminate interference. After the signal passes through the matching elements (25) the resistance of the circuit can be altered to ensure an industry standard of 50 ~~ohm~~ Ohms resistance in the transmission line to the antenna (28). The resistance of the circuit can be altered by inclusion of resistor (25A) to establish the standard 50 ~~ohm~~ Ohms resistance in the circuit.

These calculations, however, apply to a radio signal ~~frequency~~ generator (21) used in normal atmospheric air (also known as "free air"). Because the radio signal generator (~~23~~ 21) included in embodiments of the bolus (1) operate within the mass of a ruminant animal (3), it has been discovered that the center frequency (the arithmetic mean of the lower cutoff frequency and the upper cutoff frequency) is shifted lower and may not have the maximum gain.

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 339 of 607

Accordingly, there can be a substantial advantage, by selection of the inductors (27) and capacitors (26) as well as their position in the resonant circuit (25) to increase the inductance and capacitance values to purposefully shift the center frequency upward and allowing the radio signal frequency (23) to be re-tuned to a desired radio signal frequency (23) by passing through the mass of the ruminant animal (3).

Embodiments of the bolus (1) further include an antenna (28) which converts electric power into radio signal (22). In transmission, the radio signal generator (21) supplies an electric current oscillating at one of the above described radio signal frequencies (23). In reception, the antenna (28) intercepts some of the power of an electromagnetic wave (29) in order to produce a tiny voltage at its terminals that is applied to a receiver (30). As to particular embodiments, the antenna (28) can, but need not necessarily, be a laid down electrically conductive path on a printed circuit board (31). An advantage of this configuration of antenna (28) can be that it does not require winding upon or interaction with a magnetic field of a magnet to transmit the radio signal (22). Accordingly, this configuration of antenna (28) can produce a lesser amount of interference from a magnetic field of a magnet (69) contained in the bolus (1) resulting a lower incidence of loss of the radio signal (22) or less modulation of the radio signal (22) which results in a greater consistency (or lesser amount of lost data) in transmission of encoded physiological data (19) associated with the ruminant animal (3).

Now referring primarily to Figures 4 through 13, particular embodiments can, but need not necessarily, include an antenna (28) including a first electrically conductive loop (32) electrically interconnected to a second electrically conductive loop (33)(as shown in the example of Figures 6 through 13) electrically connected to the radio signal generator (21) or radio signal receiver (30)(or combined as a radio signal transceiver (21/30)). 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). Typically, the conductive sheet material will be a copper sheet material or a copper layer. As to particular embodiments, the antenna (28) can further include a non-electrically conductive substrate (38) such as a circuit board (31) (as shown in the example of Figure 6) disposed between the pair of electrically conductive

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 340 of 607

loops (32)(33) with one or more vias (39) electrically interconnecting the first and second electrically conductive loops (32)(33) by one or more holes (40) through the non-electrically conductive substrate (38). The one or more holes (40) can be made electrically conductive by electroplating, or by lining the hole with a tube or a rivet thereby electrically interconnecting the pair of electrically conductive loops (32)(33). There can be substantial advantages in structuring the antenna (28) as above described and as shown in Figures 4 through 13. First, the structure increases the cross-section width of the antenna (28) which increases the stability of the radiated electrical field (41) of the antenna (28). Second, the structure increases the bandwidth of the antenna (28) allowing shift in radio signal frequency (23) or attenuation resulting from passing through the mass of the ruminant animal (3) to be more readily counteracted. Third, the structure alters the magnetic field and electrical field generation which reduces the impact of uncontrollable changes in the orientation of the bolus (1) and correspondingly the orientation of the antenna (28) in the reticulorumen (5) of the ruminant animal (3).

Again referring primarily to Figures 2, 4 and 5, embodiments of the bolus (~~3~~ 1) further include a power source (46) (and associated power regulator (46A)) which supplies and adjusts energy (42) (electrical power) to the bolus (1). The power source (46) shown in Figures 2, 4 and 5 can take the form of a battery such as a AA battery, a AAA battery, or the like. The power source (42) provides power to the electronic components supported on the printed circuit board (31) including for example: the microcontroller (8), radio frequency generator (21) and one or more sensors (13). Because the power source (46) of a bolus (1) disposed in the reticulorumen (5) of the ruminant animal (3) cannot be recharged, the operational lifespan of bolus (1) will depend upon capacity of the power source (46) in ampere-hours (Ah) and the load current of the circuit. Power source (46) life will be longer as the load current is reduced and vice versa. The calculation to find out the capacity of power source (46) in the form of a battery can be mathematically derived from the following formula:

Battery Life = Battery Capacity in amps per hour / load current in amps x 0.70

As to particular embodiments of the bolus (1), the computer code (11) can include a power management module (12) which functions to regulate energy use by the bolus (1) to extend the

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 341 of 607

operational life of the bolus (1) disposed in the reticulorumen (5) of the ruminant animal (3). Embodiments of the bolus (1), including particular embodiments the power management module (12), can be operational within the reticulorumen (5) of the ruminant animal (3) for greater than three years and up to about ten years, a period of time substantially greater than that of conventional bolus.

As one illustrative example, embodiments of the inventive bolus (1) can be orally administered to a calf at, or immediately after birth, and remain operational over the entire productive lifespan (53) of the dairy cow, on average about 2.4 lactations, or about five to six years.

As another illustrative example, a ewe typically has a productive lifespan (53) of between about five years to about seven years of age. A ewe's productivity usually peaks between 3 and 6 years of age and begins to decline after the age of seven. As a result, most ewes are removed from a flock before they would reach their natural life expectancy. Accordingly, embodiments of the bolus (1) disposed in the reticulorumen (5) of the ewe at birth can be operational throughout the entire productive lifetime (53) of the ewe.

As to particular embodiments of the bolus (1), the power management module (12), can but need not necessarily include, an activation element (43) which functions to enable and encode the sensor signal(s)(14) from one or more sensors (13) and can further function to compare the one or more encoded sensor signals (19) against one or more preselected activation code(s)(44). If by comparison of the encoded sensor signal(s)(19) against the preselected activation code(s)(44), a pre-selected activation match threshold (45) is met, the activation element (43) can further function to cause activation of the bolus (1) for normal operation. This provides the advantage of avoiding inadvertent or premature activation of the bolus (1) and the corresponding unnecessary expenditure of energy (42) from the power source (46).

As one illustrative example of the function of the activation element (43), the bolus (1) can include a first sensor (13A) which can be an accelerometer (16). Accelerometers (16) in accordance with embodiments of the invention can sense the movement of the bolus (1)(whether

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 342 of 607

within or without the ruminant animal), in a manner similar to accelerometers (16) used in tablet computers and digital cameras, such that images on display screens are always displayed upright, or as used in drones for flight stabilization. The accelerometer (16) can be enabled by the function of the activation element (43), and the activation element (43) can further function to encode the first sensor signal (14A) from the accelerometer (16) and compare the first encoded sensor signal (19A) against a first preselected activation code (44A). The first preselected activation code (44A), in the context of this illustrative embodiment, can correspond to a particular pre-activation movement (47) of the bolus (1) which can, but need not necessarily be, three serial reciprocal linear movements of the bolus (1) each terminating in an impact of the bolus (1) within a period of time of between about five seconds and ten seconds (also referred as "three bumps"). If the pre-activation movement (47) of the bolus (1) including "three bumps" meets the first pre-selected activation match threshold (45A) relating to the first preselected activation code (44A) corresponding to "three bumps" the activation element (43) can cause the bolus (1) to be activated for normal monitoring of the ruminant animal (3). As to particular embodiments, the bolus (1) can, but need not necessarily, include an illumination element (48), such as a light emitting diode (49). The illumination element (48) can be switched on by operation of the activation element (43) to provide an amount of light (50) as an indicator that the bolus (1) has been activated and can be orally administered to a ruminant animal (3).

As to particular embodiments, the bolus (1) can, but need not necessarily, include a second sensor (13B) which can be a temperature sensor (17) (also referred to as a "thermistor"). Thermistors (17), in accordance with embodiments of the invention, can sense the temperature (57) of the bolus (1)(whether within or without of the ruminant animal) in a useful range of temperature and accuracy depending upon the ruminant animal (3) into which the bolus (1) is to be orally administered and the determinations to be made from the sensed temperature (57). For example, the useful temperature range in dairy cow will be between about 95°F (about 35°C) to about 115°F (about 46°C) with an accuracy of between about 0.1°C and about 0.3°C. The normal temperature of an adult cow will typically be about 101.5°F (about 38.5°C), but can vary throughout the estrous cycle with the lowest temperature being just before heat and highest temperature on the day of heat or due to being in milk, and a temperature of about 103.0°F (about 39.4°C) to about 104.0°F (about 40°C) and upward to about 108°F (about 42.2°C), typically

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 343 of 607

indicative of a sick cow. However, this illustrative example is not intended to preclude the use of thermistors (17) which may sense a wider temperature range, as one illustrative example, about -40°C to about +125°C, as long as the accuracy is not less than about 0.1°C to about 0.2°C of the actual temperature about the bolus (1) and the time constant to change from one temperature value to another temperature value is sufficiently short to support the sampling rate of the sensor signal (14) effected by the computer code (11) in regard to the thermistor (17). For example, thermistors (17) utilized with embodiments of the bolus (1) may have a time constant of about one minute or less and while the sampling rate may be once every 10 minutes to 20 minutes or longer depending upon the application.

As to particular embodiments, the activation element (43) having activated the bolus (1)(and as to particular embodiments, switched on the light illumination element (48)) can, but need not necessarily, further enable and encode a second sensor signal (14B) from a second sensor (13B) which can be a thermistor (17). The activation element (43) can further function to encode the second sensor signal (14B) from the second sensor (13B) such as thermistor (17) and compare the second encoded sensor signal (19B) against the second preselected activation code (44B). The second preselected activation code (44B), in the context of this illustrative embodiment, can correspond to a pre-activation temperature (51) of the bolus (~~3~~ 1) which can, but need not necessarily be, three serial temperature reads of the bolus (1) each about 15 minutes apart within a period of time of about 45 minutes (also referred to as "three temperature reads"). If the pre-activation temperature (51) of the bolus (1) including "three temperature reads" meets the second pre-selected activation match threshold (45B) for the second preselected activation code (44B) corresponding to "three temperature reads" the activation element (43) can cause the bolus (1) to be activated for normal monitoring of a ruminant animal (3). In the illustrative example of a bolus (1) used in calves or cows, if the three temperature reads are between about 100°F (about 37.8°C) and about 105°F (about 40.6°C), this would be indicative that the bolus (1) resides in the reticulorumen (5) of a calf or cow, and the activation element (43) can then function to cause the bolus (1) to be activated for normal monitoring of the ruminant animal (3). This provides the advantage of avoiding inadvertent or premature activation of the bolus (1) and the corresponding unnecessary expenditure of energy (42).

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 344 of 607

As to particular embodiments, the power management module (12) can, but need not necessarily, further function to reconfigure the mode of operation of the bolus (1) or allow the mode of operation of the bolus (1) to be reconfigured while residing in the reticulorumen (5) of the ruminant animal (3) to regulate energy (42) use by the bolus (1) which can have the advantage of extending the operational life of the bolus (1).

As to particular embodiments, the power management module (12) can regulate energy (42) use by the bolus (1) by enabling or disabling one or more sensors (13) based upon a pre-determined set of physiological parameters (2) to be sensed during one or more stages (52) in a lifespan (53) of the ruminant animal (3). The encoded physiological data (19) useful in ~~make~~ making determinations relating to a ruminant animal (3) may be different in a first stage (54) in the lifespan (53)(for example, the time period between birth and puberty) as compared to a second stage (55) (for example, the time period commencing with puberty until the end of reproductive age (or useful reproductive age))(as shown in the example of Figure 1). As one illustrative example in dairy cows, from ~~the~~ birth until puberty in dairy cows at about eight months to about seventeen months of age depending upon the breed, the useful encoded physiological data (19) may only include encoded physiological data (19) relating to temperature (57). Accordingly, in a first stage (54) of the ruminant animal (3) lifespan (53) the power management module (12) can function upon activation of the bolus (1), as above described, to only enable and periodically read the sensor signal (14A) and generate encoded physiological data (19) for temperature (57) of the ruminant animal (3). Additionally, because the encoded physiological data (19) for temperature (57) may only be used to determine whether the ruminant animal (3) is sick, there may be a substantial period of time between reads of the temperature sensor signal (14), such as, once in a twenty-four hour period. Similarly, there may be a substantial period of time between operational periods of the radio signal generator (~~22~~ 21), such as twenty four hours, and the operational period of the radio signal generator (~~22~~ 21) may be very short, such as, a few milliseconds (also referred to as a "transmission burst (56)"). Because the majority of energy (42) used by the bolus (1) is in operation of the radio signal generator (21), increasing the time period between transmission bursts (56) and limiting the duration of the transmission burst (56) only to that period of time necessary to transmit the limited amount of encoded physiological data (19) can substantially increase the operating lifespan of the bolus (1).

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 345 of 607

By comparison, in second stage (55) of the lifespan (53) of a ruminant animal (3) from puberty to the end of reproductive age of the ruminant animal (3), the useful encoded physiological data (19) may include both encoded physiological data (19) for temperature (57) and encoded physiological data (19) for movement (58). As above explained, the temperature (57) of ruminant animal (3) may vary throughout the estrous cycle with the lowest temperature being just before heat and highest temperature on the day of heat. Additionally, the activity of the cow can measurably change prior to or concurrent with heat.

Accordingly, as to particular embodiments, the power management module (12) can further include a timer element (59) which functions to assess elapsed time from activation of the bolus (1) allowing regulation of energy (42) use by the bolus (1) based on elapsed time which can be coordinated to one or more of the stages (52) in the lifespan (53) of the ruminant animal (3). As one illustrative example, if the bolus (1) is orally administered at birth, the timer element (59) and the power management module (12) can function to enable a first sensor (13A) (or first set of sensors (13) providing useful encoded physiological data (19) during the first stage (54)) and encode physiological data (19) for temperature (57) (or first set of physiological parameters) for a period of time corresponding the first stage (54) of the lifespan (53) of the ruminant animal (3)(for example, between birth and puberty), and then function to further enable a second sensor (13B)(or second set of sensors (13) providing useful encoded physiological data (19) during a second stage (55) of the ruminant animal (3)) and encode physiological data (19) for both temperature (57) and movement (58).

Additionally, because the encoded physiological data (19) for movement (58) and temperature (57) may be used to determine whether the ruminant animal (3) is in estrus, the power management module (12) can function to reduce the period of time between reads of the sensor signal (14) temperature (57) and the sensor signal (14) for movement (58), such as, four times in a twenty-four hour period. Similarly, there may be a lesser period of time between operational periods of the radio signal generator (21), such as every six hours, and the operational period of the radio signal generator (~~14~~ 21) may be adjusted to a period of time to transmit the additional encoded physiological data (19).

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 346 of 607

As to particular embodiments, once the ruminant animal (3) becomes pregnant and during the pregnancy, the power management module (12) can further function to reconfigure the operation of the bolus (1) to disable the sensor (13) for movement (58) and read only the sensor (13) for temperature (57) and transmit encoded physiological data (19) at less frequent intervals.

As to particular embodiments, the program code (11) can be reprogrammed while the bolus (1) resides in the reticulorumen (5) of the ruminant animal (3) by receiving programming data (60) to reconfigure the power management module (12) to regulate energy (42) use by the bolus (1), as above described.

As to particular embodiments, the power management module (12) can, but need not necessarily, include a power sensor element (61) executable to determine the remaining amount of energy (42) in the power source (46). The power management module (12) can be further executed to determine the amount of energy (42) required to power the bolus (1) through a pre-determined period of time (62) based on the then existing program code (11) contained in the memory element (10) of the bolus (1). The power management module (12) can be further executed to compare the remaining amount of energy (42) in the power source (46) with the amount of energy (42) required to power the bolus (1) through the pre-determined period of time (62) based on the then existing program code (11) to determine the difference in the amount of energy (42) remaining in the power source (46) and the amount of energy (42) required to power the bolus (1) through the pre-determined period of time (62). The power management module (12) can be further executed to perform one or more power regulation events (63) to make up the difference in the amount of energy (42) to allow operation of the bolus (1) through the pre-determined period of time (62). The power regulation events (63) can include or consist of one or more of: switching off the light illumination element (48), increasing the interval of time between operation of the radio signal generator (21), decreasing the operational time period of the radio signal generator (21), disabling one or more of the plurality of sensors (13), interrupt encoding of the sensor signal (14) from one or more of said plurality of sensors (13), or other re-programming that reduces energy (42) use.

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 347 of 607

As to particular embodiments, the power management module (12) can be pre-programmed to perform one or more of the power regulation events (63) in one or more pre-programmed priority orders based upon the magnitude of the difference in the amount of energy (42) remaining in the energy source (46) and the required amount of energy (42) to power the bolus through the remaining portion of a pre-programmed or re-programmed life cycle. Alternately, the power management module (12) can function to encode and transmit as part of a transmission burst (56) encoded power source data (64) from which the remaining amount of energy (42) in the energy source (46) can be calculated using a remote specialized computer (82) and the power management module (12) can be re-programmed to execute one more power regulation events (63) based on a priority order encoded in the programming data (60) received by the bolus (1).

Now referring primarily to Figures 4 and 5, embodiments of the bolus (1) which are orally administered to a ruminant animal (3) can, but need not necessarily, include an inert bolus body (6) having external dimensional relations adapted to allow oral administration and retention of the bolus (1) in the reticulorumen (5) of a ruminant animal (3). As one non-limiting example, the inert bolus body (6) can include an amount of plastic resin (65) cast about the animal monitoring assembly (66) ("AMA"), including one or more of the components above-described. The amount of plastic resin (65) can be, as an example, a plastic resin such as urethane resin, epoxy resin, polyester resin, or the like used in accordance with the manufacturer's instructions. As to other embodiments, the inert bolus body (6) can comprise a sealable housing (67) defining a hollow inside space (68) which receives the AMA (66). As to other embodiments, the sealable housing (67) including the AMA (66) received in the hollow space (68) (and as to particular embodiments further including one or more magnets (69) received in the hollow space (68)) can have the amount of plastic resin (65) cast about the AMA (66) (and one or more magnets (69)) located inside said sealable housing (67).

Again referring primarily to Figure 4, configurations of the inventive bolus (1) suitable for oral administration to a ruminant animal (3) can have a generally cylindrical configuration with a diameter (77) in orthogonal cross section in the range of about one-half inch (about 13 millimeters ("mm")) to about one and one quarter inch (about 32 mm) and having a bolus length (70) disposed between a first bolus end (71) and a second bolus end (72) in the range of about two inches (about

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 348 of 607

50 mm) and about five inches (about 127 mm). Particular embodiments of the bolus (1) can have a length of about four inches (about 102 mm) and a diameter (77) in orthogonal cross section of about one inch (about 25 mm). While the example of Figure 4 shows the bolus (1) including a housing (67) having matable halves (73)(74) with an outer most external surface (7) configured as a cylinder; the bolus (1) can have numerous and varied outer most external surface (7) configurations capable of oral administration and retention within the reticulorumen (5) of a ruminant animal (3). The inert bolus body (6) can be molded, cast, or machined from biocompatible (or biologically inert) non-magnetic materials which allow transmission of the radio signal (22) from within the bolus (1) to outside of the ruminant animal (3). As examples, the inert bolus body (6) can be made from plastics such as nylon, fluorocarbon, polypropylene, polycarbonate, urethane, epoxy, polyethylene, or the like; or metals such as stainless steel; or other materials such as glass can be utilized. The bolus (1) having a hollow inside space (68) can be generated by a wide variety of procedures such as molding, casting, fabrication or the like. As one non-limiting example, a cylindrical tube having an external diameter and an internal diameter, as above described, can be divided into sections of suitable length to which end caps can be fitted. Alternately, a bore can be made in a cylindrical solid rod having an external diameter, as above described, to provide a closed end tube with the bore having sufficient dimension to provide the hollow inside space (68).

As to particular embodiments, the inert bolus body (~~1~~ 6) can, but need not necessarily, include a translucent or transparent element (75) to allow viewing of the amount of light (50) generated by the illumination element (48) as a viewable indicator that the bolus is activated as above described. The translucent or transparent element (75) can include a portion or the entirety of the housing (67) of the inert bolus body (6).

As to particular embodiments of the bolus (1), the inert bolus body (~~1~~ 6) can be configured for oral administration to ruminant animals (3) at birth. The digestive track between the mouth (76) and the reticulorumen (5) of a ruminant animal (3) at birth can have comparatively restrictive dimensions as compared to adult ruminant animals (3). Therefore, conventionally configured bolus (1) may not be orally administered to ruminant animals (3) at birth or when orally

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 349 of 607

administered may cause injury or be regurgitated as the digestive track between the mouth (76) and the reticulorumen (5) enlarges due to growth of the ruminant animal (3).

The configuration of outer most external surface (7) of the housing (67) of the inert bolus body (6) or the bolus density (78), or combinations thereof, can be critical when a bolus (1) is orally administered to a ruminant animal (3) at birth. It has been discovered that while the bolus length (70) between the first and second bolus ends (71)(72) can be more variable ~~bolus (1)~~, it can be critical that the greatest bolus diameter (77) (or width) of the outer most external surface (7) along the length (70) between the pair of bolus ends (71)(72) should be between one half inch (about 13 mm) and not exceed three quarters of an inch (about 19 millimeters). The configuration of the outer most external surface (7) of the bolus (1) can have a bolus width (77) selected from the group including or consisting of: about 13 mm to about 15 mm, about 14 mm to about 16 mm, about 15 mm to about 17 mm, about 16 mm to about 18 mm, and about 17 mm to about 19mm.

As one illustrative example, a bolus (1) configured for oral administration to ruminant animals (3) at birth can have an outer most external surface (7) of the bolus body (6) having cylindrical configuration as shown in the example of Figure 4. The bolus length (70) can vary between about three inches (about 76 mm) and about six inches (about 152 mm) between the a pair of bolus ends (71)(72); however, the outer most external surface (7) at any cross section orthogonal to the bolus length (70) should not exceed about 19 millimeters. As a second illustrative example, the bolus body can be substantially spherical having an external diameter not exceeding about three quarters of an inch (about 19 mm).

Embodiments of the inventive bolus (1) can, but need not necessarily, have a bolus density (78) of between about 2.1 grams per cubic centimeter ("g/cm^3") to about 3.3 g/cm^3. However, there can be substantial advantages in configuring the bolus (1) to achieve a bolus density (78) in the range of between about 2.1 g/cm^3 to about 3.3 g/cm^3 in that the bolus (1) is substantially less likely to be regurgitated or ejected from reticulorumen (5) of a ruminant animal (~~1~~ 3) as compared to conventional bolus. It can be critical to achieve a bolus density (78) of between about 2.1 g/cm^3 to about 3.3 g/cm^3 when dimensions of the outer most external surface (7) are reduced for oral administration to ruminant animals (3) at birth or the bolus (1) resides in the reticulorumen (5) of

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 350 of 607

the ruminant animal (~~1~~ 3) for the entire lifespan (53) of the ruminant animal (3). Within the range of bolus density (78), the bolus density can be selected from the group including or consisting of: about 2.3 g/cm^3 to about 2.5 g/cm^3, about 2.4 g/cm^3 to about 2.6 g/cm^3, about 2. g/cm^3 to about 2.7 g/cm^3, about 2.6 g/cm^3 to about 2.8 g/cm^3, about 2.7 grams g/cm^3 to about 2.9 g/cm^3; about 2.8 g/cm^3 to about 3.0 g/cm^3, about 2.9 g/cm^3 to about 3.1 g/cm^3; about 3.0 g/cm^3 to about 3.2 g/cm^3, and about 3.1 g/cm^3 to about 3.3 g/cm^3.

Now referring primarily to Figure 3, the animal monitoring system (4) can, but need not necessarily, include one or more radio signal reader(s) (79) can be located to receive the radio signal (22) carrying the encoded physiological data (19) from one or more bolus (1). As to particular embodiments, the one or more radio signal readers (79) ("RSR") can further operate to assemble the encoded physiological data (19) into one or more data packets (80) which can be transmitted and received by a wired or wireless reception device (81) (which can be integrated into a specialized computer (82)). The reception device (81) can transfer the data packets (80) to a specialized computer (82). The specialized computer (82) can operate to transform the encoded animal identification data (83) and encoded physiological data (19) to output an animal identification value (84) (an alpha or numeric or other animal identifier) and to output physiological parameter values (85)(an alpha or numeric or other symbols). A computer user (86) can access the animal identification value (84) and the physiological parameter values (85) by use of the specialized computer (82).

Now referring generally to Figure 3, the specialized computer (82) is described herein in terms of functional block components, screen shots, and various process steps. It should be appreciated that such functional blocks may be realized by any number of hardware or software components configured to perform the specified functions.

Similarly, the software elements of the present invention may be implemented with any programming or scripting language such as C, C++, ~~Java~~ JAVA, COBOL, ~~assembler~~ ASSEMBLER, PERL, ~~Labview~~ LABVIEW, or any graphical user interface programming language, extensible markup language (XML), Microsoft's ~~Visual Studio~~ VISUAL STUDIO.NET, ~~Visual Basic~~ VISUAL BASIC, or the like, with the various algorithms or Boolean

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 351 of 607

Logic being implemented with any combination of data structures, objects, processes, routines or other programming elements. Further, it should be noted that the present invention might employ any number of conventional wired or wireless techniques for data transmission, signaling, data processing, network control, and the like.

It should be appreciated that the particular computer implementations shown and described herein are illustrative of the invention and its best mode and are not intended to otherwise limit the scope of the present invention in any way. Indeed, for the sake of brevity, conventional data networking, application development and other functional aspects of the systems (and components of the individual operating components of the systems) may not be described in detail herein. Furthermore, the connecting lines shown in the various figures contained herein are intended to represent exemplary functional relationships and/or physical couplings between the various elements. It should be noted that many alternative or additional functional relationships or physical connections may be present in a computer implemented animal monitoring system (4).

As will be appreciated by one of ordinary skill in the art, the present invention may be embodied in the alternative as a method, a data processing system, a device for data processing, a computer program product, or the like. Accordingly, the present invention may take the form of an entirely software embodiment, an entirely hardware embodiment, or an embodiment combining aspects of both software and hardware. Furthermore, the present invention may take the form of a computer program product on a computer-readable storage medium having computer-readable program code means embodied in the storage medium. Any suitable computer-readable storage medium may be utilized, including hard disks, CD-ROM, optical storage devices, magnetic storage devices, ROM, flash RAM, or the like.

It will be understood that each functional block of the block diagrams and the flowchart illustrations, and combinations of functional blocks in the block diagrams and flowchart illustrations, respectively, can be implemented by computer program instructions. These computer program instructions may be loaded onto a general purpose computer, special purpose computer, or other programmable data processing apparatus to produce a machine, such that the instructions which execute on the computer or other programmable data processing apparatus for implementing

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 352 of 607

the functions specified in the flowchart block or blocks.

These computer program instructions may also be stored in a computer-readable memory that can direct a computer or other programmable data processing apparatus to function in a particular manner, such that the instructions stored in the computer-readable memory produce an article of manufacture including instruction means which implement the function specified in the flowchart block or blocks. The computer program instructions may also be loaded onto a computer or other programmable data processing apparatus to cause a series of operational steps to be performed on the computer or other programmable apparatus to produce a computer-implemented process such that the instructions which execute on the computer or other programmable apparatus provide steps for implementing the functions specified in the flowchart block or blocks.

Accordingly, functional blocks of the block diagrams and flowchart illustrations support combinations of elements for performing the specified functions, combinations of steps for performing the specified functions, and program instruction means for performing the specified functions. It will also be understood that each functional block of the block diagrams and flowchart illustrations, and combinations of functional blocks in the block diagrams and flowchart illustrations, can be implemented by either special purpose hardware based computer systems which perform the specified functions or steps, or suitable combinations of special purpose hardware and computer instructions.

Again referring to Figure 3, the computer implemented animal monitoring system (4) can include a specialized computer (82) for receiving, processing and transforming a radio signal (22) from a reception device (81) carrying animal identification data (83) and animal physiological parameter data (19) to generate animal identification values (84) and physiological parameter values (85) accessible by the computer user (86). The specialized computer (82) can include at least one processing unit (87), a memory unit (88), and a bus (89) which operably couples components of the computer (82), including, without limitation the memory unit (88) to the processing unit (87). The computer (82) may be a conventional computer, a distributed computer, or any other type of computer which may contain all or a part of the elements described or shown to accomplish the functions described herein; the invention is not so limited. The processing unit

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 353 of 607

(87) can comprise without limitation one central-processing unit (CPU), or a plurality of processing units which operate in parallel to process digital information, or a digital signal processor (DSP) plus a host processor, or the like. The bus (89) can be without limitation any of several types of bus configurations such as a memory bus or memory controller, a peripheral bus, and a local bus using any of a variety of bus architectures. The memory element (88) can without limitation be a read only memory (ROM)(90) or a random access memory (RAM)(91), or both. A basic input/output system (BIOS)(92) containing routines that assist transfer of data between the components of the specialized computer (82), for example during start-up, can be stored in ROM (90). The computer (82) can further include a hard disk drive (93) for reading from and writing to a hard disk (94), a magnetic disk drive (95) for reading from or writing to a removable magnetic disk (96), and an optical disk drive (97) for reading from or writing to a removable optical disk (98) such as a CD ROM or other optical media.

The hard disk drive (93), magnetic disk drive (95), and optical disk drive (97) and the reception device (81) can be connected to the bus (89) by a hard disk drive interface (99), a magnetic disk drive interface (100), and an optical disk drive interface (101), and a radio signal reception device interface (102), respectively. The drives and their associated computer-readable media provide nonvolatile storage of computer-readable instructions, data structures, program modules and other data for the computer (82). It can be appreciated by those skilled in the art that any type of computer-readable media that can store data that is accessible by a computer, such as magnetic cassettes, flash memory cards, digital video disks, Bernoulli cartridges, random access memories (RAMs), read only memories (ROMs), RFID devices or the like, may be used in the exemplary operating environment.

The computer (82) can further include an operating system (103) and an animal monitoring program (104)("AMP") which as to particular embodiments of the invention can include an animal monitoring assembly encoder-decoder module (105) ("AMA encoder-decoder") for programming the animal monitoring assembly (AMA)(66) with animal identification data (83). As to particular embodiments, programming of the AMA (66) can be accomplished using an animal monitoring assembly programmer (106) connected to the bus (89) by an AMA interface (107). The AMA encoder-decoder module (105) can be stored on or in the hard disk (94), magnetic disk (96), optical

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 354 of 607

disk (98), ROM (90), in RAM (91) of the specialized computer (82) or alternately the functionalities of the AMA encoder-decoder module (105) may be implemented as an application specific integrated chip (ASIC) or file programmable gate array (FPGA), or the like.

As to particular embodiments, the specialized computer (82) can be further configured to generate programming data (60) based on computer user (86) interaction the AMP (104) which can be received by the RSR (79) over a local area network (108) over a wide area network (109). The RSR (79) can generate a second radio signal (110) to carry the programming data (60) to the radio signal receiver (30) contained in the AMA (66). The second radio signal (110) can be processed by the microcontroller (8) to reprogram the program code (11) and particularly the power management module (12) to correspondingly alter the operation of the AMA (66), regardless as to whether the bolus (1) containing the AMA (66) has a location outside of the ruminant animal (3) or has a location inside of the ruminant animal (3).

The computer user (86) can enter commands and information into the computer (82) through input devices such as a keyboard (111) and a pointing device (112) such as a mouse. Other input devices (not shown) may include for example: touch on a touch screen, a microphone, joystick, game pad, satellite dish, scanner, magnetic strip of a card, or the like. These and other input devices are often connected to the processing unit (87) through a serial port interface (113) that can be coupled to the bus (89), but may be connected by other interfaces, such as a parallel port, game port, or a universal serial bus (USB). A monitor (114) or other type of display device can also be connected to the bus (89) via interfaces such as a video adapter (115), or the like. In addition to the monitor (114), the computer (82) can further include peripheral output devices (116), such as speakers and printers.

The computer (82) may operate in a networked environment using logical connections to one or a plurality of remote second computers (117). These logical connections can be achieved by a communication device (118) coupled to or a part of the computer (82). Each of the plurality of remote second computers (117) can include a part or all of the elements as included in the specialized computer (82) although only a single box has been illustrated in Figure 3 for the remote second computer (117).

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 355 of 607

When used in a LAN (108) networking environment, the computer (82) can be connected to the LAN (108) through a network interface (119). When used in a WAN (109)-networking environment, the computer (~~92~~ 82) typically includes a modem (120), or other type of communications device, for establishing communications over the WAN (109), such as the Internet. The modem (120), which may be internal or external to the specialized computer (82), can be connected to the bus (89) via the serial port interface (113). In a networked environment, the AMP (104), or portions thereof, may be stored in any one or more of the plurality of remote second computers (117). It is appreciated that the logical connections shown are exemplary and other hardware elements and communications elements can be utilized for establishing a communications link between the specialized computer (82) and one or more of the a plurality of remote second computers (117).

While the computer elements and the network elements shown in Figure 3 can be utilized to practice the invention including the best mode, it is not intended that the description of the best mode of the invention or any preferred embodiment of the invention be limiting with respect to the utilization of a wide variety of similar, different, or equivalent computer elements or network elements to practice embodiments of the invention which include without limitation hand-held devices, such as personal digital assistants or camera/cell phone, tablet or slate computers, multiprocessor systems, microprocessor-based or programmable consumer electronics, network PCs, minicomputers, mainframe computers, PLCs, or the like.

Now referring primarily to Figures 1 and 3, the RSR (79) can receive the first radio signal (22) from the AMA (66) inside the bolus (1) whether inside or outside of the reticulorumen (5) of the ruminant animal (3). The AMA (66) within the bolus (1) can send encoded animal identification data (83) and the encoded physiological data (19) using the first radio signal (22), as above described.

One illustrative embodiment of the RSR (79) as shown in Figures 1 and 3, provides a reader microcontroller (121) which includes a reader processor (122) which controls the functions of a variety of reader processor elements (123) stored in a reader memory element (124) each of which

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 356 of 607

provides a response to events related to receiving the first radio signal (22) from the AMA (66) within the bolus (1) carrying encoded animal identification data (83) and encoded physiological data (19), or receiving reader sensor signals (125) from reader sensors (126) which monitor environmental parameters proximate the RSR (79) such as ambient temperature (127); or generating data packets (80) which include all or parts of such information, or sending data packets (80) to the computer (82) or a remote second computer (117) for access by a computer user (86). A reader microcontroller (121) suitable for use with embodiments of the RSR (79) can be obtained from Microchip Technology. Inc., 2355 West Chandler Blvd., Chandler, Arizona, Part No. PIC18F4620-I/PT, or similar or equivalent components can be suitable as a reader microcontroller (121) programmable to perform the above-described functions of the RSR (79).

Again referring primarily to Figure 3, a reader antenna (128) can receive encoded animal identification data (83) and encoded physiological data (19) and other information generated by operation of the AMA (66) within the bolus (1) within or without of the ruminant animal (3). The reader antenna (128) can be tuned to the first radio signal (22) generated by the AMA (66).

Again referring primarily to Figure 3, the reader sensor (126) can be located to sense the ambient temperature (127) surrounding the RSR (79). The reader sensor (126) can take the form of a thermistor. A suitable thermistor for use in embodiments of the RSR (79) is available from Microchip Technology, Inc., 2355 West Chandler Blvd., Chandler, Arizona, Part No. MCP98242, and similar and equivalent parts.

The reader sensor (126) can be operated under the control of a second reader processor (129) which functions to regulate power to the reader sensor (126) and converts the reader sensor signal (125) into a digital representation of the ambient temperature (127). The second reader processor (129) can further function to encode or re-encode from time to time an amount of reader temperature calibration data (130) which allows calculation and output of an ambient temperature value (131).

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 357 of 607

Again referring primarily to Figure 3, a reader clock element (132) can operate under the control of a third reader processor element (133) to generate a date and time signal (134) that represents a date and time value (135).

Again referring primarily to Figure 3, a fourth reader processor element (136) can function to assemble data packets (80) which as an example can include a representation of the ambient temperature value (141) and the date and time value (135) at which the information from the AMA (66) was received by the RSR (79). The assembled data packet (80) can be stored and retrieved from the reader memory element (124) under the control of the fourth reader processor element (136).

Again referring primarily to Figure 3, a fifth reader processor element (137) can function to provide an ether net interface (138) for an ether net controller (139) to receive instructions or requests from the computer (82) (or remote computer (117). The fifth reader processor (137) can further function to operate a second radio signal generator (140) and transmit the second radio signal (110) to reprogram the computer code (11) or the power management module (12) of the AMA (66) within the bolus (1). The fifth reader processor element (137) can further function to send the data packets (80) to the ether net controller (139) for transmission to the computer (82).

As can be easily understood from the foregoing, the basic concepts of the present invention may be embodied in a variety of ways. The invention involves numerous and varied embodiments of a reciprocally telescoping door stop and methods for making and using such door stops including the best mode.

As such, the particular embodiments or elements of the invention disclosed by the description or shown in the figures or tables accompanying this application are not intended to be limiting, but rather exemplary of the numerous and varied embodiments generically encompassed by the invention or equivalents encompassed with respect to any particular element thereof. In addition, the specific description of a single embodiment or element of the invention may not explicitly describe all embodiments or elements possible; many alternatives are implicitly disclosed by the description and figures.

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 358 of 607

It should be understood that each element of an apparatus or each step of a method may be described by an apparatus term or method term. Such terms can be substituted where desired to make explicit the implicitly broad coverage to which this invention is entitled. As but one example, it should be understood that all steps of a method may be disclosed as an action, a means for taking that action, or as an element which causes that action. Similarly, each element of an apparatus may be disclosed as the physical element or the action which that physical element facilitates. As but one example, the disclosure of a "generator" should be understood to encompass disclosure of the act of "generating" -- whether explicitly discussed or not -- and, conversely, were there effectively disclosure of the act of "generating", such a disclosure should be understood to encompass disclosure of a "generator" and even a "means for generating." Such alternative terms for each element or step are to be understood to be explicitly included in the description.

In addition, as to each term used it should be understood that unless its utilization in this application is inconsistent with such interpretation, common dictionary definitions should be understood to be included in the description for each term as contained in the Random House Webster's Unabridged Dictionary, second edition, each definition hereby incorporated by reference.

All numeric values herein are assumed to be modified by the term "about", whether or not explicitly indicated. For the purposes of the present invention, ranges may be expressed as from "about" one particular value to "about" another particular value. When such a range is expressed, another embodiment includes from the one particular value to the other particular value. The recitation of numerical ranges by endpoints includes all the numeric values subsumed within that range. A numerical range of one to five includes for example the numeric values 1, 1.5, 2, 2.75, 3, 3.80, 4, 5, and so forth. It will be further understood that the endpoints of each of the ranges are significant both in relation to the other endpoint, and independently of the other endpoint. When a value is expressed as an approximation by use of the antecedent "about," it will be understood that the particular value forms another embodiment. The term "about" generally refers to a range of numeric values that one of skill in the art would consider equivalent to the recited numeric value or having the same function or result. Similarly, the antecedent "substantially" means largely, but

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 359 of 607

not wholly, the same form, manner or degree and the particular element will have a range of configurations as a person of ordinary skill in the art would consider as having the same function or result. When a particular element is expressed as an approximation by use of the antecedent "substantially," it will be understood that the particular element forms another embodiment.

Moreover, for the purposes of the present invention, the term "a" or "an" entity refers to one or more of that entity unless otherwise limited. As such, the terms "a" or "an", "one or more" and "at least one" can be used interchangeably herein.

Thus, the applicant(s) should be understood to claim at least: i) each of the bolus or animal monitoring systems herein disclosed and described, ii) the related methods disclosed and described, iii) similar, equivalent, and even implicit variations of each of these devices and methods, iv) those alternative embodiments which accomplish each of the functions shown, disclosed, or described, v) those alternative designs and methods which accomplish each of the functions shown as are implicit to accomplish that which is disclosed and described, vi) each feature, component, and step shown as separate and independent inventions, vii) the applications enhanced by the various systems or components disclosed, viii) the resulting products produced by such systems or components, ix) methods and apparatuses substantially as described hereinbefore and with reference to any of the accompanying examples, x) the various combinations and permutations of each of the previous elements disclosed.

The background section of this patent application provides a statement of the field of endeavor to which the invention pertains. This section may also incorporate or contain paraphrasing of certain United States patents, patent applications, publications, or subject matter of the claimed invention useful in relating information, problems, or concerns about the state of technology to which the invention is drawn toward. It is not intended that any United States patent, patent application, publication, statement or other information cited or incorporated herein be interpreted, construed or deemed to be admitted as prior art with respect to the invention.

The claims set forth in this specification, if any, are hereby incorporated by reference as part of this description of the invention, and the applicant expressly reserves the right to use all of

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 360 of 607

or a portion of such incorporated content of such claims as additional description to support any of or all of the claims or any element or component thereof, and the applicant further expressly reserves the right to move any portion of or all of the incorporated content of such claims or any element or component thereof from the description into the claims or vice-versa as necessary to define the matter for which protection is sought by this application or by any subsequent application or continuation, division, or continuation-in-part application thereof, or to obtain any benefit of, reduction in fees pursuant to, or to comply with the patent laws, rules, or regulations of any country or treaty, and such content incorporated by reference shall survive during the entire pendency of this application including any subsequent continuation, division, or continuation-in-part application thereof or any reissue or extension thereon.

Additionally, the claims set forth in this specification, if any, are further intended to describe the metes and bounds of a limited number of the preferred embodiments of the invention and are not to be construed as the broadest embodiment of the invention or a complete listing of embodiments of the invention that may be claimed. The applicant does not waive any right to develop further claims based upon the description set forth above as a part of any continuation, division, or continuation-in-part, or similar application.

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 361 of 607

SUBSTITUTE SPECIFICATION

"CLEAN" VERSION

CALF BOLUS

I. FIELD OF THE INVENTION

An animal monitoring device configured as a bolus for oral administration to reside in the reticulorumen of a ruminant animal. The animal monitoring device includes a memory element, a processor in communication with the memory element and a computer code contained in the memory element. The computer code includes a power management module executable by the processor to regulate power use by the bolus based on determination of remaining energy stored in an energy source and the determined power requirements over a pre-determined life cycle of the bolus.

II. BACKGROUND OF THE INVENTION

Conventional boluses orally administered to reside in the reticulorumen for monitoring of physiological parameters of ruminant animals may not have a configuration capable of oral administration at birth. Additionally, boluses even when orally administered to adult ruminant animals may not have an operational lifespan long enough to monitor useful physiological parameters over the remaining productive lifespan of the ruminant animal. Moreover, uncontrollable changes in the orientation of the bolus and correspondingly uncontrolled orientation of the bolus antenna in the reticulorumen of the ruminant animal may cause variable quality in radio signal transmission from the ruminant animal resulting in the loss of encoded physiological data.

III. SUMMARY OF THE INVENTION

Accordingly, a broad object of the invention can be to provide a bolus having an outer most surface configuration and a density which allows oral administration to a ruminant animal immediately after birth and prevents or substantially reduces the likelihood of being regurgitated or ejected from the reticulorumen of a ruminant animal over the entire lifespan or productive lifespan of the ruminant animal.

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 363 of 607

Another broad object of the invention can be to provide a bolus which can reside in the reticulorumen of a ruminant animal having an operational lifespan corresponding to the entire lifespan or the productive lifespan of the ruminant animal. One aspect of this broad object of the invention involves a power management module including an activation element which maintains the bolus in a sleep mode in which one or more encoded sensor signals are compared to a pre-selected activation code and upon achieving a pre-selected activation match threshold between the encoded sensor signals and the pre-selected activation code causes the bolus to be activated for normal monitoring of one or more physiological parameters of the ruminant animal. As to particular embodiments, a first and second pre-selected activation match threshold can be met by comparison of a corresponding first and second encoded sensor signals and a first and second pre-selected activation code to provide assurance that environmental events to not inadvertently activate the bolus for normal monitoring. Another aspect of this broad object of the invention involves a power management module pre-programmed or re-programmable to reconfigure the operating parameters of the bolus during residence in the reticulorumen of a ruminant animal to collect only useful physiological data and encode and transmit such physiological data at intervals based upon the life stage of the ruminant animal. Another aspect of this broad object of the invention involves a power management module which functions to evaluate the remaining amount of energy stored in the power source of the bolus and compare the remaining amount of energy to the energy requirements of the bolus during a pre-determined period of time based on the existing programmed operational parameters of the bolus and further functions to employ power regulation events to offset the difference between the energy requirement of the bolus over the pre-determined period of time and the amount of energy remaining in the power source.

Another broad object of the invention can be to provide an antenna having a structure that alters the magnetic field and electrical field generation in a manner that reduces the impact of uncontrollable changes in the orientation of the bolus and correspondingly the orientation of the antenna during residence of the bolus in the reticulorumen of the ruminant animal.

Naturally, further objects of the invention are disclosed throughout other areas of the specification, drawings, photographs, and claims.

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 364 of 607

IV. BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a diagram which shows a particular method of using an embodiment of the animal monitoring system to monitor one or more physiological parameters of a ruminant animal.

Figure 2 is a block diagram of a particular embodiment of a bolus capable of being orally administered to a ruminant animal.

Figure 3 is a block diagram which shows a particular embodiment of an animal monitoring system including a specialized computer, a radio frequency reader and a bolus.

Figure 4 is an exploded view of a particular embodiment of a bolus capable of being orally administered to a ruminant animal.

Figure 5 is a diagram of a particular embodiment of the animal monitoring assembly of the bolus.

Figure 6 is an exploded view of a particular embodiment of an antenna included in the particular embodiment of the bolus shown in Figures 4 and 5.

Figure 7 is a top perspective view of the particular embodiment of the antenna shown in Figure 6 having first and second electrically conductive loops disposed on the opposed surfaces of a non-electrically conductive sheet material.

Figure 8 is top plan view of the particular embodiment of the antenna shown in Figure 6 with vias (shown in broken line) interconnecting a first and second electrically conductive loops without being disposed on opposed surfaces of a non-electrically conductive sheet material.

Figure 9 is a top plan view of the particular embodiment of the antenna shown in Figure 8.

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 365 of 607

Figure 10 is a first side elevation view of the particular embodiment of the antenna shown in Figure 8.

Figure 11 is a second side elevation view of the particular embodiment of the antenna shown in Figure 8.

Figure 12 is a first end elevation view of the particular embodiment of the antenna shown in Figure 8.

Figure 13 is a second end elevation view of the particular embodiment of the antenna shown in Figure 8.

V. DETAILED DESCRIPTION OF THE INVENTION

Now generally referring to Figures 1 through 13, which provide illustrative examples of an inventive bolus (1) and a method of using a bolus (1) to monitor one or more physiological parameters (2) of a ruminant animal (3) and a computer implemented animal monitoring system (4). The bolus (1) can be orally administered to reside in the reticulorumen (5) of the ruminant animal (3). As to certain embodiments, the bolus (1) can include a bolus body (6) having an outer most external surface (7) configured to allow oral administration to a ruminant animal (3), with certain embodiments capable of being orally administered immediately after birth. As to certain embodiments, the bolus (1) can include a microcontroller (8) including a processor (9) in communication with a memory element (10) containing a program code (11) including a power management module (12) which allows the bolus (1) to operate in the reticulorumen (5) of the ruminant animal (3) during the entire life span of the ruminant animal from birth to death or from birth to the end of the productive lifespan of the ruminant animal (3).

For the purposes of this invention the term "ruminant animal (3)" means any mammal of the suborder Ruminantia (both wild and domestic) and, without limiting the breadth of the foregoing definition, includes as illustrative examples: cattle, buffalo, goats, sheep, deer, antelope, giraffes, yaks, okapi, chevotain or the like.

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 366 of 607

For the purposes of this invention the term "birth" means the emergence of the ruminant animal (3) from the body of its mother to begin life as a physically separate ruminant animal (3).

For the purposes of this invention the term "death" means the permanent cessation of vital bodily functions to end life of a ruminant animal (3).

For the purposes of this invention the term "life span" means the period of time between birth and death of a ruminant animal (3).

For the purposes of this invention the term "productive lifespan" means the period of time between birth and the age reached before being culled from production.

For the purposes of this invention the term "reticulorumen (5)" means the first chamber in the alimentary canal of a ruminant animal (3) composed of the rumen and reticulum. The reticulum differs from the rumen with regard to the texture of its lining. The rumen wall is covered in small, finger-like projections called papillae, whereas the reticulum is lined with ridges that form a hexagonal honeycomb pattern. Despite the differences in the texture of the lining of the two parts of the reticulorumen (5), it represents one functional space.

The bolus (1) and the animal monitoring system (4) are described herein in terms of functional block components and various process steps. It should be appreciated that such functional blocks may be realized by any number of hardware or software components configured to perform the specified functions. For example, the bolus (1) and the animal monitoring system (4) may employ various integrated circuit components which function as: memory elements, processing elements, logic elements, look-up tables, or the like, which may carry out a variety of functions under the control of one or more processors or other control devices.

Now referring generally to Figure 2, the bolus (1) can include one or more sensors (13) each capable of generating a sensor signal (14)(whether analog or digital) which varies based on a corresponding change the one or more physiological parameters (2) of a ruminant animal (3). For

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 367 of 607

the purposes of this invention the term "physiological parameter" means a measurable condition of a ruminant animal (3), and without limitation to the breadth of the foregoing, includes one or more of: movement (including one or more of the pitch, yaw, roll, tilt, vibration, jolt, impact, or the like), temperature, sound (including one or more of reticulorumen digestive sounds, heartbeat sound, or the like), heart rate, or the like. Each of the one or more sensors (13) can generate a sensor signal (14) (whether analog or digital) which varies based upon occurrence or change in the sensed physiological parameter (2).

As illustrative examples, sensors (13) suitable for use in particular embodiments include: an omnidirectional tilt and vibration sensor (16)(also referred to as an "accelerometer")(PN SQ-SEN-200) distributed by Signal Quest Precision Microsensors; a temperature sensor (17) such as a Betachip Thermistor (PN 1K2OG3) distributed by BetaTHERM Sensors; a microphone (18) distributed by ST Microelectronics (PN MP34DT01); a humidity sensor (PN HCZ-D5) distributed by Ghitron Technology CO., Ltd; an ultra-miniature pressure transducer (PN COQ-062) distributed by Kulite, a proximity sensor (PN PY3-AN-3) distributed by Automation Direct.com., or similar or equivalent sensors. The illustrative examples and description of these sensors (13) are intended to provide a person of ordinary skill in the art sufficient information to make and use embodiments of the bolus including a numerous and wide variety of sensors whether or not specifically enumerated.

The microcontroller (8) includes a processor (9) in communication with the memory element (10) which contains a computer code (11). In part, the computer code (11) can be executed to continuously or intermittently transform the analog or digital sensor signal (14) from the one or more sensors (13) as encoded physiological data (19)(also referred to as "encoded sensor signals"). The encoded physiological data (19) varies based upon change in the sensor signal (14) which correspondingly varies based upon change in the sensed physiological parameter (2). As to particular embodiments, the computer code (11) can be executed to encode or recode from time to time an amount of sensor calibration data (19A) which allows calculation and output of a physiological parameter value (20) of the ruminant animal (3)(whether by the bolus (1) or by operation of a remote computer (82)). The computer code (11) can be further executed to couple animal identification data (83) to the encoded physiological data (19).

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 368 of 607

The computer code (11) can be further executed to control a radio signal generator (21), for example, an oscillator to generate a stable radio signal (22). An oscillator suitable for use with the invention is available from Freescale Semiconductor, Part No. MC1319x, MC1320x, MC1321x, and MC1322x, and similar or equivalent components. In regard to the particular embodiment of the invention, the radio signal generator (21) can generate a radio signal (22) having a radio signal frequency (23) between about 410MHz and about 1Gz. As one particular embodiment of the invention, the radio signal generator (21) can generate a radio signal frequency (23) of about 433MHz. As to other particular embodiments, the radio signal generator (21) can generate a radio signal (22) having a radio signal frequency (23) of about between about 700 MHz to about 1GHz. The radio signal frequency (23) can be selected from the group including or consisting of: between about 700 MHz to about 800MHz, 750 MHz to about 850MHz, about 800 MHz to about 900MHz, about 850 MHz to about 950MHz, and about 900 MHz to about 1GHz.

The computer code (11) can further function to control a radio frequency stabilizer (24)(shown in the example of Figure 2 as a low pass filter (24A) and a surface acoustic wave filter (24B)) which functions to offset changes in radio signal wave flux caused by changes in temperature or power to the radio signal generator (21). A radio frequency stabilizer (24) suitable for use with embodiments is available from Hope Microelectronics Co., Ltd, Part No. HF433E, RF Monolithics, Inc., Part No. RF1172C, and similar or equivalent parts.

Embodiments of the bolus (1) can further include matching elements (25) which function to match the input impedance of the electrical load or the output impedance of the loads corresponding signal source to maximize the power transfer or minimize signal reflection from the load. In an ideal situation, source impedance and load impedance should be equal to maximize power transfer.

Three elements influence the balance of impedance in radio design: the antenna (28) or "load", the radio signal generator (21) or "source", and the device's ground plane. Since each of these elements have different physical characteristics, their corresponding impedances are inherently different. The passive capacitors (26) and inductors (27) that make up the matching

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 369 of 607

elements (25) of embodiments of the bolus (1) are used to mitigate these differences and rebalance the impedance for a given radio signal frequency (23).

Impedance for an inductor (27) is given by,

$$Z = iwL$$

where L is the inductance and w is angular frequency.

Impedance for a capacitor (26) is given by,

$$Z = \frac{1}{iwC}$$

where C is capacitance

The reactance is,

$$X = -\frac{1}{wC}$$

The matching elements (25) (also referred to as the "resonant circuit") include an array of inductors (27) and capacitors (26) used in series or in parallel to balance the circuit impedance once the impedance of the antenna (28), the radio signal generator (21), and the ground plane (not shown) are known.

A series resonant circuit (25) has an impedance that is the sum of the impedances of the inductor(s)(27) and capacitor(s)(26),

$$Z = i\omega L + \frac{1}{i\omega C} = i\left(\omega L - \frac{1}{\omega C}\right)$$

The impedance of a Parallel Resonant Circuit is found as follows,

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 370 of 607

$$Z = i\left(\frac{\omega L}{1-\omega^2 LC}\right)$$

Resonance in the resonant circuit (25) occurs when the resonant circuit (25) is driven at a frequency *w0* at which the inductive and capacitive reactances are equal in magnitude. The frequency at which this equality holds for the resonant circuit is called the resonant frequency, and can be determined, as follows,

$$\omega_0 = \frac{1}{\sqrt{LC}}$$

This value can then be converted to hertz,

$$f_0 = \frac{\omega_0}{2\pi} = \frac{1}{2\pi\sqrt{LC}}$$

The calculations above can be used to identify the inductors (27) and capacitors (26) used as matching elements (25) in association with the radio signal generator (21) that operates at a specific radio signal frequency (23) to balance the impedance between the radio signal generator (21) and the antenna (28) and limiting the bandwidth to eliminate interference. After the signal passes through the matching elements (25) the resistance of the circuit can be altered to ensure an industry standard of 50 Ohms resistance in the transmission line to the antenna (28). The resistance of the circuit can be altered by inclusion of resistor (25A) to establish the standard 50 Ohms resistance in the circuit.

These calculations, however, apply to a radio signal generator (21) used in normal atmospheric air (also known as "free air"). Because the radio signal generator (21) included in embodiments of the bolus (1) operate within the mass of a ruminant animal (3), it has been discovered that the center frequency (the arithmetic mean of the lower cutoff frequency and the upper cutoff frequency) is shifted lower and may not have the maximum gain.

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 371 of 607

Accordingly, there can be a substantial advantage, by selection of the inductors (27) and capacitors (26) as well as their position in the resonant circuit (25) to increase the inductance and capacitance values to purposefully shift the center frequency upward and allowing the radio signal frequency (23) to be re-tuned to a desired radio signal frequency (23) by passing through the mass of the ruminant animal (3).

Embodiments of the bolus (1) further include an antenna (28) which converts electric power into radio signal (22). In transmission, the radio signal generator (21) supplies an electric current oscillating at one of the above described radio signal frequencies (23). In reception, the antenna (28) intercepts some of the power of an electromagnetic wave (29) in order to produce a tiny voltage at its terminals that is applied to a receiver (30). As to particular embodiments, the antenna (28) can, but need not necessarily, be a laid down electrically conductive path on a printed circuit board (31). An advantage of this configuration of antenna (28) can be that it does not require winding upon or interaction with a magnetic field of a magnet to transmit the radio signal (22). Accordingly, this configuration of antenna (28) can produce a lesser amount of interference from a magnetic field of a magnet (69) contained in the bolus (1) resulting a lower incidence of loss of the radio signal (22) or less modulation of the radio signal (22) which results in a greater consistency (or lesser amount of lost data) in transmission of encoded physiological data (19) associated with the ruminant animal (3).

Now referring primarily to Figures 4 through 13, particular embodiments can, but need not necessarily, include an antenna (28) including a first electrically conductive loop (32) electrically interconnected to a second electrically conductive loop (33)(as shown in the example of Figures 6 through 13) electrically connected to the radio signal generator (21) or radio signal receiver (30)(or combined as a radio signal transceiver (21/30)). 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). Typically, the conductive sheet material will be a copper sheet material or a copper layer. As to particular embodiments, the antenna (28) can further include a non-electrically conductive substrate (38) such as a circuit board (31) (as shown in the example of Figure 6) disposed between the pair of electrically conductive

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 372 of 607

loops (32)(33) with one or more vias (39) electrically interconnecting the first and second electrically conductive loops (32)(33) by one or more holes (40) through the non-electrically conductive substrate (38). The one or more holes (40) can be made electrically conductive by electroplating, or by lining the hole with a tube or a rivet thereby electrically interconnecting the pair of electrically conductive loops (32)(33). There can be substantial advantages in structuring the antenna (28) as above described and as shown in Figures 4 through 13. First, the structure increases the cross-section width of the antenna (28) which increases the stability of the radiated electrical field (41) of the antenna (28). Second, the structure increases the bandwidth of the antenna (28) allowing shift in radio signal frequency (23) or attenuation resulting from passing through the mass of the ruminant animal (3) to be more readily counteracted. Third, the structure alters the magnetic field and electrical field generation which reduces the impact of uncontrollable changes in the orientation of the bolus (1) and correspondingly the orientation of the antenna (28) in the reticulorumen (5) of the ruminant animal (3).

Again referring primarily to Figures 2, 4 and 5, embodiments of the bolus (1) further include a power source (46) (and associated power regulator (46A)) which supplies and adjusts energy (42) (electrical power) to the bolus (1). The power source (46) shown in Figures 2, 4 and 5 can take the form of a battery such as a AA battery, a AAA battery, or the like. The power source (42) provides power to the electronic components supported on the printed circuit board (31) including for example: the microcontroller (8), radio frequency generator (21) and one or more sensors (13). Because the power source (46) of a bolus (1) disposed in the reticulorumen (5) of the ruminant animal (3) cannot be recharged, the operational lifespan of bolus (1) will depend upon capacity of the power source (46) in ampere-hours (Ah) and the load current of the circuit. Power source (46) life will be longer as the load current is reduced and vice versa. The calculation to find out the capacity of power source (46) in the form of a battery can be mathematically derived from the following formula:

Battery Life = Battery Capacity in amps per hour / load current in amps x 0.70

As to particular embodiments of the bolus (1), the computer code (11) can include a power management module (12) which functions to regulate energy use by the bolus (1) to extend the

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 373 of 607

operational life of the bolus (1) disposed in the reticulorumen (5) of the ruminant animal (3). Embodiments of the bolus (1), including particular embodiments the power management module (12), can be operational within the reticulorumen (5) of the ruminant animal (3) for greater than three years and up to about ten years, a period of time substantially greater than that of conventional bolus.

As one illustrative example, embodiments of the inventive bolus (1) can be orally administered to a calf at, or immediately after birth, and remain operational over the entire productive lifespan (53) of the dairy cow, on average about 2.4 lactations, or about five to six years.

As another illustrative example, a ewe typically has a productive lifespan (53) of between about five years to about seven years of age. A ewe's productivity usually peaks between 3 and 6 years of age and begins to decline after the age of seven. As a result, most ewes are removed from a flock before they would reach their natural life expectancy. Accordingly, embodiments of the bolus (1) disposed in the reticulorumen (5) of the ewe at birth can be operational throughout the entire productive lifetime (53) of the ewe.

As to particular embodiments of the bolus (1), the power management module (12), can but need not necessarily include, an activation element (43) which functions to enable and encode the sensor signal(s)(14) from one or more sensors (13) and can further function to compare the one or more encoded sensor signals (19) against one or more preselected activation code(s)(44). If by comparison of the encoded sensor signal(s)(19) against the preselected activation code(s)(44), a pre-selected activation match threshold (45) is met, the activation element (43) can further function to cause activation of the bolus (1) for normal operation. This provides the advantage of avoiding inadvertent or premature activation of the bolus (1) and the corresponding unnecessary expenditure of energy (42) from the power source (46).

As one illustrative example of the function of the activation element (43), the bolus (1) can include a first sensor (13A) which can be an accelerometer (16). Accelerometers (16) in accordance with embodiments of the invention can sense the movement of the bolus (1)(whether

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 374 of 607

within or without the ruminant animal), in a manner similar to accelerometers (16) used in tablet computers and digital cameras, such that images on display screens are always displayed upright, or as used in drones for flight stabilization. The accelerometer (16) can be enabled by the function of the activation element (43), and the activation element (43) can further function to encode the first sensor signal (14A) from the accelerometer (16) and compare the first encoded sensor signal (19A) against a first preselected activation code (44A). The first preselected activation code (44A), in the context of this illustrative embodiment, can correspond to a particular pre-activation movement (47) of the bolus (1) which can, but need not necessarily be, three serial reciprocal linear movements of the bolus (1) each terminating in an impact of the bolus (1) within a period of time of between about five seconds and ten seconds (also referred as "three bumps"). If the pre-activation movement (47) of the bolus (1) including "three bumps" meets the first pre-selected activation match threshold (45A) relating to the first preselected activation code (44A) corresponding to "three bumps" the activation element (43) can cause the bolus (1) to be activated for normal monitoring of the ruminant animal (3). As to particular embodiments, the bolus (1) can, but need not necessarily, include an illumination element (48), such as a light emitting diode (49). The illumination element (48) can be switched on by operation of the activation element (43) to provide an amount of light (50) as an indicator that the bolus (1) has been activated and can be orally administered to a ruminant animal (3).

As to particular embodiments, the bolus (1) can, but need not necessarily, include a second sensor (13B) which can be a temperature sensor (17) (also referred to as a "thermistor"). Thermistors (17), in accordance with embodiments of the invention, can sense the temperature (57) of the bolus (1)(whether within or without of the ruminant animal) in a useful range of temperature and accuracy depending upon the ruminant animal (3) into which the bolus (1) is to be orally administered and the determinations to be made from the sensed temperature (57). For example, the useful temperature range in dairy cow will be between about 95°F (about 35°C) to about 115°F (about 46°C) with an accuracy of between about 0.1°C and about 0.3°C. The normal temperature of an adult cow will typically be about 101.5°F (about 38.5°C), but can vary throughout the estrous cycle with the lowest temperature being just before heat and highest temperature on the day of heat or due to being in milk, and a temperature of about 103.0°F (about 39.4°C) to about 104.0°F (about 40°C) and upward to about 108°F (about 42.2°C), typically

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 375 of 607

indicative of a sick cow. However, this illustrative example is not intended to preclude the use of thermistors (17) which may sense a wider temperature range, as one illustrative example, about -40°C to about +125°C, as long as the accuracy is not less than about 0.1°C to about 0.2°C of the actual temperature about the bolus (1) and the time constant to change from one temperature value to another temperature value is sufficiently short to support the sampling rate of the sensor signal (14) effected by the computer code (11) in regard to the thermistor (17). For example, thermistors (17) utilized with embodiments of the bolus (1) may have a time constant of about one minute or less and while the sampling rate may be once every 10 minutes to 20 minutes or longer depending upon the application.

As to particular embodiments, the activation element (43) having activated the bolus (1)(and as to particular embodiments, switched on the light illumination element (48)) can, but need not necessarily, further enable and encode a second sensor signal (14B) from a second sensor (13B) which can be a thermistor (17). The activation element (43) can further function to encode the second sensor signal (14B) from the second sensor (13B) such as thermistor (17) and compare the second encoded sensor signal (19B) against the second preselected activation code (44B). The second preselected activation code (44B), in the context of this illustrative embodiment, can correspond to a pre-activation temperature (51) of the bolus (1) which can, but need not necessarily be, three serial temperature reads of the bolus (1) each about 15 minutes apart within a period of time of about 45 minutes (also referred to as "three temperature reads"). If the pre-activation temperature (51) of the bolus (1) including "three temperature reads" meets the second pre-selected activation match threshold (45B) for the second preselected activation code (44B) corresponding to "three temperature reads" the activation element (43) can cause the bolus (1) to be activated for normal monitoring of a ruminant animal (3). In the illustrative example of a bolus (1) used in calves or cows, if the three temperature reads are between about 100°F (about 37.8°C) and about 105°F (about 40.6°C), this would be indicative that the bolus (1) resides in the reticulorumen (5) of a calf or cow, and the activation element (43) can then function to cause the bolus (1) to be activated for normal monitoring of the ruminant animal (3). This provides the advantage of avoiding inadvertent or premature activation of the bolus (1) and the corresponding unnecessary expenditure of energy (42).

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 376 of 607

As to particular embodiments, the power management module (12) can, but need not necessarily, further function to reconfigure the mode of operation of the bolus (1) or allow the mode of operation of the bolus (1) to be reconfigured while residing in the reticulorumen (5) of the ruminant animal (3) to regulate energy (42) use by the bolus (1) which can have the advantage of extending the operational life of the bolus (1).

As to particular embodiments, the power management module (12) can regulate energy (42) use by the bolus (1) by enabling or disabling one or more sensors (13) based upon a pre-determined set of physiological parameters (2) to be sensed during one or more stages (52) in a lifespan (53) of the ruminant animal (3). The encoded physiological data (19) useful in making determinations relating to a ruminant animal (3) may be different in a first stage (54) in the lifespan (53)(for example, the time period between birth and puberty) as compared to a second stage (55) (for example, the time period commencing with puberty until the end of reproductive age (or useful reproductive age))(as shown in the example of Figure 1). As one illustrative example in dairy cows, from birth until puberty in dairy cows at about eight months to about seventeen months of age depending upon the breed, the useful encoded physiological data (19) may only include encoded physiological data (19) relating to temperature (57). Accordingly, in a first stage (54) of the ruminant animal (3) lifespan (53) the power management module (12) can function upon activation of the bolus (1), as above described, to only enable and periodically read the sensor signal (14A) and generate encoded physiological data (19) for temperature (57) of the ruminant animal (3). Additionally, because the encoded physiological data (19) for temperature (57) may only be used to determine whether the ruminant animal (3) is sick, there may be a substantial period of time between reads of the temperature sensor signal (14), such as, once in a twenty-four hour period. Similarly, there may be a substantial period of time between operational periods of the radio signal generator (21), such as twenty four hours, and the operational period of the radio signal generator (21) may be very short, such as, a few milliseconds (also referred to as a "transmission burst (56)"). Because the majority of energy (42) used by the bolus (1) is in operation of the radio signal generator (21), increasing the time period between transmission bursts (56) and limiting the duration of the transmission burst (56) only to that period of time necessary to transmit the limited amount of encoded physiological data (19) can substantially increase the operating lifespan of the bolus (1).

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 377 of 607

By comparison, in second stage (55) of the lifespan (53) of a ruminant animal (3) from puberty to the end of reproductive age of the ruminant animal (3), the useful encoded physiological data (19) may include both encoded physiological data (19) for temperature (57) and encoded physiological data (19) for movement (58). As above explained, the temperature (57) of ruminant animal (3) may vary throughout the estrous cycle with the lowest temperature being just before heat and highest temperature on the day of heat. Additionally, the activity of the cow can measurably change prior to or concurrent with heat.

Accordingly, as to particular embodiments, the power management module (12) can further include a timer element (59) which functions to assess elapsed time from activation of the bolus (1) allowing regulation of energy (42) use by the bolus (1) based on elapsed time which can be coordinated to one or more of the stages (52) in the lifespan (53) of the ruminant animal (3). As one illustrative example, if the bolus (1) is orally administered at birth, the timer element (59) and the power management module (12) can function to enable a first sensor (13A) (or first set of sensors (13) providing useful encoded physiological data (19) during the first stage (54)) and encode physiological data (19) for temperature (57) (or first set of physiological parameters) for a period of time corresponding the first stage (54) of the lifespan (53) of the ruminant animal (3)(for example, between birth and puberty), and then function to further enable a second sensor (13B)(or second set of sensors (13) providing useful encoded physiological data (19) during a second stage (55) of the ruminant animal (3)) and encode physiological data (19) for both temperature (57) and movement (58).

Additionally, because the encoded physiological data (19) for movement (58) and temperature (57) may be used to determine whether the ruminant animal (3) is in estrus, the power management module (12) can function to reduce the period of time between reads of the sensor signal (14) temperature (57) and the sensor signal (14) for movement (58), such as, four times in a twenty-four hour period. Similarly, there may be a lesser period of time between operational periods of the radio signal generator (21), such as every six hours, and the operational period of the radio signal generator (21) may be adjusted to a period of time to transmit the additional encoded physiological data (19).

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 378 of 607

As to particular embodiments, once the ruminant animal (3) becomes pregnant and during the pregnancy, the power management module (12) can further function to reconfigure the operation of the bolus (1) to disable the sensor (13) for movement (58) and read only the sensor (13) for temperature (57) and transmit encoded physiological data (19) at less frequent intervals.

As to particular embodiments, the program code (11) can be reprogrammed while the bolus (1) resides in the reticulorumen (5) of the ruminant animal (3) by receiving programming data (60) to reconfigure the power management module (12) to regulate energy (42) use by the bolus (1), as above described.

As to particular embodiments, the power management module (12) can, but need not necessarily, include a power sensor element (61) executable to determine the remaining amount of energy (42) in the power source (46). The power management module (12) can be further executed to determine the amount of energy (42) required to power the bolus (1) through a pre-determined period of time (62) based on the then existing program code (11) contained in the memory element (10) of the bolus (1). The power management module (12) can be further executed to compare the remaining amount of energy (42) in the power source (46) with the amount of energy (42) required to power the bolus (1) through the pre-determined period of time (62) based on the then existing program code (11) to determine the difference in the amount of energy (42) remaining in the power source (46) and the amount of energy (42) required to power the bolus (1) through the pre-determined period of time (62). The power management module (12) can be further executed to perform one or more power regulation events (63) to make up the difference in the amount of energy (42) to allow operation of the bolus (1) through the pre-determined period of time (62). The power regulation events (63) can include or consist of one or more of: switching off the light illumination element (48), increasing the interval of time between operation of the radio signal generator (21), decreasing the operational time period of the radio signal generator (21), disabling one or more of the plurality of sensors (13), interrupt encoding of the sensor signal (14) from one or more of said plurality of sensors (13), or other re-programming that reduces energy (42) use.

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 379 of 607

As to particular embodiments, the power management module (12) can be pre-programmed to perform one or more of the power regulation events (63) in one or more pre-programmed priority orders based upon the magnitude of the difference in the amount of energy (42) remaining in the energy source (46) and the required amount of energy (42) to power the bolus through the remaining portion of a pre-programmed or re-programmed life cycle. Alternately, the power management module (12) can function to encode and transmit as part of a transmission burst (56) encoded power source data (64) from which the remaining amount of energy (42) in the energy source (46) can be calculated using a remote specialized computer (82) and the power management module (12) can be re-programmed to execute one more power regulation events (63) based on a priority order encoded in the programming data (60) received by the bolus (1).

Now referring primarily to Figures 4 and 5, embodiments of the bolus (1) which are orally administered to a ruminant animal (3) can, but need not necessarily, include an inert bolus body (6) having external dimensional relations adapted to allow oral administration and retention of the bolus (1) in the reticulorumen (5) of a ruminant animal (3). As one non-limiting example, the inert bolus body (6) can include an amount of plastic resin (65) cast about the animal monitoring assembly (66) ("AMA"), including one or more of the components above-described. The amount of plastic resin (65) can be, as an example, a plastic resin such as urethane resin, epoxy resin, polyester resin, or the like used in accordance with the manufacturer's instructions. As to other embodiments, the inert bolus body (6) can comprise a sealable housing (67) defining a hollow inside space (68) which receives the AMA (66). As to other embodiments, the sealable housing (67) including the AMA (66) received in the hollow space (68) (and as to particular embodiments further including one or more magnets (69) received in the hollow space (68)) can have the amount of plastic resin (65) cast about the AMA (66) (and one or more magnets (69)) located inside said sealable housing (67).

Again referring primarily to Figure 4, configurations of the inventive bolus (1) suitable for oral administration to a ruminant animal (3) can have a generally cylindrical configuration with a diameter (77) in orthogonal cross section in the range of about one-half inch (about 13 millimeters ("mm")) to about one and one quarter inch (about 32 mm) and having a bolus length (70) disposed between a first bolus end (71) and a second bolus end (72) in the range of about two inches (about

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 380 of 607

50 mm) and about five inches (about 127 mm). Particular embodiments of the bolus (1) can have a length of about four inches (about 102 mm) and a diameter (77) in orthogonal cross section of about one inch (about 25 mm). While the example of Figure 4 shows the bolus (1) including a housing (67) having matable halves (73)(74) with an outer most external surface (7) configured as a cylinder; the bolus (1) can have numerous and varied outer most external surface (7) configurations capable of oral administration and retention within the reticulorumen (5) of a ruminant animal (3). The inert bolus body (6) can be molded, cast, or machined from biocompatible (or biologically inert) non-magnetic materials which allow transmission of the radio signal (22) from within the bolus (1) to outside of the ruminant animal (3). As examples, the inert bolus body (6) can be made from plastics such as nylon, fluorocarbon, polypropylene, polycarbonate, urethane, epoxy, polyethylene, or the like; or metals such as stainless steel; or other materials such as glass can be utilized. The bolus (1) having a hollow inside space (68) can be generated by a wide variety of procedures such as molding, casting, fabrication or the like. As one non-limiting example, a cylindrical tube having an external diameter and an internal diameter, as above described, can be divided into sections of suitable length to which end caps can be fitted. Alternately, a bore can be made in a cylindrical solid rod having an external diameter, as above described, to provide a closed end tube with the bore having sufficient dimension to provide the hollow inside space (68).

As to particular embodiments, the inert bolus body (6) can, but need not necessarily, include a translucent or transparent element (75) to allow viewing of the amount of light (50) generated by the illumination element (48) as a viewable indicator that the bolus is activated as above described. The translucent or transparent element (75) can include a portion or the entirety of the housing (67) of the inert bolus body (6).

As to particular embodiments of the bolus (1), the inert bolus body (6) can be configured for oral administration to ruminant animals (3) at birth. The digestive track between the mouth (76) and the reticulorumen (5) of a ruminant animal (3) at birth can have comparatively restrictive dimensions as compared to adult ruminant animals (3). Therefore, conventionally configured bolus (1) may not be orally administered to ruminant animals (3) at birth or when orally

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 381 of 607

administered may cause injury or be regurgitated as the digestive track between the mouth (76) and the reticulorumen (5) enlarges due to growth of the ruminant animal (3).

The configuration of outer most external surface (7) of the housing (67) of the inert bolus body (6) or the bolus density (78), or combinations thereof, can be critical when a bolus (1) is orally administered to a ruminant animal (3) at birth. It has been discovered that while the bolus length (70) between the first and second bolus ends (71)(72) can be more variable, it can be critical that the greatest bolus diameter (77) (or width) of the outer most external surface (7) along the length (70) between the pair of bolus ends (71)(72) should be between one half inch (about 13 mm) and not exceed three quarters of an inch (about 19 millimeters). The configuration of the outer most external surface (7) of the bolus (1) can have a bolus width (77) selected from the group including or consisting of: about 13 mm to about 15 mm, about 14 mm to about 16 mm, about 15 mm to about 17 mm, about 16 mm to about 18 mm, and about 17 mm to about 19 mm.

As one illustrative example, a bolus (1) configured for oral administration to ruminant animals (3) at birth can have an outer most external surface (7) of the bolus body (6) having cylindrical configuration as shown in the example of Figure 4. The bolus length (70) can vary between about three inches (about 76 mm) and about six inches (about 152 mm) between the a pair of bolus ends (71)(72); however, the outer most external surface (7) at any cross section orthogonal to the bolus length (70) should not exceed about 19 millimeters. As a second illustrative example, the bolus body can be substantially spherical having an external diameter not exceeding about three quarters of an inch (about 19 mm).

Embodiments of the inventive bolus (1) can, but need not necessarily, have a bolus density (78) of between about 2.1 grams per cubic centimeter ("g/cm^3") to about 3.3 g/cm^3. However, there can be substantial advantages in configuring the bolus (1) to achieve a bolus density (78) in the range of between about 2.1 g/cm^3 to about 3.3 g/cm^3 in that the bolus (1) is substantially less likely to be regurgitated or ejected from reticulorumen (5) of a ruminant animal (3) as compared to conventional bolus. It can be critical to achieve a bolus density (78) of between about 2.1 g/cm^3 to about 3.3 g/cm^3 when dimensions of the outer most external surface (7) are reduced for oral administration to ruminant animals (3) at birth or the bolus (1) resides in the reticulorumen (5) of

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 382 of 607

the ruminant animal (3) for the entire lifespan (53) of the ruminant animal (3). Within the range of bolus density (78), the bolus density can be selected from the group including or consisting of: about 2.3 g/cm^3 to about 2.5 g/cm^3, about 2.4 g/cm^3 to about 2.6 g/cm^3, about 2. g/cm^3 to about 2.7 g/cm^3, about 2.6 g/cm^3 to about 2.8 g/cm^3, about 2.7 grams g/cm^3 to about 2.9 g/cm^3; about 2.8 g/cm^3 to about 3.0 g/cm^3, about 2.9 g/cm^3 to about 3.1 g/cm^3; about 3.0 g/cm^3 to about 3.2 g/cm^3, and about 3.1 g/cm^3 to about 3.3 g/cm^3.

Now referring primarily to Figure 3, the animal monitoring system (4) can, but need not necessarily, include one or more radio signal reader(s) (79) can be located to receive the radio signal (22) carrying the encoded physiological data (19) from one or more bolus (1). As to particular embodiments, the one or more radio signal readers (79) ("RSR") can further operate to assemble the encoded physiological data (19) into one or more data packets (80) which can be transmitted and received by a wired or wireless reception device (81) (which can be integrated into a specialized computer (82)). The reception device (81) can transfer the data packets (80) to a specialized computer (82). The specialized computer (82) can operate to transform the encoded animal identification data (83) and encoded physiological data (19) to output an animal identification value (84) (an alpha or numeric or other animal identifier) and to output physiological parameter values (85)(an alpha or numeric or other symbols). A computer user (86) can access the animal identification value (84) and the physiological parameter values (85) by use of the specialized computer (82).

Now referring generally to Figure 3, the specialized computer (82) is described herein in terms of functional block components, screen shots, and various process steps. It should be appreciated that such functional blocks may be realized by any number of hardware or software components configured to perform the specified functions.

Similarly, the software elements of the present invention may be implemented with any programming or scripting language such as C, C++, JAVA, COBOL, ASSEMBLER, PERL, LABVIEW, or any graphical user interface programming language, extensible markup language (XML), Microsoft's VISUAL STUDIO.NET, VISUAL BASIC, or the like, with the various algorithms or Boolean Logic being implemented with any combination of data structures, objects,

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 383 of 607

processes, routines or other programming elements. Further, it should be noted that the present invention might employ any number of conventional wired or wireless techniques for data transmission, signaling, data processing, network control, and the like.

It should be appreciated that the particular computer implementations shown and described herein are illustrative of the invention and its best mode and are not intended to otherwise limit the scope of the present invention in any way. Indeed, for the sake of brevity, conventional data networking, application development and other functional aspects of the systems (and components of the individual operating components of the systems) may not be described in detail herein. Furthermore, the connecting lines shown in the various figures contained herein are intended to represent exemplary functional relationships and/or physical couplings between the various elements. It should be noted that many alternative or additional functional relationships or physical connections may be present in a computer implemented animal monitoring system (4).

As will be appreciated by one of ordinary skill in the art, the present invention may be embodied in the alternative as a method, a data processing system, a device for data processing, a computer program product, or the like. Accordingly, the present invention may take the form of an entirely software embodiment, an entirely hardware embodiment, or an embodiment combining aspects of both software and hardware. Furthermore, the present invention may take the form of a computer program product on a computer-readable storage medium having computer-readable program code means embodied in the storage medium. Any suitable computer-readable storage medium may be utilized, including hard disks, CD-ROM, optical storage devices, magnetic storage devices, ROM, flash RAM, or the like.

It will be understood that each functional block of the block diagrams and the flowchart illustrations, and combinations of functional blocks in the block diagrams and flowchart illustrations, respectively, can be implemented by computer program instructions. These computer program instructions may be loaded onto a general purpose computer, special purpose computer, or other programmable data processing apparatus to produce a machine, such that the instructions which execute on the computer or other programmable data processing apparatus for implementing the functions specified in the flowchart block or blocks.

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 384 of 607

These computer program instructions may also be stored in a computer-readable memory that can direct a computer or other programmable data processing apparatus to function in a particular manner, such that the instructions stored in the computer-readable memory produce an article of manufacture including instruction means which implement the function specified in the flowchart block or blocks. The computer program instructions may also be loaded onto a computer or other programmable data processing apparatus to cause a series of operational steps to be performed on the computer or other programmable apparatus to produce a computer-implemented process such that the instructions which execute on the computer or other programmable apparatus provide steps for implementing the functions specified in the flowchart block or blocks.

Accordingly, functional blocks of the block diagrams and flowchart illustrations support combinations of elements for performing the specified functions, combinations of steps for performing the specified functions, and program instruction means for performing the specified functions. It will also be understood that each functional block of the block diagrams and flowchart illustrations, and combinations of functional blocks in the block diagrams and flowchart illustrations, can be implemented by either special purpose hardware based computer systems which perform the specified functions or steps, or suitable combinations of special purpose hardware and computer instructions.

Again referring to Figure 3, the computer implemented animal monitoring system (4) can include a specialized computer (82) for receiving, processing and transforming a radio signal (22) from a reception device (81) carrying animal identification data (83) and animal physiological parameter data (19) to generate animal identification values (84) and physiological parameter values (85) accessible by the computer user (86). The specialized computer (82) can include at least one processing unit (87), a memory unit (88), and a bus (89) which operably couples components of the computer (82), including, without limitation the memory unit (88) to the processing unit (87). The computer (82) may be a conventional computer, a distributed computer, or any other type of computer which may contain all or a part of the elements described or shown to accomplish the functions described herein; the invention is not so limited. The processing unit (87) can comprise without limitation one central-processing unit (CPU), or a plurality of

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 385 of 607

processing units which operate in parallel to process digital information, or a digital signal processor (DSP) plus a host processor, or the like. The bus (89) can be without limitation any of several types of bus configurations such as a memory bus or memory controller, a peripheral bus, and a local bus using any of a variety of bus architectures. The memory element (88) can without limitation be a read only memory (ROM)(90) or a random access memory (RAM)(91), or both. A basic input/output system (BIOS)(92) containing routines that assist transfer of data between the components of the specialized computer (82), for example during start-up, can be stored in ROM (90). The computer (82) can further include a hard disk drive (93) for reading from and writing to a hard disk (94), a magnetic disk drive (95) for reading from or writing to a removable magnetic disk (96), and an optical disk drive (97) for reading from or writing to a removable optical disk (98) such as a CD ROM or other optical media.

The hard disk drive (93), magnetic disk drive (95), and optical disk drive (97) and the reception device (81) can be connected to the bus (89) by a hard disk drive interface (99), a magnetic disk drive interface (100), and an optical disk drive interface (101), and a radio signal reception device interface (102), respectively. The drives and their associated computer-readable media provide nonvolatile storage of computer-readable instructions, data structures, program modules and other data for the computer (82). It can be appreciated by those skilled in the art that any type of computer-readable media that can store data that is accessible by a computer, such as magnetic cassettes, flash memory cards, digital video disks, Bernoulli cartridges, random access memories (RAMs), read only memories (ROMs), RFID devices or the like, may be used in the exemplary operating environment.

The computer (82) can further include an operating system (103) and an animal monitoring program (104)("AMP") which as to particular embodiments of the invention can include an animal monitoring assembly encoder-decoder module (105) ("AMA encoder-decoder") for programming the animal monitoring assembly (AMA)(66) with animal identification data (83). As to particular embodiments, programming of the AMA (66) can be accomplished using an animal monitoring assembly programmer (106) connected to the bus (89) by an AMA interface (107). The AMA encoder-decoder module (105) can be stored on or in the hard disk (94), magnetic disk (96), optical disk (98), ROM (90), in RAM (91) of the specialized computer (82) or alternately the

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 386 of 607

functionalities of the AMA encoder-decoder module (105) may be implemented as an application specific integrated chip (ASIC) or file programmable gate array (FPGA), or the like.

As to particular embodiments, the specialized computer (82) can be further configured to generate programming data (60) based on computer user (86) interaction the AMP (104) which can be received by the RSR (79) over a local area network (108) over a wide area network (109). The RSR (79) can generate a second radio signal (110) to carry the programming data (60) to the radio signal receiver (30) contained in the AMA (66). The second radio signal (110) can be processed by the microcontroller (8) to reprogram the program code (11) and particularly the power management module (12) to correspondingly alter the operation of the AMA (66), regardless as to whether the bolus (1) containing the AMA (66) has a location outside of the ruminant animal (3) or has a location inside of the ruminant animal (3).

The computer user (86) can enter commands and information into the computer (82) through input devices such as a keyboard (111) and a pointing device (112) such as a mouse. Other input devices (not shown) may include for example: touch on a touch screen, a microphone, joystick, game pad, satellite dish, scanner, magnetic strip of a card, or the like. These and other input devices are often connected to the processing unit (87) through a serial port interface (113) that can be coupled to the bus (89), but may be connected by other interfaces, such as a parallel port, game port, or a universal serial bus (USB). A monitor (114) or other type of display device can also be connected to the bus (89) via interfaces such as a video adapter (115), or the like. In addition to the monitor (114), the computer (82) can further include peripheral output devices (116), such as speakers and printers.

The computer (82) may operate in a networked environment using logical connections to one or a plurality of remote second computers (117). These logical connections can be achieved by a communication device (118) coupled to or a part of the computer (82). Each of the plurality of remote second computers (117) can include a part or all of the elements as included in the specialized computer (82) although only a single box has been illustrated in Figure 3 for the remote second computer (117).

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 387 of 607

When used in a LAN (108) networking environment, the computer (82) can be connected to the LAN (108) through a network interface (119). When used in a WAN (109)-networking environment, the computer (82) typically includes a modem (120), or other type of communications device, for establishing communications over the WAN (109), such as the Internet. The modem (120), which may be internal or external to the specialized computer (82), can be connected to the bus (89) via the serial port interface (113). In a networked environment, the AMP (104), or portions thereof, may be stored in any one or more of the plurality of remote second computers (117). It is appreciated that the logical connections shown are exemplary and other hardware elements and communications elements can be utilized for establishing a communications link between the specialized computer (82) and one or more of the a plurality of remote second computers (117).

While the computer elements and the network elements shown in Figure 3 can be utilized to practice the invention including the best mode, it is not intended that the description of the best mode of the invention or any preferred embodiment of the invention be limiting with respect to the utilization of a wide variety of similar, different, or equivalent computer elements or network elements to practice embodiments of the invention which include without limitation hand-held devices, such as personal digital assistants or camera/cell phone, tablet or slate computers, multiprocessor systems, microprocessor-based or programmable consumer electronics, network PCs, minicomputers, mainframe computers, PLCs, or the like.

Now referring primarily to Figures 1 and 3, the RSR (79) can receive the first radio signal (22) from the AMA (66) inside the bolus (1) whether inside or outside of the reticulorumen (5) of the ruminant animal (3). The AMA (66) within the bolus (1) can send encoded animal identification data (83) and the encoded physiological data (19) using the first radio signal (22), as above described.

One illustrative embodiment of the RSR (79) as shown in Figures 1 and 3, provides a reader microcontroller (121) which includes a reader processor (122) which controls the functions of a variety of reader processor elements (123) stored in a reader memory element (124) each of which provides a response to events related to receiving the first radio signal (22) from the AMA (66)

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 388 of 607

within the bolus (1) carrying encoded animal identification data (83) and encoded physiological data (19), or receiving reader sensor signals (125) from reader sensors (126) which monitor environmental parameters proximate the RSR (79) such as ambient temperature (127); or generating data packets (80) which include all or parts of such information, or sending data packets (80) to the computer (82) or a remote second computer (117) for access by a computer user (86). A reader microcontroller (121) suitable for use with embodiments of the RSR (79) can be obtained from Microchip Technology. Inc., 2355 West Chandler Blvd., Chandler, Arizona, Part No. PIC18F4620-I/PT, or similar or equivalent components can be suitable as a reader microcontroller (121) programmable to perform the above-described functions of the RSR (79).

Again referring primarily to Figure 3, a reader antenna (128) can receive encoded animal identification data (83) and encoded physiological data (19) and other information generated by operation of the AMA (66) within the bolus (1) within or without of the ruminant animal (3). The reader antenna (128) can be tuned to the first radio signal (22) generated by the AMA (66).

Again referring primarily to Figure 3, the reader sensor (126) can be located to sense the ambient temperature (127) surrounding the RSR (79). The reader sensor (126) can take the form of a thermistor. A suitable thermistor for use in embodiments of the RSR (79) is available from Microchip Technology, Inc., 2355 West Chandler Blvd., Chandler, Arizona, Part No. MCP98242, and similar and equivalent parts.

The reader sensor (126) can be operated under the control of a second reader processor (129) which functions to regulate power to the reader sensor (126) and converts the reader sensor signal (125) into a digital representation of the ambient temperature (127). The second reader processor (129) can further function to encode or re-encode from time to time an amount of reader temperature calibration data (130) which allows calculation and output of an ambient temperature value (131).

Again referring primarily to Figure 3, a reader clock element (132) can operate under the control of a third reader processor element (133) to generate a date and time signal (134) that represents a date and time value (135).

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 389 of 607

Again referring primarily to Figure 3, a fourth reader processor element (136) can function to assemble data packets (80) which as an example can include a representation of the ambient temperature value (141) and the date and time value (135) at which the information from the AMA (66) was received by the RSR (79). The assembled data packet (80) can be stored and retrieved from the reader memory element (124) under the control of the fourth reader processor element (136).

Again referring primarily to Figure 3, a fifth reader processor element (137) can function to provide an ether net interface (138) for an ether net controller (139) to receive instructions or requests from the computer (82) (or remote computer (117). The fifth reader processor (137) can further function to operate a second radio signal generator (140) and transmit the second radio signal (110) to reprogram the computer code (11) or the power management module (12) of the AMA (66) within the bolus (1). The fifth reader processor element (137) can further function to send the data packets (80) to the ether net controller (139) for transmission to the computer (82).

As can be easily understood from the foregoing, the basic concepts of the present invention may be embodied in a variety of ways. The invention involves numerous and varied embodiments of a reciprocally telescoping door stop and methods for making and using such door stops including the best mode.

As such, the particular embodiments or elements of the invention disclosed by the description or shown in the figures or tables accompanying this application are not intended to be limiting, but rather exemplary of the numerous and varied embodiments generically encompassed by the invention or equivalents encompassed with respect to any particular element thereof. In addition, the specific description of a single embodiment or element of the invention may not explicitly describe all embodiments or elements possible; many alternatives are implicitly disclosed by the description and figures.

It should be understood that each element of an apparatus or each step of a method may be described by an apparatus term or method term. Such terms can be substituted where desired to

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 390 of 607

make explicit the implicitly broad coverage to which this invention is entitled. As but one example, it should be understood that all steps of a method may be disclosed as an action, a means for taking that action, or as an element which causes that action. Similarly, each element of an apparatus may be disclosed as the physical element or the action which that physical element facilitates. As but one example, the disclosure of a "generator" should be understood to encompass disclosure of the act of "generating" -- whether explicitly discussed or not -- and, conversely, were there effectively disclosure of the act of "generating", such a disclosure should be understood to encompass disclosure of a "generator" and even a "means for generating." Such alternative terms for each element or step are to be understood to be explicitly included in the description.

In addition, as to each term used it should be understood that unless its utilization in this application is inconsistent with such interpretation, common dictionary definitions should be understood to be included in the description for each term as contained in the Random House Webster's Unabridged Dictionary, second edition, each definition hereby incorporated by reference.

All numeric values herein are assumed to be modified by the term "about", whether or not explicitly indicated. For the purposes of the present invention, ranges may be expressed as from "about" one particular value to "about" another particular value. When such a range is expressed, another embodiment includes from the one particular value to the other particular value. The recitation of numerical ranges by endpoints includes all the numeric values subsumed within that range. A numerical range of one to five includes for example the numeric values 1, 1.5, 2, 2.75, 3, 3.80, 4, 5, and so forth. It will be further understood that the endpoints of each of the ranges are significant both in relation to the other endpoint, and independently of the other endpoint. When a value is expressed as an approximation by use of the antecedent "about," it will be understood that the particular value forms another embodiment. The term "about" generally refers to a range of numeric values that one of skill in the art would consider equivalent to the recited numeric value or having the same function or result. Similarly, the antecedent "substantially" means largely, but not wholly, the same form, manner or degree and the particular element will have a range of configurations as a person of ordinary skill in the art would consider as having the same function

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 391 of 607

or result. When a particular element is expressed as an approximation by use of the antecedent "substantially," it will be understood that the particular element forms another embodiment.

Moreover, for the purposes of the present invention, the term "a" or "an" entity refers to one or more of that entity unless otherwise limited. As such, the terms "a" or "an", "one or more" and "at least one" can be used interchangeably herein.

Thus, the applicant(s) should be understood to claim at least: i) each of the bolus or animal monitoring systems herein disclosed and described, ii) the related methods disclosed and described, iii) similar, equivalent, and even implicit variations of each of these devices and methods, iv) those alternative embodiments which accomplish each of the functions shown, disclosed, or described, v) those alternative designs and methods which accomplish each of the functions shown as are implicit to accomplish that which is disclosed and described, vi) each feature, component, and step shown as separate and independent inventions, vii) the applications enhanced by the various systems or components disclosed, viii) the resulting products produced by such systems or components, ix) methods and apparatuses substantially as described hereinbefore and with reference to any of the accompanying examples, x) the various combinations and permutations of each of the previous elements disclosed.

The background section of this patent application provides a statement of the field of endeavor to which the invention pertains. This section may also incorporate or contain paraphrasing of certain United States patents, patent applications, publications, or subject matter of the claimed invention useful in relating information, problems, or concerns about the state of technology to which the invention is drawn toward. It is not intended that any United States patent, patent application, publication, statement or other information cited or incorporated herein be interpreted, construed or deemed to be admitted as prior art with respect to the invention.

The claims set forth in this specification, if any, are hereby incorporated by reference as part of this description of the invention, and the applicant expressly reserves the right to use all of or a portion of such incorporated content of such claims as additional description to support any of or all of the claims or any element or component thereof, and the applicant further expressly

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 392 of 607

reserves the right to move any portion of or all of the incorporated content of such claims or any element or component thereof from the description into the claims or vice-versa as necessary to define the matter for which protection is sought by this application or by any subsequent application or continuation, division, or continuation-in-part application thereof, or to obtain any benefit of, reduction in fees pursuant to, or to comply with the patent laws, rules, or regulations of any country or treaty, and such content incorporated by reference shall survive during the entire pendency of this application including any subsequent continuation, division, or continuation-in-part application thereof or any reissue or extension thereon.

Additionally, the claims set forth in this specification, if any, are further intended to describe the metes and bounds of a limited number of the preferred embodiments of the invention and are not to be construed as the broadest embodiment of the invention or a complete listing of embodiments of the invention that may be claimed. The applicant does not waive any right to develop further claims based upon the description set forth above as a part of any continuation, division, or continuation-in-part, or similar application.

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 393 of 607

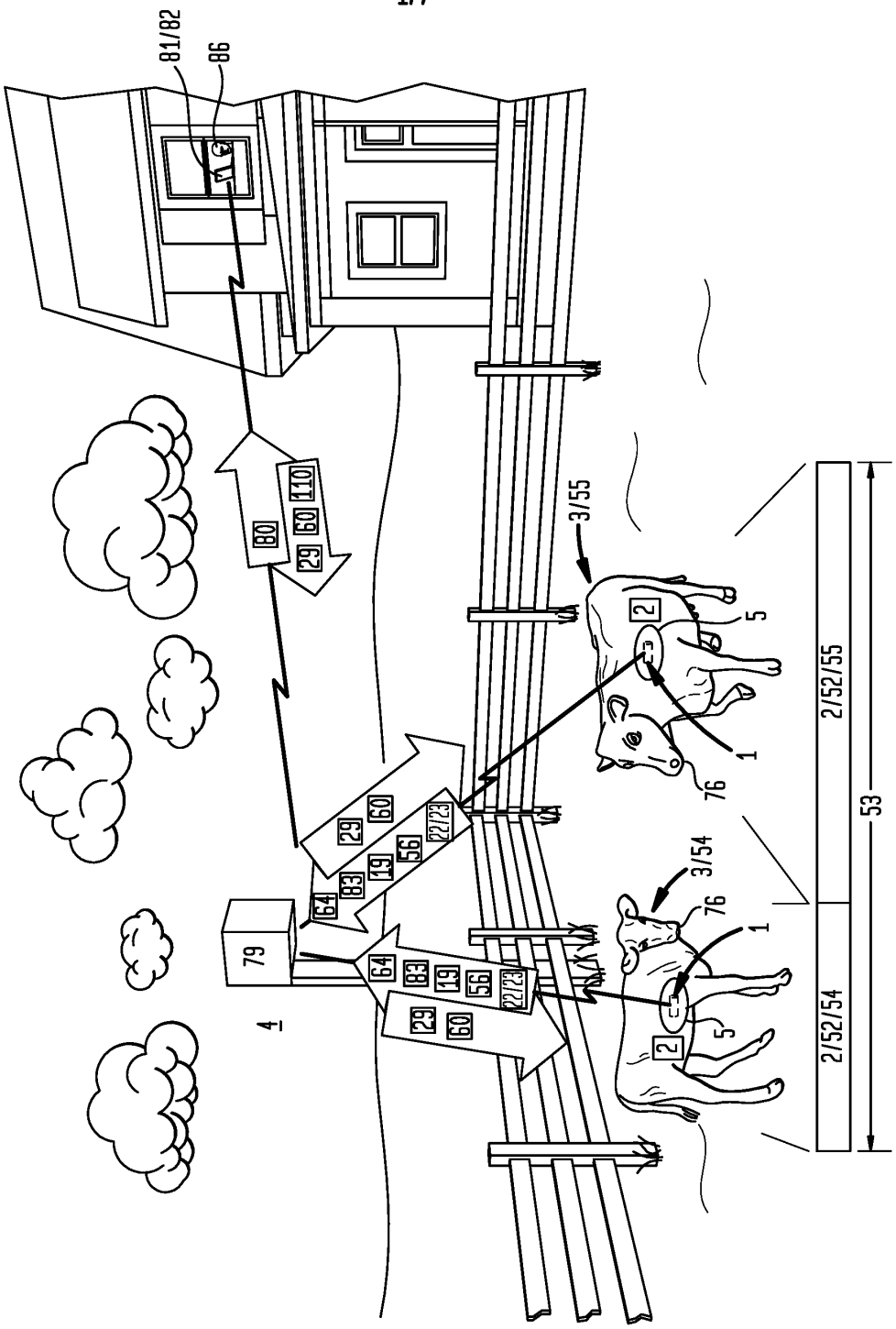
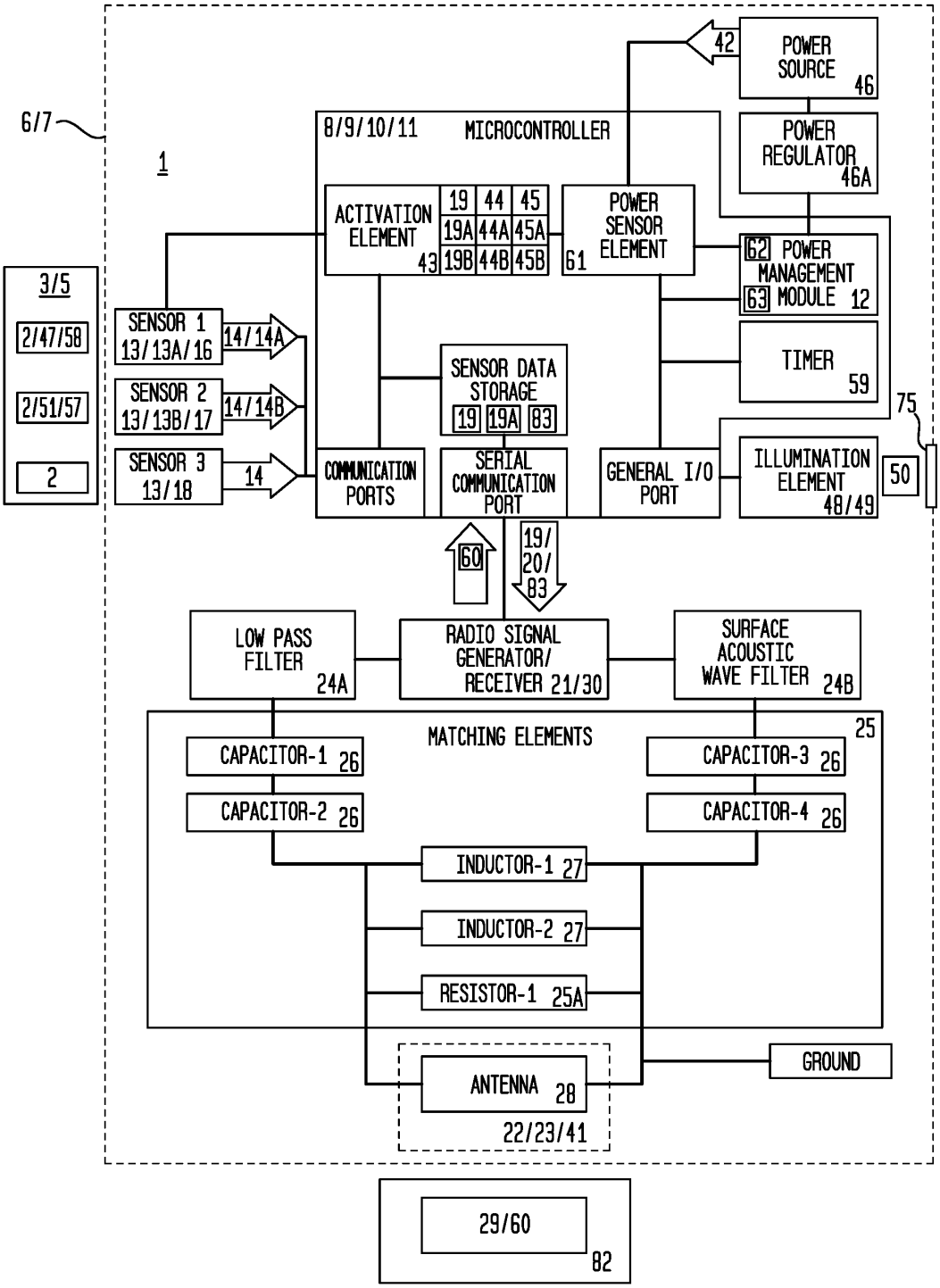

81/82
86
80
110
60
29
3/55
2
5
1
76
2/52/55
53
29
60
22/23
56
19
83
64
3/54
79
4
2/52/54

FIG. 1

2/7

FIG. 2


6/7
1
8/9/10/11 MICROCONTROLLER
42
POWER SOURCE 46
POWER REGULATOR 46A
ACTIVATION ELEMENT 43
19 44 45
19A 44A 45A
19B 44B 45B
POWER SENSOR ELEMENT 61
62 POWER MANAGEMENT 63 MODULE 12
TIMER 59
3/5
2/47/58
2/51/57
2
SENSOR 1 13/13A/16
14/14A
SENSOR 2 13/13B/17
14/14B
SENSOR 3 13/18
14
SENSOR DATA STORAGE 19 19A 83
COMMUNICATION PORTS
SERIAL COMMUNICATION PORT
GENERAL I/O PORT
ILLUMINATION ELEMENT 48/49
50
75
60
19/20/83
LOW PASS FILTER 24A
RADIO SIGNAL GENERATOR/ RECEIVER 21/30
SURFACE ACOUSTIC WAVE FILTER 24B
25
MATCHING ELEMENTS
CAPACITOR-1 26
CAPACITOR-2 26
CAPACITOR-3 26
CAPACITOR-4 26
INDUCTOR-1 27
INDUCTOR-2 27
RESISTOR-1 25A
ANTENNA 28
22/23/41
GROUND
29/60
82

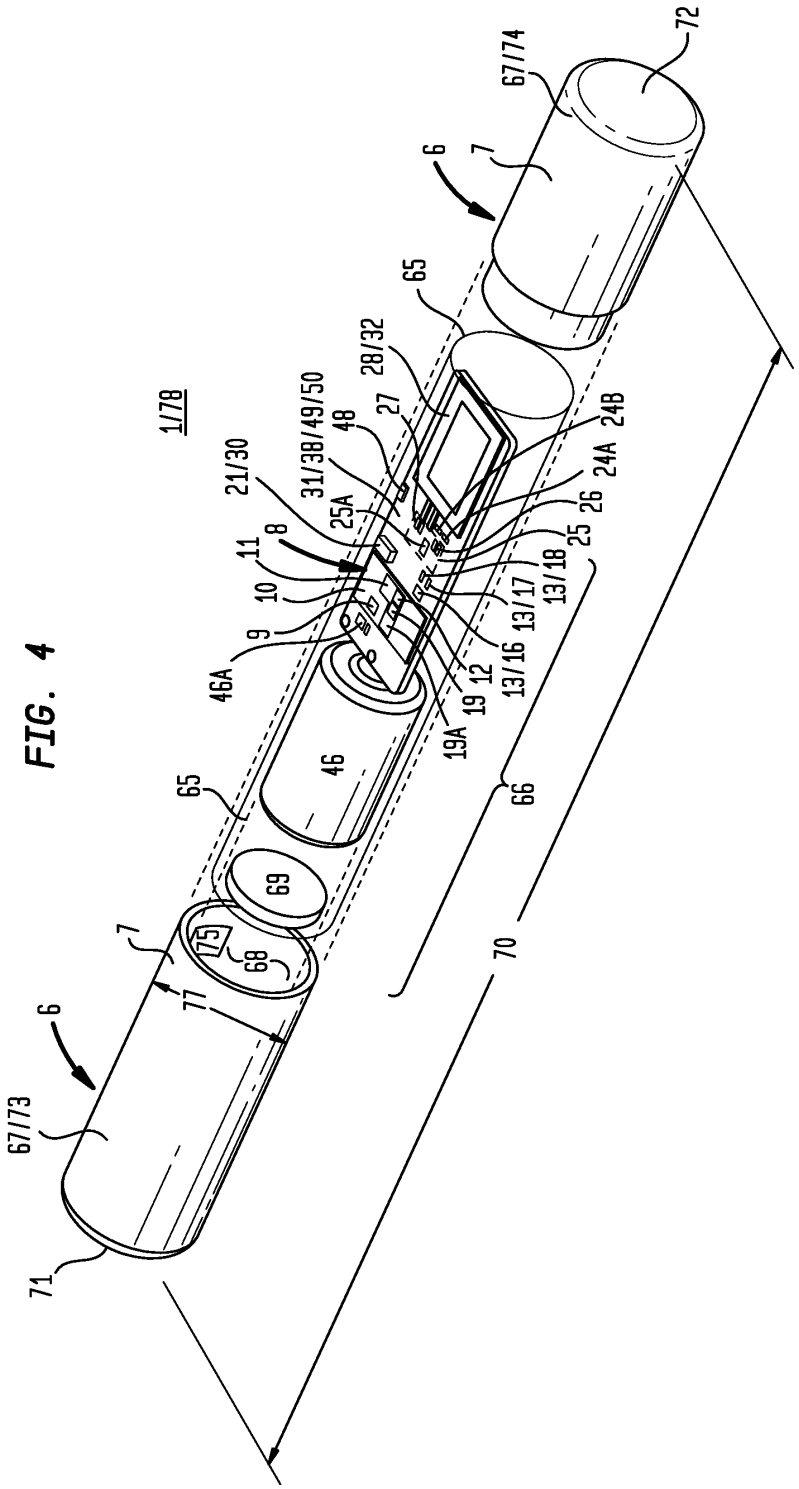

1/78
67/73
67/74
72
71
6
7
77
65
46
46A
69
68
75
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10
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8
21/30
31/38/49/50
48
27
28/32
25A
24A
24B
26
25
13/18
13/17
13/16
12
19
19A
66
70

FIG. 4

VII. ABSTRACT

An animal monitoring device configured as a bolus for oral administration to reside in the reticulorumen of a ruminant animal. The animal monitoring device includes a memory element, a processor in communication with the memory element and a computer code contained in the memory element. The computer code includes a power management module executable by the processor to regulate power use by the bolus based on determination of remaining energy stored in an energy source and the determined power requirements over a pre-determined life cycle of the bolus.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the application of: Nicholas P. Rettedal, Stephen M. Weilnau, Scott R. Cockroft, and Joseph Janus IV

Application No.: 14/738,789

Filed: June 12, 2015

For: Calf Bolus

Attorney Docket No.: bellaUScalf (280-10)

Confirmation No.: 8986

Group Art Unit: 3766

Examiner: Heller, Tammie K.

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

STATEMENT UNDER 37 C.F.R. 1.125(b)

Applicant submits a Substitute Specification including a "marked up" version of the Specification and a "clean" version of the Specification. The Substitute Specification contains no new matter.

Applicant also submits Replacement Drawing Sheets 1, 2 and 4, Figures 1, 2 and 4. The Replacement Drawing Sheets 1, 2 and 4, Figures 1, 2 and 4 contain no new matter.

Applicant also submits a substitute Abstract. The substitute Abstract contains no new matter.

Applicant respectfully requests that the Substitute Specification, Replacement Drawing Sheets and substitute Abstract be entered into the file.

Dated this 31 day of March, 2017

Respectfully Submitted,

CR MILES P.C.

By: _____

Susan F. Hudachek
PATENT AGENT FOR APPLICANT
USPTO Reg. No. 70,013
CR MILES P.C.
405 Mason Court, Suite 119
Fort Collins, CO 80524
(970) 492-0000 telephone
(970) 492-0003 facsimile

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

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Application No.: 14/738,789

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Group Art Unit: 3766

Examiner: Heller, Tammie K.

Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

PETITION FOR EXTENSION OF TIME UNDER 37 C.F.R. §1.136

This is a request to extend the period for filing a reply in the above-identified application under the provisions of 37 C.F.R. §1.136(a) and 37 C.F.R. §1.17(a)(2). The two month extension of time extends until April 1, 2017, the period in which the applicant can timely file a reply in the above-referenced application which would otherwise be due within three months of the mailing date of the official communication mailed November 1, 2016. Applicant claims small entity status under 37 C.F.R. § 1.27, therefore Applicant submits the fee amount under 37 C.F.R. §1.17(a)(2) of $300.00.

Dated this 30 day of March, 2017

Respectfully Submitted,

By: _____

Susan F. Hudachek
PATENT AGENT FOR APPLICANT
USPTO Reg. No. 70,013
CR MILES P.C.
405 Mason Court, Suite 119
Fort Collins, CO 80524
(970) 492-0000 telephone
(970) 492-0003 facsimile

Electronic Patent Application Fee Transmittal

Application Number:	14738789
Filing Date:	12-Jun-2015
Title of Invention:	Calf Bolus
First Named Inventor/Applicant Name:	Nicholas P. Rettedal
Filer:	Craig R. Miles/Justin Ruth Harbour
Attorney Docket Number:	bellaUScalf (280-10)

Filed as Small Entity

Filing Fees for Utility under 35 USC 111(a)

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Extension - 2 months with $0 paid	2252	1	300	300
Miscellaneous:				
		Total in USD ($)		**300**

Electronic Acknowledgement Receipt	
EFS ID:	28805878
Application Number:	14738789
International Application Number:	
Confirmation Number:	8986
Title of Invention:	Calf Bolus
First Named Inventor/Applicant Name:	Nicholas P. Rettedal
Customer Number:	39208
Filer:	Craig R. Miles/Justin Ruth Harbour
Filer Authorized By:	Craig R. Miles
Attorney Docket Number:	bellaUScalf (280-10)
Receipt Date:	31-MAR-2017
Filing Date:	12-JUN-2015
Time Stamp:	17:55:56
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	$300
RAM confirmation Number	040317INTEFSW17582500
Deposit Account	
Authorized User	
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:	

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Transmittal Letter	280-10_resp_trans_ltr.pdf	45417 f7a74b6d4dd1f817d39ec0e7f0a54286aef7a64f	no	2
Warnings:					
Information:					
2	Amendment/Req. Reconsideration-After Non-Final Reject	280-10_resp_response.pdf	906683 a9e2d8e24bba8998db86de4bcceb483f9b5f54f2	no	24
Warnings:					
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3	Specification	280-10_resp_sub_spec_marks.pdf	1602042 4654054b2e222245719bfbd0bf40198faf44e2a1	no	32
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4	Specification	280-10_resp_sub_spec_clean.pdf	1596723 816d9430ca28a6c4c9a3a8255d0a65e21c45d66e	no	32
Warnings:					
Information:					
5	Drawings-only black and white line drawings	280-10_resp_repl_drawings.pdf	563240 8e52498c58e002ededb2997f5f3c2e0f56e6ace6	no	3
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6	Abstract	280-10_resp_sub_abstract.pdf	15372 6e226e975e1af2efc8020e8ba0cca34bf6fef415	no	1
Warnings:					
Information:					

7	Miscellaneous Incoming Letter	280-10_resp_stmt.pdf	33490 33cdb389bad5e2948d936da3086be597fb67eceb	no	1
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Information:					
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		Total Files Size (in bytes):	4827625		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

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Application No.: 14/738,789

Filed: June 12, 2015

For: Calf Bolus

Attorney Docket No.: bellaUScalf (280-10)

Confirmation No.: 8986

Group Art Unit: 3766

Examiner: Heller, Tammie K.

Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

LETTER OF TRANSMITTAL

Dear Sir/Madam:

In response to the Office Action mailed November 1, 2016, please find the following documents:

1. a Response and Request For Reconsideration Under 37 C.F.R. § 1.111 (24 page(s));
2. a Substitute Specification with markings (31 page(s)), including a cover page;
3. a clean version of the Substitute Specification (without markings) (31 page(s)), including a cover page;
4. Replacement Drawings (3 sheet(s));
5. a substitute Abstract (1 page);
6. a Statement under 37 C.F.R. 1.125(b) (1 page(s));
7. a Petition for Extension of Time Under 37 C.F.R. §1.136 (1 page(s)); and
8. this firm Letter of Transmittal (2 page(s)).

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 405 of 607

I have this 31 day of March, 2017, either myself personally, or through my direction of staff at this office, deposited all of the items listed in this Letter of Transmittal with the United States Patent and Trademark Office via EFS-Web.

Please enter the submitted documents in the above-identified patent application.

Direct all correspondence to:

CR MILES P.C.
405 Mason Court, Suite 119
Fort Collins, CO 80524

USPTO Customer No.: 39208

Dated this 31 day of March, 2017

Respectfully Submitted,

By: _____

Susan F. Hudachek
PATENT AGENT FOR APPLICANT
USPTO Reg. No. 70,013
CR MILES P.C.
405 Mason Court, Suite 119
Fort Collins, CO 80524
(970) 492-0000 telephone
(970) 492-0003 facsimile

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 406 of 607

PTO/SB/06 (09-11)
Approved for use through 1/31/2014. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 14/738,789	Filing Date 06/12/2015	☐ To be Mailed

ENTITY: ☐ LARGE ☒ SMALL ☐ MICRO

APPLICATION AS FILED – PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA	RATE ($)	FEE ($)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 = *		X $ =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 = *		X $ =	
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).			
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))				
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL	

APPLICATION AS AMENDED – PART II

AMENDMENT	03/31/2017	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	* 19	Minus	** 20	= 0	X $40 =	0
	Independent (37 CFR 1.16(h))	* 1	Minus	***3	= 0	X $210 =	0
	☐ Application Size Fee (37 CFR 1.16(s))						
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))						
						TOTAL ADD'L FEE	**0**

AMENDMENT		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	*	Minus	**	=	X $ =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	X $ =	
	☐ Application Size Fee (37 CFR 1.16(s))						
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))						
						TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

LIE
MARGARET BYARS

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
14/738,789	06/12/2015	Nicholas P. Rettedal	bellaUScalf (280-10)	8986

39208 7590 04/26/2017

CR MILES, P.C.
CRAIG R. MILES
405 MASON COURT, SUITE 119
FORT COLLINS, CO 80524

EXAMINER	
HELLER, TAMMIE K	

ART UNIT	PAPER NUMBER
3766	

MAIL DATE	DELIVERY MODE
04/26/2017	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Applicant-Initiated Interview Summary	Application No.	Applicant(s)		
	14/738,789	RETTEDAL ET AL.		
	Examiner	Art Unit	AIA (First Inventor to File) Status	Page
	Tammie K. Heller	3766	Yes	1 of 1

All participants (applicant, applicant's representative, PTO personnel):

1. Tammie K. Heller (Primary Examiner); Telephonic 2. Craig Miles (Attorney of Record); Telephonic

Date of Interview: 19 April 2017

Claim(s) discussed: 1

Issues Discussed:

Item(s) under 35 U.S.C. 101:
The Applicant's representative indicated that the amendments submitted on March 31, 2017 should have overcome the rejection under 35 USC 101. The Examiner indicated that the amendments were beneficial, but there was still an appropriate rejection under 35 USC 101. The Examiner suggested that the claims be amended to include an active step of "enabling or disabling said one or more sensor coordinated with a plurality of stages in the lifespan of said ruminant animal" rather than only reciting the obtaining and orally administering of the bolus.

/Tammie K Heller/ Primary Examiner, Art Unit 3766	

Applicant recordation instructions: The formal written reply to the last Office action must include the substance of the interview. (See MPEP section 713.04). If a reply to the last Office action has already been filed, applicant is given a non-extendable time limit of the longer of one month or thirty days from this interview date, or the mailing date of this interview summary form, whichever is later, to file a statement of the substance of the interview.

Examiner recordation instructions: Examiners must summarize the substance of any interview of record. A complete and proper recordation of the substance of an interview should include the items listed in MPEP 713.04 for complete and proper recordation including the identification of the general thrust of each argument or issue discussed, a general indication of any other pertinent matters discussed regarding patentability and the general results or outcome of the interview, to include an indication as to whether or not agreement was reached on the issues raised.

Applicant is reminded that a complete written statement as to the substance of the interview must be made of record in the application file. It is the applicant's responsibility to provide the written statement, unless the interview was initiated by the Examiner and the Examiner has indicated that a written summary will be provided. See MPEP 713.04

Please further see:

MPEP 713.04
Title 37 Code of Federal Regulations (CFR) § 1.133 Interviews, paragraph (b)
37 CFR § 1.2 Business to be transacted in writing

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the application of: Nicholas P. Rettedal, Stephen M. Weilnau, Scott R. Cockroft, and Joseph Janus IV

Application No.: 14/738,789

Filed: June 12, 2015

For: Calf Bolus

Attorney Docket No.: bellaUScalf (280-10)

Confirmation No.: 8986

Group Art Unit: 3766

Examiner: Heller, Tammie K.

Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT UNDER 37 C.F.R. §1.97(c) AND STATEMENT UNDER 37 C.F.R. 1.97(e)(1)

Applicant respectfully requests entry of the attached Supplemental Information Disclosure Statement under 37 C.F.R. §1.97(c) made in compliance with Section 1.98 during the pendency of the above-identified United States patent application. No fee is required because submission of the supplemental information disclosure statement is accompanied by the statement under 37 C.F.R. §1.97(e)(1) that each item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in § 1.56(c) more than three months prior to the filing of the information disclosure statement.

Dated this 5 day of May, 2017

Respectfully Submitted,

CR MILES P.C.

By: _____

Craig R. Miles
ATTORNEY FOR APPLICANT
USPTO Reg. No. 45,954
405 Mason Court, Suite 119
Fort Collins, CO 80524
(970) 492-0000
(970) 492-0003 facsimile

SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT BY APPLICANT	Application Number	14/738,789
	Filling Date	June 12, 2015
	First Named Inventor	Nicholas P. Rettedal
	Art Unit	3766
	Examiner Name	Heller, Tammie K.
	Attorney Docket Number	bellaUScalf (280-10)
Sheet 1 of 1	Express Mail Label No.:	-

UNITED STATES PATENT PUBLICATION DOCUMENTS

EXAMINER INITIALS	DOCUMENT NUMBER	PUBLICATION DATE MM-DD-YYYY	NAME OF PATENTEE OR APPLICANT
	2007/0136154	06-14-2007	Chung
	2014/0240088	08-28-2014	Robinette et al.

NON-PATENT LITERATURE DOCUMENTS

EXAMINER INITIALS	CITE NO.	AUTHOR, title of article, title of item, date, page(s), volume-issue number(s), publisher, city and /or country where published	T2
		International PCT Patent Application No.: PCT/US2016/066012; International Search Report and Written Opinion dated March 3, 2017, 9 pages total.	

EXAMINER SIGNATURE:	DATE CONSIDERED:

PATENT COOPERATION TREATY

From the INTERNATIONAL SEARCHING AUTHORITY

To: CRAIG R. MILES
CR MILES P.C.
405 MASON COURT, SUITE 119
FORT COLLINS, CO 80524

PCT

NOTIFICATION OF TRANSMITTAL OF THE INTERNATIONAL SEARCH REPORT AND THE WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY, OR THE DECLARATION

(PCT Rule 44.1)

	Date of mailing *(day/month/year)* 03 APR 2017
Applicant's or agent's file reference PCT 280-16	**FOR FURTHER ACTION** See paragraphs 1 and 4 below
International application No. PCT/US 16/66012	International filing date *(day/month/year)* 09 December 2016 (09.12.2016)
Applicant BELLA TECHNOLOGIES, LLC	

1. ☒ The applicant is hereby notified that the international search report and the written opinion of the International Searching Authority have been established and are transmitted herewith.

   Filing of amendments and statement under Article 19:
   The applicant is entitled, if he so wishes, to amend the claims of the international application (see Rule 46):

   When? The time limit for filing such amendments is normally two months from the date of transmittal of the international search report.

   How? Directly to the International Bureau of WIPO preferably through ePCT or on paper to, 34 chemin des Colombettes 1211 Geneva 20, Switzerland, Facsimile No.: +41 22 338 82 70

   For more detailed instructions, see *PCT Applicant's Guide*, International Phase, paragraphs 9.004 – 9.011.

2. ☐ The applicant is hereby notified that no international search report will be established and that the declaration under Article 17(2)(a) to that effect and the written opinion of the International Searching Authority are transmitted herewith.

3. ☐ **With regard to any protest** against payment of (an) additional fee(s) under Rule 40.2, the applicant is notified that:
   ☐ the protest together with the decision thereon has been transmitted to the International Bureau together with any request to forward the texts of both the protest and the decision thereon to the designated Offices.
   ☐ no decision has been made yet on the protest; the applicant will be notified as soon as a decision is made.

4. **Reminders**

   The applicant may **submit comments on an informal basis on the written opinion of the International Searching Authority** to the International Bureau. These comments will be made available to the public after international publication. The International Bureau will send a copy of such comments to all designated Offices unless an international preliminary examination report has been or is to be established.

   Shortly after the expiration of **18 months from the priority date, the international application will be published** by the International Bureau. If the applicant wishes to avoid or postpone publication, a notice of withdrawal of the international application, or of the priority claim, must reach the International Bureau before the completion of the technical preparations for international publication (Rules 90*bis*.1 and 90*bis*.3).

   Within **19 months** from the priority date, but only in respect of some designated Offices, a demand for international preliminary examination must be filed if the applicant wishes to postpone the entry into the national phase **until 30 months** from the priority date (in some Offices even later); otherwise, the applicant must, **within 20 months** from the priority date, perform the prescribed acts for **entry into the national phase** before those designated Offices. In respect of other designated Offices, the time limit of **30 months** (or later) will apply even if no demand is filed within 19 months. For details about the applicable time limits, Office by Office, see www.wipo.int/pct/en/texts/time_limits.html and the *PCT Applicant's Guide*, National Chapters.

   Within **19 months from the priority date, the applicant may request that a supplementary international search be carried out** by a different International Searching Authority that offers this service (Rule 45*bis*.1). The procedure for requesting supplementary international search is described in the *PCT Applicant's Guide*, International Phase, paragraphs 8.006-8.032.

Name and mailing address of the ISA/ Mail Stop PCT, Attn: ISA/US Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-8300	Authorized officer Lee W. Young Telephone No. PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774

Form PCT/ISA/220 (July 2014)

PATENT COOPERATION TREATY

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference PCT 280-16	FOR FURTHER ACTION	see Form PCT/ISA/220 as well as, where applicable, item 5 below.
International application No. PCT/US 16/66012	International filing date *(day/month/year)* 09 December 2016 (09.12.2016)	(Earliest) Priority Date *(day/month/year)* 15 December 2015 (15.12.2015)
Applicant BELLA TECHNOLOGIES, LLC		

This international search report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This international search report consists of a total of 9 sheets.

☐ It is also accompanied by a copy of each prior art document cited in this report.

1. **Basis of the report**

   a. With regard to the **language**, the international search was carried out on the basis of:

   ☒ the international application in the language in which it was filed.

   ☐ a translation of the international application into _____ which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b)).

   b. ☐ This international search report has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43.6*bis*(a)).

   c. ☐ With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, see Box No. I.

2. ☐ **Certain claims were found unsearchable** (see Box No. II).

3. ☐ **Unity of invention is lacking** (see Box No. III).

4. With regard to the **title**,

   ☒ the text is approved as submitted by the applicant.

   ☐ the text has been established by this Authority to read as follows:

5. With regard to the **abstract**,

   ☒ the text is approved as submitted by the applicant.

   ☐ the text has been established, according to Rule 38.2, by this Authority as it appears in Box No. IV. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. With regard to the **drawings**,

   a. the figure of the **drawings** to be published with the abstract is Figure No. 1

      ☒ as suggested by the applicant.

      ☐ as selected by this Authority, because the applicant failed to suggest a figure.

      ☐ as selected by this Authority, because this figure better characterizes the invention.

   b. ☐ none of the figures is to be published with the abstract.

PATENT COOPERATION TREATY

From the INTERNATIONAL SEARCHING AUTHORITY

To: CRAIG R. MILES
CR MILES P.C.
405 MASON COURT, SUITE 119
FORT COLLINS, CO 80524

PCT

NOTIFICATION OF TRANSMITTAL OF THE INTERNATIONAL SEARCH REPORT AND THE WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY, OR THE DECLARATION

(PCT Rule 44.1)

Applicant's or agent's file reference PCT 280-16	Date of mailing *(day/month/year)* **FOR FURTHER ACTION** See paragraphs 1 and 4 below
International application No. PCT/US 16/66012	International filing date *(day/month/year)* 09 December 2016 (09.12.2016)
Applicant BELLA TECHNOLOGIES, LLC	

1. ☒ The applicant is hereby notified that the international search report and the written opinion of the International Searching Authority have been established and are transmitted herewith.

   Filing of amendments and statement under Article 19:
   The applicant is entitled, if he so wishes, to amend the claims of the international application (see Rule 46):

   When? The time limit for filing such amendments is normally two months from the date of transmittal of the international search report.

   How? Directly to the International Bureau of WIPO preferably through ePCT or on paper to, 34 chemin des Colombettes 1211 Geneva 20, Switzerland, Facsimile No.: +41 22 338 82 70

   For more detailed instructions, see *PCT Applicant's Guide*, International Phase, paragraphs 9.004 – 9.011.

2. ☐ The applicant is hereby notified that no international search report will be established and that the declaration under Article 17(2)(a) to that effect and the written opinion of the International Searching Authority are transmitted herewith.

3. ☐ **With regard to any protest** against payment of (an) additional fee(s) under Rule 40.2, the applicant is notified that:
   ☐ the protest together with the decision thereon has been transmitted to the International Bureau together with any request to forward the texts of both the protest and the decision thereon to the designated Offices.
   ☐ no decision has been made yet on the protest; the applicant will be notified as soon as a decision is made.

4. **Reminders**

   The applicant may **submit comments on an informal basis on the written opinion of the International Searching Authority** to the International Bureau. These comments will be made available to the public after international publication. The International Bureau will send a copy of such comments to all designated Offices unless an international preliminary examination report has been or is to be established.

   Shortly after the expiration of **18 months from the priority date, the international application will be published** by the International Bureau. If the applicant wishes to avoid or postpone publication, a notice of withdrawal of the international application, or of the priority claim, must reach the International Bureau before the completion of the technical preparations for international publication (Rules 90*bis*.1 and 90*bis*.3).

   Within **19 months** from the priority date, but only in respect of some designated Offices, a demand for international preliminary examination must be filed if the applicant wishes to postpone the entry into the national phase **until 30 months** from the priority date (in some Offices even later); otherwise, the applicant must, **within 20 months** from the priority date, perform the prescribed acts for **entry into the national phase** before those designated Offices. In respect of other designated Offices, the time limit of **30 months** (or later) will apply even if no demand is filed within 19 months. For details about the applicable time limits, Office by Office, see www.wipo.int/pct/en/texts/time_limits.html and the *PCT Applicant's Guide*, National Chapters.

   Within **19 months from the priority date, the applicant may request that a supplementary international search be carried out** by a different International Searching Authority that offers this service (Rule 45*bis*.1). The procedure for requesting supplementary international search is described in the *PCT Applicant's Guide*, International Phase, paragraphs 8.006-8.032.

Name and mailing address of the ISA/ Mail Stop PCT, Attn: ISA/US Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-8300	Authorized officer Lee W. Young Telephone No. PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774

Form PCT/ISA/220 (July 2014)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US 16/66012

A. CLASSIFICATION OF SUBJECT MATTER
IPC(8) - A01K 11/00 (2016.01)
CPC - A01K 11/007
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC(8): A01K 11/00 (2016.01)
CPC: A01K 11/007

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
CPC: A01K 29/00, A61B 5/00, A61B 5/07, A61B 5/0002, A01K 11/00, A01K 11/006, A01K 11/008, A01K 29/005 (keyword limited search below)

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
PatBase, Google Scholar, Google Patents; Search Terms: bolus, animal, cattle, buffalo, okapi, chevotain, oral, mouth, sensor, communicat*, BELLA TECHNOLOGIES, RETTEDAL, WEILNAU, COCKROFT, JANUS, encod*, environmental, physiological*, tilt, vibration, temperature, Mhz, Ghz, goat, sheep, deer, antelope, giraffe, yak

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 2014/0368338 A1 (Rettedal et al.) 18 December 2014 (18.12.2014) entire document especially Abstract, para [0028]-[0030], para [0046]-[0056], para [0060]-[0066]	1-38
Y	US 2014/0240088 A1 (ROBINETTE et al.) 28 August 2014 (28.08.2014) entire document especially Abstract, para [0020], para [0076]-[0077], para [0088], para [0100]-[0105], para [0139]-[0140],	1-38
A	US 2007/0136154 A1 (Chung) 14 June 2007 (14.06.2007) entire document	1-38

☐ Further documents are listed in the continuation of Box C. ☐

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
31 January 2017	03 APR 2017
Name and mailing address of the ISA/US Mail Stop PCT, Attn: ISA/US, Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-8300	Authorized officer: Lee W. Young PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774

Form PCT/ISA/210 (second sheet) (January 2015)

PATENT COOPERATION TREATY

From the
INTERNATIONAL SEARCHING AUTHORITY

To: CRAIG R. MILES
CR MILES P.C.
405 MASON COURT, SUITE 119
FORT COLLINS, CO 80524

PCT

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

(PCT Rule 43*bis*.1)

Date of mailing *(day/month/year)*	03 APR 2017

Applicant's or agent's file reference	FOR FURTHER ACTION
PCT 280-16	See paragraph 2 below

International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/US 16/66012	09 December 2016 (09.12.2016)	15 December 2015 (15.12.2015)

International Patent Classification (IPC) or both national classification and IPC
IPC(8) - A01K 11/00 (2016.01)
CPC - A01K 11/007

Applicant BELLA TECHNOLOGIES, LLC

1. This opinion contains indications relating to the following items:

- ☒ Box No. I Basis of the opinion
- ☐ Box No. II Priority
- ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☐ Box No. IV Lack of unity of invention
- ☒ Box No. V Reasoned statement under Rule *43bis*.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- ☐ Box No. VI Certain documents cited
- ☐ Box No. VII Certain defects in the international application
- ☐ Box No. VIII Certain observations on the international application

2. **FURTHER ACTION**

If a demand for international preliminary examination is made, this opinion will be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1 *bis*(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Fom PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

Name and mailing address of the ISA/US	Date of completion of this opinion	Authorized officer:
Mail Stop PCT, Attn: ISA/US Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-8300	31 January 2017	Lee W. Young PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774

Form PCT/ISA/237 (cover sheet) (January 2015)

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/US 16/66012

Box No. I Basis of this opinion

1. With regard to the **language**, this opinion has been established on the basis of:

☒ the international application in the language in which it was filed.

☐ a translation of the international application into _____ which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b)).

2. ☐ This opinion has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43*bis*.1(a)).

3. ☐ With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, this opinion has been established on the basis of a sequence listing:

a. ☐ forming part of the international application as filed:

☐ in the form of an Annex C/ST.25 text file.

☐ on paper or in the form of an image file.

b. ☐ furnished together with the international application under PCT Rule 13*ter*.1(a) for the purposes of international search only in the form of an Annex C/ST.25 text file.

c. ☐ furnished subsequent to the international filing date for the purposes of international search only:

☐ in the form of an Annex C/ST.25 text file (Rule 13*ter*.1(a)).

☐ on paper or in the form of an image file (Rule 13*ter*.1(b) and Administrative Instructions, Section 713).

4. ☐ In addition, in the case that more than one version or copy of a sequence listing has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that forming part of the application as filed or does not go beyond the application as filed, as appropriate, were furnished.

5. Additional comments:

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/US 16/66012

Box No. V **Reasoned statement under Rule 43*bis*.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

1. Statement

Novelty (N)	Claims	1-38	YES
	Claims	None	NO
Inventive step (IS)	Claims	None	YES
	Claims	1-38	NO
Industrial applicability (IA)	Claims	1-38	YES
	Claims	None	NO

2. Citations and explanations:

Claims 1-38 lack an inventive step under PCT Article 33(3) as being obvious over US 2014/0368338 A1 to Rettedal et al. (hereinafter 'Rettedal') in view of US 2014/0240088 A1 to ROBINETTE et al. (hereinafter 'ROBINETTE').

As to claims 1 and 19, Rettedal discloses an animal monitoring system/method (animal management program, Abstract), comprising:

a bolus capable of oral administration to an animal (bolus (79) can be ingested by certain RFID objects (39), such as cattle and be retained in a part of the stomach, para [0054]), said bolus including:

at least one bolus sensor capable of generating a bolus sensor signal which varies based on change in at least one physiological parameter of said animal (received from a sensor (83) which can be located within the bolus - sensed characteristic - physiological characteristics of an animal (40) such as temperature, pH, heart rate, blood pressure, partial pressures of dissolved gases, or the like, para [0054]);

a bolus memory element (RFID object identification information (80)(or a bolus identification number (81) animal identification number (82) for animal (40) embodiments) - stored in a corresponding plurality of RFID database tables (87) stored in a memory element (3), para [0056]);

a bolus processor communicatively coupled to said memory element (inventive computer implemented animal management system may employ various integrated circuit components which function without limitation as memory elements, to modulate and demodulate radio frequency signal, processing elements, logic elements, look-up tables, or the like, which may carry out a variety of functions under the control of one or more microprocessors or other control devices, para [0028]-[0030]);

a bolus computer code contained in said memory element executable to encode said at least one bolus sensor signal generated by said at least one bolus sensor (encoder-decoder application (18), para [0038], second bit segment (72) of the RFID (19) can be encoded or re-encoded from time to time with sensed RFID object characteristics (84) received from a sensor (83) which can be located within the bolus (79) or otherwise implanted within the RFID object (39) whether an animal (40) or an asset (41), para [0054]);

a bolus communication signal generator capable of generating a bolus communication signal carrying encoded bolus sensor data (communication controller (50) which provides communication with the server computer (1) or remote computer (34) via LAN or WAN, para [0048]-[0052]);

and a bolus communication signal receiver (radio frequency signal receiver (48), para [0046], para [0052]);

a tag securable to an external surface of said animal (animal (40)) having the related ear tag identifier (97)(bolus number (81), para [0060] -[0062]) but fails to specifically disclose said tag including: at least one tag sensor capable of generating a tag sensor signal which varies based on change in at least one environmental parameter surrounding said animal; a tag memory element; a tag processor communicatively coupled to said tag memory element; a tag computer code contained in said memory element executable to encode said at least one tag sensor signal generated by said at least one tag sensor; a tag first communication signal receiver capable of receiving said bolus communication signal carrying said encoded bolus sensor data; a tag first communication signal generator capable of generating a tag first communication signal at a tag first communication signal frequency carrying bolus programming data to said bolus communication signal receiver; and a tag second communication signal generator capable of generating a tag second communication signal at a tag second communication signal frequency carrying encoded environmental data or encoded bolus sensor data to a remote processor.

--(Continued in Supplemental Box)--

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/US 16/66012

Supplemental Box

In case the space in any of the preceding boxes is not sufficient.
Continuation of:
Box V, 2. Citations and explanations:

However, Robinette in analogous art discloses said tag including at least one tag sensor capable of generating a tag sensor signal which varies based on change in at least one environmental parameter surrounding said animal (A tag can be connected to environmental or automation sensors 128 measuring, for example, such factors as temperature, humidity, strain, force, pressure, para [0103]); a tag memory element (The tag 101 consists of the hardware of the circuit 100 with microprocessor 108 and memory 120, antenna 111, a power source 116 and has one input of 104/105/132, and output 139, para [0102]); a tag processor communicatively coupled to said tag memory element (para [0102]); a tag computer code contained in said memory element executable to encode said at least one tag sensor signal generated by said at least one tag sensor (novel software, inside the tags, area tags and controllers is inaccessible and cannot be copied. Wireless transmissions are encrypted to military grade levels and packets are never repeated, making it unhackable, even by brute force attack, Abstract); a tag first communication signal receiver capable of receiving said bolus communication signal carrying said encoded bolus sensor data (Abstract, real-time tracking of people, animals, material, and any tagged item while in transit and along the supply chain through warehouses, shipping, delivery and storage, para [0139]); a tag first communication signal generator capable of generating a tag first communication signal at a tag first communication signal frequency carrying bolus programming data to said bolus communication signal receiver (Area tags can be used to extend the wireless range between controllers and between controller and tags - An area tag used for more tasks than pure range extension can have the interface 140 to be connected to a network or can monitor/log sensor data 128 connected to it, para [0104]-[0105]); and a tag second communication signal generator capable of generating a tag second communication signal at a tag second communication signal frequency carrying encoded environmental data or encoded bolus sensor data to a remote processor (Combination/Linkage of Devices Forming a System - Wireless links (logical channels) are possible between controllers and between controller and tags 101. If area tags are being used by the system, a link exists between controller and area tag, and another between area tag and the target device, para [0104]-[0105]).

It would have been obvious to one of ordinary skill in the art to add Robinette's tag sensors to Rettedal's system/method as tagged objects that are mobile or moved about the premises can also alarm when these items leave their set perimeters. Exit area tags add a final check to make certain that no tagged objects leave the premises. The inventory mode can be scaled up to allow real-time tracking of people, animals, material, and any tagged item while in transit and along the supply chain through warehouses, shipping, delivery and storage. Area tags and controllers can monitor an entire warehouse, cargo plane or convoy, and report loss or deviation to the individuals travelling with the items. The system can also hook into a backbone internet connection to improve the system's transparency e.g. by sending an email if tagged objects are moved in buildings (see para [0139]-[0140]: Robinette).

As to claims 2 and 20, Rettedal discloses a system/method wherein said at least one bolus sensor comprises an omnidirectional tilt and vibration sensor and a temperature sensor (omnidirectional tilt and vibration Sensor (PN SQ-SEN-200) distributed by Signal Quest Precision Microsensors; a Betachip Thermistor (PN 1K2OG3) distributed by BetaTHERM Sensors, para [0054]).

As to claims 3 and 21, Robinette discloses a system/method wherein said bolus communication signal has a bolus communication frequency of between about 700 MHz to about 1 GHz (wavelength of the frequencies used: 400 MHz and 2.4 GHz, para [0020], Communication/Transmission/Reception - RF frequency that is equal to or greater than 433 MHz, para [0088]).

As to claims 4 and 22, Robinette discloses a system/method wherein said bolus communication signal frequency is selected from the group consist of: between about 700 MHz to about 800MHz, 750 MHz to about 850MHz, about 800 MHz to about 900MHz, 850 MHz to about 950MHz, and about 900 MHz to about 1 GHz (wavelength of the frequencies used: 400 MHz and 2.4 GHz, para [0020], Communication/Transmission/Reception - RF frequency that is equal to or greater than 433 MHz, para [0088]).

As to claim 5, Rettedal discloses a system wherein said bolus computer code is reprogrammable based on said bolus programming data received by said bolus communication signal receiver (programmable microcircuit, para [0038]).

As to claims 6 and 23, Robinette discloses a system/method wherein said tag first communication signal has a tag first communication signal frequency in a range of between about 700 MHz to about 1 GHz (wavelength of the frequencies used: 400 MHz and 2.4 GHz, para [0020], Communication/Transmission/Reception - RF frequency that is equal to or greater than 433 MHz, para [0088]).

As to claims 7 and 24, Robinette discloses a system/method wherein said tag second communication signal has a tag second 10 communication signal frequency in a range of between about 800MHz to about 950MHz or about 2.4GHz (wavelength of the frequencies used: 400 MHz and 2.4 GHz, para [0020], Communication/Transmission/Reception - RF frequency that is equal to or greater than 433 MHz, para [0088]).

As to claims 8 and 25, Rettedal discloses a system/method wherein said at least one tag sensor comprises an omnidirectional tilt and vibration sensor and a temperature sensor (omnidirectional tilt and vibration Sensor (PN SQ-SEN-200) distributed by Signal Quest Precision Microsensors; a Betachip Thermistor (PN 1K2OG3) distributed by BetaTHERM Sensors, para [0054]).

As to claims 9 and 26, Rettedal discloses a system/method further comprising a tag indicator element operable by execution of said tag computer code to generate a sensorially perceivable indicia upon the occurrence of a pre-selected indicator element activation value of a physiological parameter value or an environmental parameter value (animal management application (17) - generate the graphic user interface (88) which further provides control icons (31) which by click event activate provides a list display icon (133) which upon click event displays a plurality of list icons (134) such as an Alert List (135), a Hospital List (136), a Pens List (137), or Malfunction List (138) each of which upon click event activates the functionalities of a corresponding alert module (135a), hospital module (139), pen module (140), or malfunction module (141), or the like, para [0063]-[0064]).

--(Continued in Supplemental Box)--

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/US 16/66012

Supplemental Box

In case the space in any of the preceding boxes is not sufficient.
Continuation of:
Box V, 2. Citations and explanations:

As to claims 10 and 28, Rettedal discloses a system/method further comprising a tag indicator element operable by execution of said tag computer code to generate a sensorially perceivable indicia upon the occurrence of a pre-selected power source energy value of a tag power source (generate the graphic user interface (88) which further provides control icons (31) which by click event activate provides a list display icon (133) which upon click event displays a plurality of list icons (134) such as an Alert List (135), a Hospital List (136), a Pens List (137), or Malfunction List (138) each of which upon click event activates the functionalities of a corresponding alert module (135a), hospital module (139), pen module (140), or malfunction module (141), or the like, para [0063]-[0064]).

As to claims 11 and 30, Rettedal discloses a system/method wherein said tag further includes a manual user interface including a display surface and at least one user interface input element, said at least one user interface input elements interoperable with the display surface to allow a user to execute or reprogram said tag computer code (generate the graphic user interface (88), para [0063]-[0064]).

As to claims 12 and 31, Rettedal discloses a system/method further comprising one or more menus displayed by execution of said tag computer code, wherein at least one of said menus allows said user to communicatively pair said tag and said bolus (The RFID object - relational database table (91) of the particular RFID object (39)(animal (40))(see FIG. 5) can be updated to include the new Pen Number (115a)(Hospital Pen 150) and treatment status 02, 1 (114a) (see for example FIG. 5) identifying the treatment plan (106) for the RFID object (39)(animal (40)) having the related ear tag identifier (97)(bolus number (81)), para [0067]).

As to claims 13 and 32, Rettedal discloses a system/method wherein said at least one of said menus allows said user to activate a counting module to count days in milk (animals (40)) having a similar status such as days in milk (118), milk production (119) - maximum milking days (126), minimum milking days (127), milking schedule (128), para [0063]).

As to claims 14 and 33, Rettedal discloses a system/method wherein said at least one of said menus allows said user to activate a counting module to count days since last heat (reproductive status (120), para [0063]).

As to claims 15 and 34, Rettedal discloses a system/method wherein said at least one of said menus allows said user to display physiological data or environmental data over a period of time (physiological characteristics of an animal (40) such as temperature, pH, heart rate, blood pressure, partial pressures of dissolved gases, or the like, para [0054], para [0063]-[0064]).

As to claims 16 and 35, Rettedal discloses a system/method wherein said at least one of said menus allows said user to alter operating parameters of said bolus ("click event" is intend to broadly encompass any action or command by the computer user (22) through which a function of the operating system (16) or the animal management application (17), or the RFID device encoder-decoder application (18), or other program or application is activated or performed, whether through clickable selection of one or a plurality of control icon(s) (31) or by computer user (22) voice command, keyboard stroke(s), mouse button, touch screen, touch pad, or otherwise, para [0038]-[0040]).

As to claims 17 and 36, Rettedal discloses a system/method wherein said at least one of said menus allows said user to alter operating parameters of said tag (para [0038]-[0040]).

As to claims 18 and 37, Rettedal discloses a system/method further comprising a remote signal transceiver capable of receiving said tag second communication signal carrying said encoded bolus sensor or said encoded environmental data and transmitting said encoded bolus sensor data or said encoded environmental sensor data to said remote processor (A serial packet manager (77a) handles data packets output from the RFID reader data encoder module (77) to the communication port (51) for LAN or WAN transmission. A communication port enumerator module (78) functions to assign communication port information for a port controller module (63) which functions to control communications between the data management module (76) and server computer (1) or the remote computer (34), para [0052]).

As to claim 27, Rettedal discloses a method further comprising sensorially perceiving indicia generated by said tag indicator element upon the occurrence of said pre-selected indicator element activation value of said physiological parameter value or said environmental parameter value (animal management application (17) - generate the graphic user interface (88) which further provides control icons (31) which by click event activate provides a list display icon (133) which upon click event displays a plurality of list icons (134) such as an Alert List (135), a Hospital List (136), a Pens List (137), or Malfunction List (138) each of which upon click event activates the functionalities of a corresponding alert module (135a), hospital module (139), pen module (140), or malfunction module (141), or the like, para [0063]-[0064]).

As to claim 29, Rettedal discloses a method further comprising sensorially perceiving indicia generated by said tag indicator element upon the occurrence of said pre-selected indicator element activation value of said power source energy value (generate the graphic user interface (88) which further provides control icons (31) which by click event activate provides a list display icon (133) which upon click event displays a plurality of list icons (134) such as an Alert List (135), a Hospital List (136), a Pens List (137), or Malfunction List (138) each of which upon click event activates the functionalities of a corresponding alert module (135a), hospital module (139), pen module (140), or malfunction module (141), or the like, para [0063]-[0064]).

As to claim 38, Rettedal discloses a method receiving said encoded bolus sensor data or said encoded environmental sensor data at said remote processor (A serial packet manager (77a) handles data packets output from the RFID reader data encoder module (77) to the communication port (51) for LAN or WAN transmission. A communication port enumerator module (78) functions to assign communication port information for a port controller module (63) which functions to control communications between the data management module (76) and server computer (1) or the remote computer (34), para [0052]).

Claims 1-38 have industrial applicability as defined by PCT Article 33(4) because the subject matter can be made or used in industry.

Electronic Acknowledgement Receipt

EFS ID:	29134008
Application Number:	14738789
International Application Number:	
Confirmation Number:	8986
Title of Invention:	Calf Bolus
First Named Inventor/Applicant Name:	Nicholas P. Rettedal
Customer Number:	39208
Filer:	Craig R. Miles/Lioudmila Townsend
Filer Authorized By:	Craig R. Miles
Attorney Docket Number:	bellaUScalf (280-10)
Receipt Date:	05-MAY-2017
Filing Date:	12-JUN-2015
Time Stamp:	19:49:32
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Transmittal Letter	Transmittal_Letter.pdf	39655 87daf35bf0167a067542229bb98f099b585fc3e8	no	2
Warnings:					

Information:					
2	Information Disclosure Statement (IDS) Form (SB08)	Statement.pdf	42115 15d5047e0685c37a1d2b9a1fa9627fd256f96d1d	no	1
Warnings:					
Information:					
This is not an USPTO supplied IDS fillable form					
3	Information Disclosure Statement (IDS) Form (SB08)	Citation.pdf	32724 22434db60bb46e9387a42fc990604c026539bb71	no	1
Warnings:					
Information:					
This is not an USPTO supplied IDS fillable form					
4	Other Reference-Patent/App/Search documents	ISR.pdf	600834 925d0b55aaba4606b5458da7c87dba77d1322c79	no	9
Warnings:					
Information:					
		Total Files Size (in bytes):	715328		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the application of: Nicholas P. Rettedal, Stephen M. Weilnau, Scott R. Cockroft, and Joseph Janus IV

Application No.: 14/738,789

Filed: June 12, 2015

For: Calf Bolus

Attorney Docket No.: bellaUScalf (280-10)

Confirmation No.: 8986

Group Art Unit: 3766

Examiner: Heller, Tammie K.

Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

LETTER OF TRANSMITTAL

Sir/Madam:

Please find attached for entry into the above-identified patent application, documents as follow:

1. a Supplemental Information Disclosure Statement under 37 C.F.R. § 1.97 (c) and 37 C.F.R. §1.97(e)(1) (1 page(s));

2. a Supplemental Information Disclosure Statement (1 page(s)) along with copies of each cited reference not already available at the PTO; and

3. this firm Letter of Transmittal (2 page(s)).

I have this 5 day of May, 2017, either myself personally, or through my direction of staff at this office, deposited all of the items listed in this Letter of Transmittal with the United States Patent and Trademark Office via EFS-Web.

Please enter the submitted documents into the above-identified patent application.

Direct all correspondence to:

CR MILES P.C.
405 Mason Court, Suite 119
Fort Collins, CO 80524

Customer No.: 39208

Dated this 5 day of May, 2017

Respectfully Submitted,

CR MILES P.C.

By: _____

Craig R. Miles
ATTORNEY FOR APPLICANT
USPTO Reg. No. 45,954
405 Mason Court, Suite 119
Fort Collins, CO 80524
(970) 492-0000
(970) 492-0003 facsimile

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
14/738,789	06/12/2015	Nicholas P. Rettedal	bellaUScalf (280-10)	8986

39208 7590 07/10/2017

CR MILES, P.C.
CRAIG R. MILES
405 MASON COURT, SUITE 119
FORT COLLINS, CO 80524

EXAMINER	
HELLER, TAMMIE K	

ART UNIT	PAPER NUMBER
3766	

MAIL DATE	DELIVERY MODE
07/10/2017	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No. 14/738,789	Applicant(s) RETTEDAL ET AL.	
	Examiner Tammie K. Heller	Art Unit 3766	AIA (First Inventor to File) Status Yes

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTHS FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *3/31/2017*.

☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

4)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims*

5)☒ Claim(s) *37,39,41-46,48-55 and 64-66* is/are pending in the application.

5a) Of the above claim(s) _____ is/are withdrawn from consideration.

6)☐ Claim(s) _____ is/are allowed.

7)☒ Claim(s) *37,39,41-46,48-55 and 64-66* is/are rejected.

8)☐ Claim(s) _____ is/are objected to.

9)☐ Claim(s) _____ are subject to restriction and/or election requirement.

* If any claims have been determined allowable, you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov.

Application Papers

10)☐ The specification is objected to by the Examiner.

11)☒ The drawing(s) filed on *3/31/2017* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

Certified copies:

a)☐ All b)☐ Some** c)☐ None of the:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

** See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☒ Information Disclosure Statement(s) (PTO/SB/08a and/or PTO/SB/08b) Paper No(s)/Mail Date *Attached*.

3) ☒ Interview Summary (PTO-413) Paper No(s)/Mail Date. *20170707*.

4) ☐ Other: _____.

DETAILED ACTION

1. The present application, filed on or after March 16, 2013, is being examined under the first inventor to file provisions of the AIA.

2. The amendment filed on March 31, 2017 has been received and considered. By this amendment, claims 37, 39, 41-43, 50, and 64-66 are amended, claim 38 is cancelled, and claims 37, 39, 41-46, 48-55, and 64-66 are now pending in the application.

Information Disclosure Statement

3. The information disclosure statement(s) (IDS) submitted on 1/24/2017, 2/13/2017, 3/3/2017, and 5/5/2017 has/have been acknowledged and is/are being considered by the Examiner.

Claim Objections

4. Claim 42 is objected to because of the following informalities:

a. On lines 10 and 11, it is recommended that the word “respectively” be used to indicate that the first and second sensors are compared to said first and second pre-selected activation codes, respectively, and exceed said first and second pre-selected activation match thresholds, respectively.

b. On line 11, it is respectfully that the term “threshold” be plural as it refers to the first and second pre-selected activation match thresholds.

Claim Rejections - 35 USC § 112

5. The following is a quotation of 35 U.S.C. 112(b):

> (b) CONCLUSION.—The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the inventor or a joint inventor regards as the invention.

> The following is a quotation of 35 U.S.C. 112 (pre-AIA), second paragraph:
> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

6. Claims 37, 39, 41-46, 48-55, and 64-66 are rejected under 35 U.S.C. 112(b) or 35 U.S.C. 112 (pre-AIA), second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which the inventor or a joint inventor, or for pre-AIA the applicant regards as the invention.

7. Claim 37 recites the limitation "the lifespan of said ruminant animal" in lines 16-17. There is insufficient antecedent basis for this limitation in the claim.

8. Claim 39 recites the limitation "said stage" in line 3. There is insufficient antecedent basis for this limitation in the claim.

9. Claim 39 recites the limitation "said lifecycle" in line 3. There is insufficient antecedent basis for this limitation in the claim.

10. Claim 41 recites the limitation "said one or more sensors outside of said ruminant animal" in lines 2-3. There is insufficient antecedent basis for this limitation in the claim.

11. Claim 41 recites the limitation “activating said bolus upon occurrence of said pre-selected activation code which exceeds said first pre-selected activation match threshold" in lines 6-8. The claim does not previously discuss the “occurrence” of said pre-selected activation code.

12. Claim 42 recites the limitation “activating said bolus upon generation of said first and second sensor signals” in line 8. It is unclear if the bolus is activated upon generation of said first and second sensor signals or after the comparison of said first and second sensor signals to the first and second pre-selected activation codes.

13. Claim 42 recites the limitation “which by comparison to said first and second pre-selected activation codes exceeds said first and second pre-selected activation match threshold” at lines 9-11. It is unclear what is being required by such a recitation.

14. Claim 50 recites the limitation “matching elements which adjusts said frequency of said radio signal to compensate for change in said frequency of said radio signal” in lines 2-3. It is unclear what is being claimed, as it appears that the claim is requiring adjusting the frequency to compensate for the adjustment of the frequency, which does not make sense.

15. Claim 51 recites the limitation “wherein said radio signal generator generates said radio signal having only one frequency". It is unclear what is being claimed with such a recitation.

Claim Rejections - 35 USC § 101

16. 35 U.S.C. 101 reads as follows:

> Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

17. Claims 37, 39, 41-46, 48-55, and 64-66 are rejected under 35 U.S.C. 101 because the claimed invention is directed to non-statutory subject matter. The claim(s) does/do not fall within at least one of the four categories of patent eligible subject matter because the claims fail the machine-or-transformation test because they do not require that the method be implemented by a particular machine, as the method steps are only obtaining a bolus and orally administering said bolus, which could both be done by hand. Furthermore, the claims do not require that the method particularly transform a particular article, as there is no transformation that occurs at all. With respect to claims

37-39, 41-46, 48-55, and 64-66, and based upon consideration of all of the relevant factors with respect to the claim as a whole, the claim is held to claim an abstract idea, and is therefore rejected as ineligible subject matter under 35 U.S.C. § 101. The recitation of a machine or transformation is not sufficient and the claim, as a whole, relates to abstract ideas, rather than practical application of those ideas. In particular, the method is not tied to another statutory class (such as a particular apparatus) and it does not transform underlying subject matter to a different state or thing. Accordingly, the method of claims 37, 39, 41-46, 48-55, and 64-66 are not limited to a particular practical application because no machine or transformation is present in the claim.

Claim Rejections - 35 USC § 102

18. In the event the determination of the status of the application as subject to AIA 35 U.S.C. 102 and 103 (or as subject to pre-AIA 35 U.S.C. 102 and 103) is incorrect, any correction of the statutory basis for the rejection will not be considered a new ground of rejection if the prior art relied upon, and the rationale supporting the rejection, would be the same under either status.

19. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (a)(1) the claimed invention was patented, described in a printed publication, or in public use, on sale or otherwise available to the public before the effective filing date of the claimed invention.

20. Claims 37 and 39, as best understood, are rejected under 35 U.S.C. 102(a)(1) as being anticipated by Brune et al. (U.S. Patent No. 6,371,927), herein Brune. Regarding claim 37, Brune discloses a method of monitoring the physiological parameters of a

ruminant animal (see Abstract), comprising: obtaining a bolus 2/20/50 configured for oral administration to a ruminant animal (see Figures 1, 5-7, and 12 and col. 3, ln. 10-12); and orally administering said bolus to said animal (see col. 4, ln. 48-51). It has been held that to be entitled to weight in method claims, the recited structure limitations therein must affect the method in a manipulative sense, and not amount to the mere claiming of a use of a particular structure. *Ex parte Pfeiffer,* 1962 C.D. 408 (1961). It is respectfully submitted that the recited structural limitations in claim 37 do not affect the method in a manipulative sense and are not entitled to weight. Despite not giving weight to the structural limitations, it is respectfully submitted that Brune satisfies such limitations of said bolus including: one or more sensors 8 each capable of generating a sensor signal which varies based on a corresponding change in one or more physiological parameters of an animal (see Figure 2, col. 5, ln. 36-37, and col. 6, ln. 39); a processor 7 (see Abstract and Figure 2); a non-transitory computer readable medium containing a computer code including a power management module executable by said processor to enable and disable said one or more sensors (see col. 6, ln. 47-57); and a housing providing an outer most external surface of said bolus (see Figures 1, 5-7, and 12). The limitation “said power management module enabling or disabling said one or more sensors coordinated with a plurality of stages in the lifespan of said ruminant animal” is considered an intended use recitation that fails to further limit the claimed invention.

21. Regarding claim 39, Brune discloses enabling or disabling said one or more sensors based upon a pre-determined set of said one or more physiological parameters

to be sensed, the enablement of the diagnostic sensors after the target condition is met (see col. 6, ln. 47-57).

Claim Rejections - 35 USC § 102/103

22. In the event the determination of the status of the application as subject to AIA 35 U.S.C. 102 and 103 (or as subject to pre-AIA 35 U.S.C. 102 and 103) is incorrect, any correction of the statutory basis for the rejection will not be considered a new ground of rejection if the prior art relied upon, and the rationale supporting the rejection, would be the same under either status.

23. The following is a quotation of 35 U.S.C. 103 which forms the basis for all obviousness rejections set forth in this Office action:

> A patent for a claimed invention may not be obtained, notwithstanding that the claimed invention is not identically disclosed as set forth in section 102, if the differences between the claimed invention and the prior art are such that the claimed invention as a whole would have been obvious before the effective filing date of the claimed invention to a person having ordinary skill in the art to which the claimed invention pertains. Patentability shall not be negated by the manner in which the invention was made.

24. The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103 are summarized as follows:

1. Determining the scope and contents of the prior art.

2. Ascertaining the differences between the prior art and the claims at issue.

3. Resolving the level of ordinary skill in the pertinent art.

4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

25. This application currently names joint inventors. In considering patentability of the claims the examiner presumes that the subject matter of the various claims was

commonly owned as of the effective filing date of the claimed invention(s) absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and effective filing dates of each claim that was not commonly owned as of the effective filing date of the later invention in order for the examiner to consider the applicability of 35 U.S.C. 102(b)(2)(C) for any potential 35 U.S.C. 102(a)(2) prior art against the later invention.

26. Claims 37, 39, and 41, as best understood, are rejected under 35 U.S.C. 102(a)(1) as anticipated by or, in the alternative, under 35 U.S.C. 103 as obvious over Zander et al. (U.S. 2009/0030279), herein Zander. Regarding claim 37, Zander discloses a method of monitoring the physiological parameters of an animal (see paragraph [0033]), comprising: obtaining a bolus 20/28/36/48 configured for oral administration to an animal (see Figures 1-4); and orally administering said bolus to said animal (see Figure 4 and paragraph [0040]). It has been held that to be entitled to weight in method claims, the recited structure limitations therein must affect the method in a manipulative sense, and not amount to the mere claiming of a use of a particular structure. *Ex parte Pfeiffer,* 1962 C.D. 408 (1961). It is respectfully submitted that the recited structural limitations in claim 37 do not affect the method in a manipulative sense and are not entitled to weight. Despite not giving weight to the structural limitations, it is respectfully submitted that Zander satisfies such limitations of said bolus including: one or more sensors 24/30/32 each capable of generating a sensor signal which varies based on a corresponding change in one or more physiological parameters of an animal (see Figures 1-3 and paragraph [0014]); a processor in controller 22 (see paragraph

[0034]); a non-transitory computer readable medium containing a computer code including a power management module executable by said processor to enable and disable one or more of said plurality of sensors (see paragraphs [0016], [0034], and [0037]); and a housing providing an outer most external surface of said bolus (see Figures 1-4). The limitation "said power management module enabling or disabling said one or more sensors coordinated with a plurality of stages in the lifespan of said ruminant animal" is considered an intended use recitation that fails to further limit the claimed invention. Furthermore, the method of obtaining a bolus and orally administering said bolus is not dependent upon the animal and, thus, it is respectfully submitted that the method of Zander would be applicable to ruminant animals. In the alternative it would have been obvious to one having ordinary skill in the art to apply the method of Zander to ruminant animals, as it has been held that known work in one field of endeavor may prompt variations of it for use in either the same field or a different one based on design incentives or other market forces if the variations are predictable to one of ordinary skill in the art. *KSR Int'l Co. v. Teleflex Inc.,* 127 S.Ct. 1727, 1742, 82 USPQ2d 1385, 1396 (2007).

27. Regarding claim 39, Zander discloses enabling or disabling said one or more sensors based upon a pre-determined set of said one or more physiological parameters to be sensed, the enablement of the diagnostic sensors after the target condition is met (see paragraph [0043]).

28. Regarding claim 41, Zander discloses monitoring said sensor signal from said one or more sensors, target sensors; comparing said sensor signal from a first sensor to

a first pre-selected activation code having a first pre-selected activation match threshold, the target condition; and activating said bolus upon occurrence of said first pre-selected activation code which exceeds said first pre-selected activation match threshold (see paragraph [0042]). The “activation” of the bolus in Zander is considered to be the enabling of the diagnostic sensor that occurs in response to the signal sensed from the target sensor exceeding the target condition.

Allowable Subject Matter

29. Claims 42-46, 48-55, and 64-66 would be allowable if rewritten to overcome the rejection(s) under 35 U.S.C. 112(b) or 35 U.S.C. 112 (pre-AIA), 2nd paragraph, and 35 USC 101 set forth in this Office action and to include all of the limitations of the base claim and any intervening claims.

Response to Arguments

30. As an initial matter, it is noted that in the interest of compact prosecution, the Examiner contacted the Applicant's representative, Craig Miles, to discuss potential amendments to the claims to place them in condition for allowance, specifically to incorporate dependent claim 42 into the independent claim (see attached Interview Summary). Agreement could not be reached within the time period the Examiner had to complete an action on the application. Applicant is encouraged to contact the Examiner in the future to discuss potential amendments and ways to overcome the rejections provided above.

31. Applicant's arguments filed March 31, 2017 have been fully considered and are considered persuasive in part, moot in part, and non-persuasive in part. Those

arguments which were found either persuasive or moot will not be answered herein as the rejections to which they apply are no longer pending.

32. Regarding the rejection of the claims under 35 USC 101, the Applicant argues that claim 37 has been amended to recite a "non-transitory computer readable medium containing a computer code including a power management module executable by said processor to enable or disable said one or more sensors" and, thus, overcomes the rejection. The Examiner respectfully disagrees. As discussed in the interview of April 19, 2017 (see Interview Summary mailed on April 26, 2017), the claims are still rejectable under 35 USC 101 as being directed to an abstract idea because the claims continue to only recite two methods steps, which are to obtain and orally administer a bolus.

33. Regarding the rejection of the claims as being anticipated by Brune, the Applicant argues that amended claim 37 requires the elements of “said power management module enabling or disabling said one or more sensors coordinated with a plurality of stages in the lifespan of said ruminant animal.” As previously discussed and set out above, it has been held that to be entitled to weight in method claims, the recited structure limitations therein must affect the method in a manipulative sense, and not amount to the mere claiming of a use of a particular structure. *Ex parte Pfeiffer,* 1962 C.D. 408 (1961). It is respectfully submitted that the recited structural limitations in claim 37 do not affect the method in a manipulative sense and are not entitled to weight. Furthermore, the recitation “enabling or disabling said one or more sensors coordinated with a plurality of stages in the lifespan of said ruminant animal” is an intended use of the power management module within the computer code contained on the non-

transitory computer readable medium. In order for this limitation to be given weight, and to overcome the rejection under 35 USC 101, it is recommended that an active step of enabling or disabling said one or more sensors be claimed. Furthermore, the Examiner provides for the Applicant's review U.S. Patent No. 8,588,887 to Arneson that teaches control logic 604 which is configured to enable or disable operation of sensor 202 based on time. Even if Applicant were to amend claim 37 to overcome the rejection under 35 USC 101 and to require an active method step of enabling or disabling said one or more sensors coordinated with a plurality of stages in the lifespan of said ruminant animal, the claims would be obvious over Brune in view of the teachings of Arneson et al.

34. Regarding the rejection of the claims under 35 U.S.C. 102(a)(1) as anticipated by or, in the alternative, under 35 U.S.C. 103 as obvious over Zander, the Applicant argues that the claims require "orally administering said bolus to said ruminant animal, said bolus retained in a reticulorumen of said ruminant animal" while Zander discloses a bolus that passes through the alimentary canal and does not contemplate any capsule that is retained in the reticulorumen of a ruminant animal. The Examiner respectfully submits that retention of the bolus in the reticulorumen of a ruminant animal is not positively recited in the claims. Only two methods steps are required by the independent claim, obtaining and orally administering a bolus. The Applicant further argues "on page 12, Examiner asserts that the phrase 'obtaining a bolus configured for oral administration to said ruminant animal' has not been given patentable weight because it is preceded by the phrase 'configured for,' and, therefore is merely descriptive of an intended use. Applicant respectfully submits that this interpretation is improper." The

Examiner is unable to the section referenced by the Applicant. Nowhere on page 12 of the Non-Final Rejection of 11/01/2016, nor in the entire document, is it stated that "obtaining a bolus configured for oral administration to said ruminant animal" has not been given patentable weight. In fact, obtaining a bolus and administering the bolus are the only portions which include active method steps. Furthermore, nowhere is it stated that the use of the phrase "configured for" makes this recitation merely descriptive of intended use. Regarding claim 37, the Applicant further argues that the examiner does not provide an explanation or rationale for the conclusion that obtaining a bolus is not dependent upon the animal. The Examiner is not taking Official Notice that obtaining a bolus is not dependent upon the animal, but is rather using reasoning and common sense of such. The Applicant further argues that the "Examiner asserts that 'it would be obvious to one of ordinary skill in the art to apply Zander to ruminant animals.' *Office Action* at Page 13. Examiner does not provide an explanation or rational for this statement and it appears Examiner is substituting personal knowledge or common sense to replace documentary evidence to provide a finding that the prior art included each element." The Examiner respectfully disagrees and submits that the Examiner is using the rationale provided by *KSR Int'l Co. v. Teleflex Inc.,* 127 S.Ct. 1727, 1742, 82 USPQ2d 1385, 1396 (2007). The Applicant further argues that claim 37 has been amended to include the language "said power management module enabling or disabling said one or more sensors coordinated with a plurality of stages in the lifespan of said ruminant animal." As previously discussed and set out above, it has been held that to be entitled to weight in method claims, the recited structure limitations therein

must affect the method in a manipulative sense, and not amount to the mere claiming of a use of a particular structure. *Ex parte Pfeiffer,* 1962 C.D. 408 (1961). It is respectfully submitted that the recited structural limitations in claim 37 do not affect the method in a manipulative sense and are not entitled to weight. Furthermore, the recitation "enabling or disabling said one or more sensors coordinated with a plurality of stages in the lifespan of said ruminant animal" is an intended use of the power management module within the computer code contained on the non-transitory computer readable medium. In order for this limitation to be given weight, and to overcome the rejection under 35 USC 101, it is recommended that an active step of enabling or disabling said one or more sensors be claimed. Furthermore, the Examiner provides for the Applicant's review U.S. Patent No. 8,588,887 to Arnesson that teaches control logic 604 which is configured to enable or disable operation of sensor 202 based on time. Even if Applicant were to amend claim 37 to overcome the rejection under 35 USC 101 and to require an active method step of enabling or disabling said one or more sensors coordinated with a plurality of stages in the lifespan of said ruminant animal, the claims would be obvious over Brune in view of the teachings of Arneson et al.

Conclusion

35. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Tammie K. Heller whose telephone number is (571)272-1986. The examiner can normally be reached on Monday through Friday from 7am until 3:30 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carl H. Layno can be reached on 571-272-4949. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Tammie K Heller/
Primary Examiner, Art Unit 3766

Examiner-Initiated Interview Summary	Application No.	Applicant(s)		
	14/738,789	RETTEDAL ET AL.		
	Examiner	Art Unit	AIA (First Inventor to File) Status	Page
	Tammie K. Heller	3766	Yes	1 of 1

All participants (applicant, applicant's representative, PTO personnel):

1. Tammie K. Heller (Primary Examiner); Telephonic 2. Craig Miles (Attorney of Record); Telephonic

Date of Interview: 06 July 2017

Claim(s) discussed: 37, 41, and 42

Identification of prior art discussed: Arneson (cited with this Office Action)

Amendment Proposed: The Examiner proposed amending claim 37 to include the limitations of claim 42.

Brief Description of main topic of discussion: The Examiner contacted the Applicant's representative to discuss amending claim 37 to include the subject matter of claim 42. Further amendments were also discussed.

Issues Discussed:

Proposed Amendments:
The Examiner initially contacted the Applicant's representative to propose amending claim 37 to include the limitations of claim 42. The Applicant's representative indicated that such an amendment may be too narrowing, but suggested possibly amending claim 37 to provided more specifics about the coordination with the stages of the lifespan of the ruminant animal, and to create two new independent claims based on claims 41 and 42. The Examiner indicated that new independent claims that do not include all of the limitations of claim 37, but include the limitations of claims 41 and 42 would require further searching and consideration. The Examiner indicated to the Applicant's representative that an amendment to claim 37 to require active steps of enabling or disabling sensors based on whether the ruminant animal has reached puberty and, thus, a reproductive state, would be beneficial and overcome the prior art of record. The Examiner suggested that the Applicant file such an amendment after-final.

Attachment(s): Other, Office Action.

Applicant recordation instructions: It is not necessary for applicant to provide a separate record of the substance of the interview.

Examiner recordation instructions: Examiners must summarize the substance of any interview of record. A complete and proper recordation of the substance of an interview should include the items listed in MPEP 713.04 for complete and proper recordation including the identification of the general thrust of each argument or issue discussed, a general indication of any other pertinent matters discussed regarding patentability and the general results or outcome of the interview, to include an indication as to whether or not agreement was reached on the issues raised.

Applicant is reminded that a complete written statement as to the substance of the interview must be made of record in the application file. It is the applicant's responsibility to provide the written statement, unless the interview was initiated by the Examiner and the Examiner has indicated that a written summary will be provided. See MPEP 713.04

Please further see:

MPEP 713.04
Title 37 Code of Federal Regulations (CFR) § 1.133 Interviews, paragraph (b)
37 CFR § 1.2 Business to be transacted in writing

Notice of References Cited	Application/Control No. 14/738,789	Applicant(s)/Patent Under Reexamination RETTEDAL ET AL.	
	Examiner Tammie K. Heller	Art Unit 3766	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	CPC Classification	US Classification
*	A	US-8,588,887 B2	11-2013	Arneson; Michael R.	A61B5/0002	600/407
	B	US-				
	C	US-				
	D	US-				
	E	US-				
	F	US-				
	G	US-				
	H	US-				
	I	US-				
	J	US-				
	K	US-				
	L	US-				
	M	US-				

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	CPC Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	14738789	RETTEDAL ET AL.
	Examiner	Art Unit
	TAMMIE K HELLER	3766

CPC- SEARCHED		
Symbol	Date	Examiner
A61B 5/073, 076, 0031	10/27/2016	TKH
A61D 7/00	10/27/2016	TKH
A01K 11/006-008	10/27/2016	TKH
Updated above	7/3/2017	TKH

CPC COMBINATION SETS - SEARCHED		
Symbol	Date	Examiner

US CLASSIFICATION SEARCHED			
Class	Subclass	Date	Examiner

SEARCH NOTES		
Search Notes	Date	Examiner
Inventor name search	10/27/2016	TKH
Text-limited search -- see search history printout	10/27/2016	TKH
Updated above	7/3/2017	TKH

INTERFERENCE SEARCH			
US Class/ CPC Symbol	US Subclass / CPC Group	Date	Examiner

	/TAMMIE K HELLER/ Primary Examiner.Art Unit 3766

SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT BY APPLICANT	Application Number	14/738,789
	Filling Date	June 12, 2015
	First Named Inventor	Nicholas P. Rettedal
	Art Unit	3766
	Examiner Name	Heller, Tammie K.
	Attorney Docket Number	bellaUScalf (280-10)
Sheet 1 of 1	Express Mail Label No.:	-

UNITED STATES PATENT DOCUMENTS

EXAMINER INITIALS	DOCUMENT NUMBER	PUBLICATION DATE MM-DD-YYYY	NAME OF PATENTEE OR APPLICANT
	6,416,782	07-09-2002	Maas

UNITED STATES PATENT PUBLICATION DOCUMENTS

EXAMINER INITIALS	DOCUMENT NUMBER	PUBLICATION DATE MM-DD-YYYY	NAME OF PATENTEE OR APPLICANT
	2001/0001176	05-17-2001	Caja Lopez et al.
	2002/0128542	09-12-2002	Van Over
	2010/0302039	12-02-2010	Goto et al.

FOREIGN PATENT DOCUMENTS

EXAMINER INITIALS	DOCUMENT NUMBER	DATE	COUNTRY	NAME OF PATENTEE OR APPLICANT OF CITED DOCUMENT
	2016/201242	12-15-2016	WO	Rettedal et al.

EXAMINER SIGNATURE:	DATE CONSIDERED:
/TAMMIE K HELLER/	07/03/2017

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /T.K.H/

SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT BY APPLICANT	Application Number	14/738,789
	Filling Date	June 12, 2015
	First Named Inventor	Nicholas P. Rettedal
	Art Unit	3766
	Examiner Name	Heller, Tammie K.
	Attorney Docket Number	bellaUScalf (280-10)
Sheet 1 of 1	Express Mail Label No.:	-

NON-PATENT LITERATURE DOCUMENTS

EXAMINER INITIALS	CITE NO.	AUTHOR, title of article, title of item, date, page(s), volume-issue number(s), publisher, city and /or country where published	T2
		CARNÉ et al. Modeling the retention of rumen boluses for the electronic identification of goats. J Dairy Sci, February 2011, 94(2), pp. 716-726 (abstract only, 2 pages total).	
		GHIRARDI et al. Retention of different sizes of electronic identification boluses in the forestomachs of sheep. J Anim Sci, November 2006, 84(10), pp. 2865-2872.	

EXAMINER SIGNATURE:	DATE CONSIDERED:
/TAMMIE K HELLER/	07/03/2017

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /T.K.H/

SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT BY APPLICANT	Application Number	14/738,789
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	Art Unit	3766
	Examiner Name	Heller, Tammie K.
	Attorney Docket Number	bellaUScalf (280-10)
Sheet 1 of 1	Express Mail Label No.:	-

UNITED STATES PATENT PUBLICATION DOCUMENTS

EXAMINER INITIALS	DOCUMENT NUMBER	PUBLICATION DATE MM-DD-YYYY	NAME OF PATENTEE OR APPLICANT
	2007/0136154	06-14-2007	Chung
	2014/0240088	08-28-2014	Robinette et al.

NON-PATENT LITERATURE DOCUMENTS

EXAMINER INITIALS	CITE NO.	AUTHOR, title of article, title of item, date, page(s), volume-issue number(s), publisher, city and /or country where published	T2
		International PCT Patent Application No.: PCT/US2016/066012; International Search Report and Written Opinion dated March 3, 2017, 9 pages total.	

EXAMINER SIGNATURE:	DATE CONSIDERED:
/TAMMIE K HELLER/	07/03/2017

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /T.K.H/

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
S1	0	(("BELLA") near3 ("TECHNOLOGIES") near3 ("LLC")).AANM.	USPAT	OR	ON	2016/10/27 08:47
S2	0	(("RETTEDAL") near3 ("Nicholas")).INV.	EPO; JPO; DERWENT	OR	ON	2016/10/27 08:47
S3	4	(("RETTEDAL") near3 ("Nicholas")).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2016/10/27 08:47
S4	0	(("WEILNAU") near3 ("Stephen")).INV.	EPO; JPO; DERWENT	OR	ON	2016/10/27 08:47
S5	4	(("WEILNAU") near3 ("Stephen")).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2016/10/27 08:47
S6	0	(("COCKROFT") near3 ("Scott")).INV.	EPO; JPO; DERWENT	OR	ON	2016/10/27 08:47
S7	4	(("COCKROFT") near3 ("Scott")).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2016/10/27 08:47
S8	1	(("JANUS") near3 ("Joseph")).INV.	EPO; JPO; DERWENT	OR	ON	2016/10/27 08:47
S9	3	(("JANUS") near3 ("Joseph")).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2016/10/27 08:47
S10	29	("20040133131" | "20050134452" | "20050145187" | "20080104209" | "20080236500" | "20090182207" | "20110212782" | "20110301437" | "20120068848" | "20130197323" | "20130231188" | "20140368338" | "5482008" | "5818354" | "5963132" | "5984875" | "6059733" | "6099482" | "6371927" | "7441515" | "7962096" | "8001168" | "8545436" | "8547248" | "8588887" | "8640712" | "8694091" | "8771201" | "8823515" | "us-" | "us-" | "us-" | "us-" | "us-" | "us-" | "us-" | "us-" | "us-" | "us-" | "us-" | "us-" | "us-" | "us-" | "us-" | "us-" | "us-" | "us-").PN.	US-PGPUB; USPAT	OR	ON	2016/10/27 08:48
S12	1	("6085751").PN.	US-PGPUB; USPAT	OR	ON	2016/10/27 08:48
S13	6	("20040155782" | "20070156016" | "20090187392" | "20100030025" | "5532692" | "6702185").PN.	US-PGPUB; USPAT	OR	ON	2016/10/27 08:59
S14	3941	A61B5/073.cpc.	US-	OR	ON	2016/10/27

			PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT			09:25
S15	3064	A61B5/076.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2016/10/27 09:25
S16	11236	A61B5/0031.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2016/10/27 09:26
S17	3306	A61D7/00.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2016/10/27 09:26
S18	2920	A01K11/006.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2016/10/27 09:26
S19	399	A01K11/007.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2016/10/27 09:26
S20	819	A01K11/008.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2016/10/27 09:26
S21	205	(S14 S15 S16) and (S17 S18 S19 S20)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2016/10/27 09:26
S22	36	S10 S12 S13	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO;	OR	ON	2016/10/27 09:26

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S24	22984	(S14 S15 S16) or (S17 S18 S19 S20)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2016/10/27 09:44
S25	2333	(S22 S23 S24) and ((power near3 manage$6) (sens$6 with (((turn turned turning) near3 ("on" "off")) enabl$6 disabl$6)))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2016/10/27 09:46
S26	1246	S25 and (mouth oral$6 swallow$6 animal)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2016/10/27 09:47
S27	1245	S26 and sens$6	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2016/10/27 09:47

S28	273	(S22 S23) and ((power near3 manage$6) (sens$6 with (((turn turned turning) near3 ("on" "off")) enabl$6 disabl$6)))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2016/10/27 09:48
S29	281	(S21 S22 S23) and ((power near3 manage$6) (sens$6 with (((turn turned turning) near3 ("on" "off")) enabl$6 disabl$6)))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2016/10/27 09:48
S30	93	(S21 S22 S23) and ((power near3 manage$6) (sens$6 with (((turn turned turning) near3 ("on" "off")) (enabl$6 and disabl$6))))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2016/10/27 09:50
S31	353	(S22 S23 S24) and ((power near3 manage$6))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2016/10/27 09:51
S32	1460	(mouth oral$6 swallow$6) and animal and (sens$6 with (((turn turned turning) near3 ("on" "off")) (enabl$6 and disabl$6)))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2016/10/27 09:56
S33	9	(S22 S23) and S32	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2016/10/27 09:57
S34	0	(S21) and S32	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2016/10/27 09:57
S35	85	(S24) and S32	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2016/10/27 09:57
S36	86	S33 S35	US-PGPUB; USPAT; USOCR; FPRS;	OR	ON	2016/10/27 09:57

			EPO; JPO; DERWENT			
S37	86	(US-20020050248-$ or US-20030188689-$ or US-20050000458-$ or US-20080270173-$ or US-20120158463-$ or US-20080190369-$ or US-20130151310-$ or US-20090031961-$ or US-20090307111-$ or US-20110161125-$ or US-20090031960-$ or US-20070131175-$ or US-20070157888-$ or US-20090030279-$ or US-20080146871-$ or US-20140309503-$ or US-20090030293-$ or US-20130013031-$ or US-20080114224-$ or US-20080112885-$ or US-20140200418-$ or US-20080161660-$ or US-20140343378-$ or US-20090131768-$ or US-20090131769-$ or US-20090131776-$).did. or (US-20090131777-$ or US-20090137886-$ or US-20090137887-$ or US-20090143659-$ or US-20090178459-$ or US-20090182217-$ or US-20140058235-$ or US-20140088391-$ or US-20160198978-$ or US-20020132226-$ or US-20080269664-$ or US-20130043975-$ or US-20130043993-$ or US-20130043974-$ or US-20130043991-$ or US-20130046153-$ or US-20130046477-$ or US-20150297116-$ or US-20110295079-$ or US-20040032957-$ or US-20040171915-$ or US-20150374262-$ or US-20110130658-$).did. or (US-6805075-$ or US-6135055-$ or US-7726258-$ or US-6516746-$ or US-7464666-$ or US-5673647-$ or US-6318289-$ or US-8028657-$ or US-7464667-$ or US-7836849-$ or US-8261694-$ or US-7827934-$ or US-8474405-$ or US-7748345-$ or US-7347161-$ or US-7607405-$ or US-6000361-$ or US-8588887-$ or US-8512241-$ or US-9173592-$ or US-8287453-$ or US-8886273-$ or US-8275438-$ or US-8298142-$ or US-8447376-$ or US-8449464-$).did. or (US-8478377-$ or US-8562528-$ or US-8626257-$ or US-8615284-$ or US-8617058-$ or US-8816814-$ or US-8599009-$ or US-8723640-$ or US-8514067-$ or US-8663105-$ or US-7118529-$).did.	US-PGPUB; USPAT	OR	ON	2016/10/27 09:57
S38	86	S37 and (sens$6 with (((turn turned turning) near3 ("on" "off")) (enabl$6 and disabl$6)))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2016/10/27 09:58
S39	25	(US-20100030025-$ or US-20090187392-$ or US-20090182207-$ or US-20080236500-$ or US-20070156016-$ or US-20040133131-$ or US-20090048498-$ or US-20070161851-$ or US-20070088194-$ or US-20090171178-$ or	US-PGPUB; USPAT	OR	ON	2016/10/27 10:13

		US-20090030279-$ or US-20080269664-$ or US-20090030293-$).did. or (US-8694091-$ or US-8640712-$ or US-8588887-$ or US-6371927-$ or US-5984875-$ or US-5963132-$ or US-5482008-$ or US-9420941-$ or US-8979758-$ or US-8195304-$ or US-8512241-$ or US-8663105-$).did.				
S40	13	S39 and ((power near3 manage$6) (sens$6 with (((turn turned turning) near3 ("on" "off")) (enabl$6 and disabl$6))))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2016/10/27 10:14
S41	29	("20040133131" | "20050134452" | "20050145187" | "20080104209" | "20080236500" | "20090182207" | "20110212782" | "20110301437" | "20120068848" | "20130197323" | "20130231188" | "20140368338" | "5482008" | "5818354" | "5963132" | "5984875" | "6059733" | "6099482" | "6371927" | "7441515" | "7962096" | "8001168" | "8545436" | "8547248" | "8588887" | "8640712" | "8694091" | "8771201" | "8823515" | "us-" | "us-" | "us-" | "us-" | "us-" | "us-" | "us-" | "us-" | "us-" | "us-" | "us-" | "us-" | "us-" | "us-" | "us-" | "us-" | "us-" | "us-" | "us-" | "us-" | "us-" | "us-" | "us-" | "us-").PN.	US-PGPUB; USPAT	OR	ON	2016/10/27 17:41
S42	1	("6085751").PN.	US-PGPUB; USPAT	OR	ON	2016/10/27 17:41
S43	6	("20040155782" | "20070156016" | "20090187392" | "20100030025" | "5532692" | "6702185").PN.	US-PGPUB; USPAT	OR	ON	2016/10/27 17:41
S44	3941	A61B5/073.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2016/10/27 17:41
S45	3064	A61B5/076.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2016/10/27 17:41
S46	11236	A61B5/0031.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2016/10/27 17:41
S47	3306	A61D7/00.cpc.	US-PGPUB; USPAT; USOCR;	OR	ON	2016/10/27 17:41

			FPRS; EPO; JPO; DERWENT			
S48	2920	A01K11/006.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2016/10/27 17:41
S49	399	A01K11/007.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2016/10/27 17:41
S50	819	A01K11/008.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2016/10/27 17:41
S51	36	S41 S42 S43	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2016/10/27 17:41
S52	691	("20010035902" | "20010051766" | "20020107444" | "20020128542" | "20020138009" | "20020156356" | "20020165592" | "20020173718" | "20020177779" | "20020188323" | "20020193669" | "20030013370" | "20030018280" | "20030043263" | "20030045790" | "20030077223" | "20030114742" | "20030139661" | "20030174208" | "20030195400" | "20030195415" | "20030214579" | "20030216622" | "20040032187" | "20040032957" | "20040054278" | "20040073087" | "20040109488" | "20040114856" | "20040122315" | "20040133131" | "20040162501" | "20040171915" | "20040181155" | "20040193029" | "20040199222" | "20040202339" | "20040204744" | "20040236182" | "20040258328" | "20050025368" | "20050043634" | "20050065441" | "20050075555" | "20050075559" | "20050088299" | "20050110881" | "20050143624" | "20050143644" | "20050148816" | "20050159643" | "20050159789" | "20050187433" | "20050222490" | "20050228259" | "20050256430" | "20050266074" | "20050272974" | "20050281446" | "20060004256" | "20060009819" | "20060030754" |	US-PGPUB; USPAT; USOCR	OR	ON	2016/10/27 17:41

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"2009/0182207" | "2009/0187392" |
"2010/0030025" | "5482008" | "5963132"

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S53	22984	(S44 S45 S46) or (S47 S48 S49 S50)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2016/10/27 17:41
S54	355	(S51 S52 S53) and ((power energy) near3 (remain$6 left))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2016/10/27 17:41
S55	0	(("BELLA") near3 ("TECHNOLOGIES") near3 ("LLC")).AANM.	USPAT	OR	ON	2016/10/27 17:52
S56	0	(("RETTEDAL") near3 ("Nicholas")).INV.	EPO; JPO; DERWENT	OR	ON	2016/10/27 17:52
S57	4	(("RETTEDAL") near3 ("Nicholas")).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2016/10/27 17:52
S58	0	(("WEILNAU") near3 ("Stephen")).INV.	EPO; JPO; DERWENT	OR	ON	2016/10/27 17:52
S59	4	(("WEILNAU") near3 ("Stephen")).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2016/10/27 17:52
S60	0	(("COCKROFT") near3 ("Scott")).INV.	EPO; JPO; DERWENT	OR	ON	2016/10/27 17:52
S61	4	(("COCKROFT") near3 ("Scott")).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2016/10/27 17:52
S62	1	(("JANUS") near3 ("Joseph")).INV.	EPO; JPO; DERWENT	OR	ON	2016/10/27 17:52
S63	3	(("JANUS") near3 ("Joseph")).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2016/10/27 17:52
S64	8	(S55 S56 S57 S58 S59 S60 S61 S62 S63)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2016/10/27 17:52
S65	0	S64 and ((power energy) near3 (remain$6 left))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2016/10/27 17:52
S67	4234	animal with (lifespan$6 (life adj span$6) (life near3 stag$6))	US-PGPUB; USPAT;	OR	ON	2017/06/06 14:52

			USOCR; FPRS; EPO; JPO; DERWENT			
S68	1297	(animal with (lifespan$6 (life adj span$6) (life near3 stag$6))) same (power control controlled controlling controller sens$6 coordin$8)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2017/06/06 15:00
S69	1297	(animal with (lifespan$6 (life adj span$6) (life near3 stag$6))) same (power control controlled controlling controller sens$6 coordin$8)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2017/06/06 15:01
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S88	13	(("6416782") or ("20010001176") or ("20020128542") or ("20100302039") or ("20070136154") or ("20140240088")).PN.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	OFF	2017/07/03 10:13
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EAST Search History (Interference)

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SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT BY APPLICANT	Application Number	14/738,789
	Filling Date	June 12, 2015
	First Named Inventor	Nicholas P. Rettedal
	Art Unit	3766
	Examiner Name	Heller, Tammie K.
	Attorney Docket Number	bellaUScalf (280-10)
Sheet 1 of 1	Express Mail Label No.:	-

FOREIGN PATENT DOCUMENTS

EXAMINER INITIALS	DOCUMENT NUMBER	DATE	COUNTRY	NAME OF PATENTEE OR APPLICANT OF CITED DOCUMENT
	2007089892, with English Abstract	04-12-2007	JP	Mori et al.

EXAMINER SIGNATURE:	DATE CONSIDERED:
/TAMMIE K HELLER/	07/03/2017

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /T.K.H/

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the application of: Nicholas P. Rettedal, Stephen M. Weilnau, Scott R. Cockroft and Joseph Janus IV

Application No.: 14/738,789

Filed: June 12, 2015

For: Calf Bolus

Attorney Docket No.: bellaUScalf (280-10)

Confirmation No.: 8986

Group Art Unit: 3766

Examiner: Heller, Tammie K.

Mail Stop AF
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

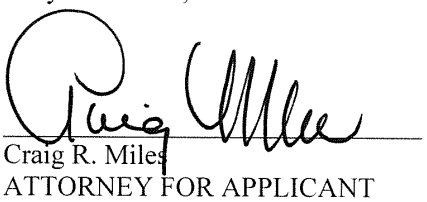
REQUEST FOR CONTINUED EXAMINATION UNDER 37 C.F.R. §1.114

This is a Request for Continued Examination under 37 C.F.R. §1.114. Applicant requests entry of the amendments set forth in the Response and Request for Reconsideration under 37 C.F.R. § 1.116 enclosed.

Applicant claims small entity status under C.F.R. § 1.27, therefore, the Request for Continued Examination is accompanied by the fee under 37 C.F.R. § 1.17(e)(1) in the amount of $600.00 and a Petition for Extension of Time under 37 C.F.R. § 1.36(a) and the fee under 37 C.F.R. § 1.17(a)(3) in the amount of $700.00.

Dated this 9 day of January, 2018

Respectfully Submitted,

By: 

Craig R. Miles
ATTORNEY FOR APPLICANT
USPTO Reg. No. 45,954
CR MILES P.C.
405 Mason Court, Suite 119
Fort Collins, CO 80524
(970) 492-0000 telephone
(970) 492-0003 facsimile

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the application of: Nicholas P. Rettedal, Stephen M. Weilnau, Scott R. Cockroft and Joseph Janus IV

Application No.: 14/738,789

Filed: June 12, 2015

For: Calf Bolus

Attorney Docket No.: bellaUScalf (280-10)

Confirmation No.: 8986

Group Art Unit: 3766

Examiner: Heller, Tammie K.

Mail Stop AF
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

PETITION FOR EXTENSION OF TIME UNDER 37 C.F.R. §1.136

This is a request to extend the period for filing a reply in the above-identified application under the provisions of 37 C.F.R. §1.136(a) and 37 C.F.R. §1.17(a)(3). The three month extension of time extends until January 10, 2018 period in which the applicant can timely file a reply in the above-referenced application which would otherwise be due within three months of the mailing date of the official communication mailed July 10, 2017. Applicant claims small entity status under 37 C.F.R. § 1.27, therefore Applicant submits the fee amount under 37 C.F.R. §1.17(a)(3) of $700.00.

Dated this 9 day of January, 2018

Respectfully Submitted,

By: _____

Craig R. Miles
ATTORNEY FOR APPLICANT
USPTO Reg. No. 45,954
CR MILES P.C.
405 Mason Court, Suite 119
Fort Collins, CO 80524
(970) 492-0000 telephone
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SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT BY APPLICANT	Application Number	14/738,789
	Filling Date	June 12, 2015
	First Named Inventor	Nicholas P. Rettedal
	Art Unit	3766
	Examiner Name	Heller, Tammie K.
	Attorney Docket Number	bellaUScalf (280-10)
Sheet 1 of 1	Express Mail Label No.:	-

UNITED STATES PATENT PUBLICATION DOCUMENTS

EXAMINER INITIALS	DOCUMENT NUMBER	PUBLICATION DATE MM-DD-YYYY	NAME OF PATENTEE OR APPLICANT
	2008/0314325	12-25-2008	Hempstead et al.

EXAMINER SIGNATURE:	DATE CONSIDERED:

Electronic Patent Application Fee Transmittal

Application Number:	14738789
Filing Date:	12-Jun-2015
Title of Invention:	Calf Bolus
First Named Inventor/Applicant Name:	Nicholas P. Rettedal
Filer:	Craig R. Miles/Lioudmila Townsend
Attorney Docket Number:	bellaUScalf (280-10)

Filed as Small Entity

Filing Fees for Utility under 35 USC 111(a)

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
INDEPENDENT CLAIMS IN EXCESS OF 3	2201	3	210	630
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
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Extension - 3 months with $0 paid	2253	1	700	700
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RCE- 1st Request	2801	1	600	600
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Electronic Acknowledgement Receipt	
EFS ID:	31453449
Application Number:	14738789
International Application Number:	
Confirmation Number:	8986
Title of Invention:	Calf Bolus
First Named Inventor/Applicant Name:	Nicholas P. Rettedal
Customer Number:	39208
Filer:	Craig R. Miles/Lioudmila Townsend
Filer Authorized By:	Craig R. Miles
Attorney Docket Number:	bellaUScalf (280-10)
Receipt Date:	09-JAN-2018
Filing Date:	12-JUN-2015
Time Stamp:	19:32:27
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	$1930
RAM confirmation Number	011018INTEFSW19333000
Deposit Account	
Authorized User	
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:	

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Transmittal Letter	Transmittal_Letter.pdf	45784 5ec6d0e280d077feb8f568080de90b9222b8f1c5	no	2
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Information:					
2	Response After Final Action	Response.pdf	512216 fecd4943a5e694e6a86a234f03c590a70bf73096	no	14
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3	Request for Continued Examination (RCE)	RCE.pdf	32546 5fc60589ee5950f17d741f553009e0cb2011eefc	no	1
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This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.
National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.
New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the application of: Nicholas P. Rettedal, Stephen M. Weilnau, Scott R. Cockroft and Joseph Janus IV

Application No.: 14/738,789

Filed: June 12, 2015

For: Calf Bolus

Attorney Docket No.: bellaUScalf (280-10)

Confirmation No.: 8986

Group Art Unit: 3766

Examiner: Heller, Tammie K.

Mail Stop AF
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

LETTER OF TRANSMITTAL

Dear Sir/Madam:

Please find attached a Response and Request for Reconsideration under 37 C.F.R. §1.116, including the following documents:

1. a Response and Request for Reconsideration under 37 C.F.R. §1.116 (14 page(s));
2. a Request For Continued Examination Under 37 C.F.R. §1.114 (1 page(s));
3. a Petition for Extension of Time Under 37 C.F.R. §1.136 (1 page(s));
4. a Supplemental Information Disclosure Statement under 37 C.F.R. § 1.97 (b)(4) (1 page(s));
5. a Supplemental Information Disclosure Statement (1 page(s)) along with copies of each cited reference not already available at the PTO; and
6. this firm Letter of Transmittal (2 page(s)).

I have this 9 day of January, 2018, either myself personally, or through my direction of staff at this office, deposited all of the items listed in this Letter of Transmittal with the United States Patent and Trademark Office via EFS-Web.

Please enter the submitted documents in the above-identified patent application.

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 472 of 607

Direct all correspondence to:

CR MILES P.C.
405 Mason Court, Suite 119
Fort Collins, CO 80524

USPTO Customer No.: 39208

Dated this 9 day of January, 2018

Respectfully Submitted,

By: _____

Craig R. Miles
ATTORNEY FOR APPLICANT
USPTO Reg. No. 45,954
CR MILES P.C.
405 Mason Court, Suite 119
Fort Collins, CO 80524
(970) 492-0000
(970) 492-0003 facsimile

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the application of: Nicholas P. Rettedal, Stephen M. Weilnau, Scott R. Cockroft and Joseph Janus IV **Application No.:** 14/738,789 **Filed:** June 12, 2015 **For:** Calf Bolus **Attorney Docket No.:** bellaUScalf (280-10)	**Confirmation No.:** 8986 **Group Art Unit:** 3766 **Examiner:** Heller, Tammie K.

Mail Stop AF
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

RESPONSE AND REQUEST FOR RECONSIDERATION UNDER 37 C.F.R.§ 1.116

Dear Sir/Madam:

This paper is submitted in response to the final Office Action mailed on July 10, 2017. Applicant believes that this response addresses each concern raised by the Examiner in the Office Action and each of the claims is now in condition for allowance. Applicant further submits a Request for Continued Examination under 37 C.F.R. §1.114. Applicant claims small entity status under C.F.R. § 1.27, therefore, the Request for Continued Examination is accompanied by the fee under 37 C.F.R. § 1.17(e)(1) in the amount of $600.00 and a Petition for Extension of Time under 37 C.F.R. § 1.36(a) and 37 C.F.R. § 1.17(a)(3) in the amount of $700.00. Please amend the above-identified United States patent application as follows.

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 474 of 607

AMENDMENTS TO THE CLAIMS

It is respectfully requested that the claims be amended without prejudice, without admission, without surrender of subject matter, and without intention of creating any estoppel as to equivalents, as follows. This listing of claims will replace all prior versions, and listings, of claims in the application.

Listing of Claims:

1-36 (canceled).

37 (currently amended). A method of monitoring physiological parameters of a ruminant animal, comprising:

obtaining a bolus configured for oral administration to and retention in the reticulorumen of ~~to~~ said ruminant animal, said bolus ~~including~~ capable of

~~one or more sensors each capable of~~ generating a sensor signal from one or more sensors which varies based on a corresponding change in one or more physiological parameters of said ruminant animal; and

~~a processor;~~

~~a non-transitory computer readable medium containing a computer code including a power management module executable by said processor to enable or disable said one or more sensors, said power management module~~ enabling or disabling said one more sensors by execution of a computer code contained in a non-transitory computer readable media communicatively coupled to a processor, said enabling or disabling of said one or more sensors coordinated with a plurality of life stages in ~~the~~ a lifespan of said ruminant animal ~~to enable or disable said one or more sensors, said power management module; and~~

~~a housing providing an outer most external surface of said bolus; and~~

~~orally administering said bolus to said ruminant animal, said bolus retained in a reticulorumen of said ruminant animal~~.

38 (canceled).

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 475 of 607

39 (currently amended). The method of claim 37, further comprising enabling or disabling said one or more sensors by operation of said power management module based upon a pre-determined set of said one or more physiological parameters ~~to be~~ sensed by said one or more sensors during said plurality of life stages in said lifespan ~~cycle~~ of said ruminant animal.

40 (canceled).

41 (currently amended). The method of 37, wherein said enabling or disabling of said one or more sensors coordinated with a plurality of life stages in a lifespan of said ruminant animal further comprises assessing elapsed time from activation of said bolus

~~further comprising:~~

~~monitoring said sensor signal from said one or more sensors outside of said ruminant animal;~~

~~comparing said sensor signal from a first sensor to a first pre-selected activation code having a first pre-selected activation match threshold; and~~

~~activating said bolus upon occurrence of said pre-selected activation code which exceeds said first pre-selected activation match threshold~~.

42 (currently amended). The method of claim 37, wherein said plurality of life stages in said life span of said ruminant animal comprise a first life stage prior to attaining puberty and a second life stage after attaining puberty

~~further comprising:~~

~~monitoring said sensor signal from said one or more sensors;~~

~~comparing a first sensor signal from a first sensor to a first pre-selected activation code having a first pre-selected activation match threshold;~~

~~comparing said a second sensor signal from a second sensor to a second pre-selected activation code having a second pre-selected activation match threshold; and~~

~~activating said bolus upon generation of said first and second sensor signals from said first and second sensors which by comparison to said first and said second pre-selected activation codes exceeds said first and said second pre-selected activation match threshold~~.

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 476 of 607

43 (currently amended). ~~The method of claim 42, further comprising:~~ A method of monitoring physiological parameters of a ruminant animal, comprising:

generating a sensor signal from one or more sensors contained in a bolus orally administered to a ruminant animal, said sensor signal varies based on a corresponding change in one or more physiological parameters of said ruminant animal;

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; and

storing said encoded physiological data in ~~said~~ a non-transitory computer readable ~~medium~~ media

enabling a radio signal generator located within said bolus;

activating said radio signal generator at pre-determined intervals to generate said radio signal to carry said encoded physiological data; and

generating a radio signal having a frequency of between about 700MHz to about 1GHz.

44 (canceled).

45 (currently amended). A method of monitoring physiological parameters of a ruminant animal, comprising: ~~The method of claim 44, wherein said bolus further comprises an energy source which supplies energy to operate said bolus, and further comprising:~~

determining a remaining amount of energy stored in ~~said~~ an energy source located within a bolus orally administered to a ruminant animal;

determining an amount of energy required by said bolus to operate through a pre-determined period of time based on current programming of ~~said~~ a computer code contained in a non-transitory computer readable media contained in said bolus;

comparing said amount of energy required by said bolus to operate through said pre-determined period of time to said remaining amount of energy stored in said energy source; and

calculating a difference in said amount of energy remaining in the power source and said amount of energy required by said bolus to operate through said pre-determined period of time.

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 477 of 607

46 (original). The method of claim 45, further comprising performing one or more power regulation events to offset said difference in said amount of energy remaining in the power source and said amount of energy required by said bolus to operate through said pre-determined period of time.

47-48 (canceled).

49 (currently amended). The method of claim [[48]] 43, wherein said frequency is selected from the group consisting of: between about 700 MHz to about 800MHz, 750 MHz to about 850MHz, about 800 MHz to about 900MHz, 850 MHz to about 950MHz, 900 MHz to about 1GHz.

50 (currently amended). The method of claim 49, 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 ~~upon~~ due to passing through a mass of said ruminant animal.

51 (canceled).

52 (currently amended). ~~The method of claim 51, wherein said bolus further comprises~~ A method of monitoring physiological parameters of a ruminant animal, comprising:

generating a sensor signal from one or more sensors contained in a bolus orally administered to a ruminant animal, said sensor signal varies based on a corresponding change in one or more physiological parameters of said ruminant animal;

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; and

storing said encoded physiological data in ~~said~~ a non-transitory computer readable ~~medium~~ media

enabling a radio signal generator located within said bolus;

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 478 of 607

activating said radio signal generator to generate a radio signal to carry said encoded physiological data; and

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.

53 (original). The method of claim 52, 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.

54 (original). The method of claim 53, wherein said antenna further comprises one or more vias interconnecting said pair of electrically conductive loops.

55 (original). The method of claim 54, wherein said antenna further comprises a non-conductive sheet material disposed between said pair of electrically conductive loops.

56-63 (canceled).

64 (currently amended). ~~The method of claim 46, wherein said bolus further comprises a radio signal receiver and further comprising:~~

A method of monitoring physiological parameters of a ruminant animal, comprising:

obtaining a bolus configured for oral administration to said ruminant animal, said bolus capable of:

generating a sensor signal from one or more sensors which varies based on a corresponding change in one or more physiological parameters of said ruminant animal;

enabling or disabling said one more sensors by execution of a computer code contained in a non-transitory computer readable media communicatively coupled to a processor;

receiving radio signal containing programming data; and

re-programming said computer code contained within said non-transitory computer readable medium ~~memory element~~.

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 479 of 607

65 (currently amended). The method of claim 64, ~~further comprising~~ wherein said re-programming said computer code is based upon ~~based upon said~~ a pre-determined set of said ~~plurality of~~ physiological parameters to be sensed during ~~said~~ a stage in ~~said~~ a life cycle of said ruminant animal.

66 (currently amended). The method of claim [[65]] 64, ~~further comprising~~ wherein said re-programming said computer code to offset said difference in said amount of energy remaining in the power source and said amount of energy required by said bolus to operate through said pre-determined period of time.

67 (new). A method of monitoring physiological parameters of a ruminant animal, comprising:

generating a sensor signal from a first sensor located within a bolus configured for oral administration to a ruminant animal;

analyzing said sensor signal generated by said first sensor by execution of a power management module contained in a non-transitory computer readable medium communicatively coupled to a processor contained within said bolus;

comparing said sensor signal from said first sensor to a first pre-selected activation code having a first pre-selected activation match threshold; and

activating said bolus upon occurrence of said pre-selected activation code which exceeds said first pre-selected activation match threshold.

68 (new). The method of claim 67, further comprising:

comparing a second sensor signal from a second sensor to a second pre-selected activation code having a second pre-selected activation match threshold; and

activating said bolus upon generation of said first and second sensor signals from said first and second sensors which by comparison to said first and said second pre-selected activation codes, respectively. exceeds said first and said second pre-selected activation match thresholds respectively.

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 480 of 607

69 (new). The method of any one of claims 67, further comprising orally administering said bolus to said ruminant animal.

70 (new). The method of claim 69, further comprising:

comparing a second sensor signal from a second sensor to a second pre-selected activation code having a second pre-selected activation match threshold; and

activating said bolus upon generation of said first and second sensor signals from said first and second sensors which by comparison to said first and said second pre-selected activation codes exceeds said first and said second pre-selected activation match threshold.

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 481 of 607

REMARKS

1. **Status Of The Claims.** Claims 37, 39, 41-46, 48-55, and 64-66 are pending in the subject application. Claim 42 is objected to due to informalities. Claims 37, 39, 41-46, 48-55, and 64-66 are rejected under 35 U.S.C. § 112(b) as being indefinite for failing to particularly point out and distinctly claim the subject matter which the inventor or a joint inventor regards as the invention. Claims 37, 39, 41-46, 48-55, and 64-66 are rejected under 35 U.S.C. Section 101 because the claimed invention is directed to non-statutory subject matter. Claims 37 and 39 are rejected under 35 U.S.C. Section 102 (a)(1) as being anticipated by United States Patent No. 6,371,927 to Brune et al. ("*Brune*"). Claims 37, 39, and 41 are rejected under 35 U.S.C. Section 102 (a)(1) as being anticipated by or, in alternative, under 35 U.S.C. Section 103 as being obvious over, United States Patent Publication No. 2009/0030279 of Zander et al. ("*Zander*"). Claims 42-46, 48-55, and 64-66 were found to be allowable if rewritten to overcome the rejection(s) under 35 U.S.C. 112(b) or 35 U.S.C. 112 (pre-AIA), 2nd paragraph, and 35 USC 101 set forth in the Office action and to include all of the limitations of the base claim and any intervening claims.

Claims 37, 39, 41-43, 45, 49, 50, 52, and 64-66 have been amended without the addition of any new matter. Claims 1-36, 38, 40, 44, 47, 48, 51, and 56-63 have been without prejudice canceled. Applicant respectfully reserves the right to pursue any non-elected claims, canceled or otherwise unclaimed subject matter in one or more continuation, continuation-in-part, or divisional applications.

2. **The Claim Objections Are Overcome.** The Examiner objects to Claim 42 the elements of which are now included in new Claim 67 and suggests an amendment which is set forth in new Claim 67. Applicant respectfully requests that the objection be withdrawn.

3. **The Claim Rejections Under 35 U.S.C. § 112(b) Are Overcome.** In the present Office Action, the Examiner has rejected Claims 37, 39, 41-46, 48-55, and 64-66 under 35 U.S.C. § 112(b) as being indefinite for failing to particularly point out and distinctly claim the subject matter which the inventor or a joint inventor regards as the invention.

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 482 of 607

In Claim 37, Applicant has replaced "the lifespan" with --a lifespan-- as suggested by Examiner.

In Claim 39, Applicant has replaced "said stage" with --said plurality of stages-- for which there is antecedent basis in Claim 37. Applicant has replaced "lifecycle" with --lifespan--.

In Claim 41, Applicant has removed the recitation of "said one or more sensors outside of said ruminant animal. Applicant has deleted the recitation of "activating said bolus. . .exceed said first pre-selected activation match threshold."

In Claim 42, Applicant has deleted the recitation of "activating said bolus upon generation of said first and second senor signals." Applicant has deleted the recitation of "which by comparison to. . .activation match threshold."

In Claim 50, Applicant has amended Claim 50, to clarify the difference between said frequency and a change in said frequency of the radio signal due to passing through a mass of the ruminant animal.

In Claim 51, Applicant has canceled Claim 51 making any response moot.

Applicant believes that above amendments address each rejection under Section 112, second paragraph, and Applicant respectfully requests that the rejections under Section 112, second paragraph, be withdrawn.

4. **Summary of Telephonic Interview.** Applicant conducted a telephonic interview with Examiner on April 18, 2017. In that telephonic interview Applicant and Examiner discussed an amendment to Claim 37 to overcome the Section 101 rejection. Also, discussed was an amendment to Claim 37 to include the language "a plurality of life stages in a lifespan of said

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 483 of 607

ruminant animal." It was Applicant's understanding that this language subject to an amendment to overcome the Section 101 rejection would be allowable.

5. The Rejections Under 35 U.S.C. Section 101 Is Overcome. The Examiner has rejected Claims 37, 39, 41-46, 48-55, and 64-66 as being directed to non-statutory subject matter because they do not require that the method be implemented by a particular machine. Applicant has amended the language of Claims 37, 39, 41-46 and 64-66 to make clear that the method is implemented by a particular machine.

In view of the amendments, Applicant respectfully requests that the Section 101 rejection be withdrawn.

6. Allowable Subject Matter. The Examiner found Claims 42-46, 48-55, and 64-66 were found to be allowable if rewritten to overcome the rejection(s) under 35 U.S.C. 112(b) or 35 U.S.C. 112 (pre-AIA), 2nd paragraph, and 35 USC 101 set forth in the Office action and to include all of the limitations of the base claim and any intervening claims.

Claim 37. Applicant has rewritten Claim 37 to overcome the Section 101 rejection as suggested by Examiner during the telephonic interview of April 18, 2017 by further including the language "enabling or disabling of said one or more sensors coordinated with a plurality of life stages in a lifespan of said ruminant animal." Claims 39, 41 and 42 are made ultimately dependent upon Claim 37. Applicant respectfully requests allowance of Claims 37, 39, 41, and 42.

Claim 42. The elements of original Claims 42-44 are now presented as new Claims 67-70. Claim 67 has been rewritten as an independent Claim 67 and Applicant respectfully requests allowance of Claims 67-70.

Claim 43. The elements of Claim 48 have been inserted into Claims 43 and 49-51. Claim 48 has been rewritten as an independent Claim 48 and Applicant respectfully requests allowance of Claims 48 and 49-51.

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 484 of 607

Claim 45. The elements of Claim 45 are rewritten as an independent Claim 45. Claim 46 is made ultimately dependent upon Claim 45 and Applicant respectfully requests allowance of Claims 45 and 46.

Claim 52. The elements of Claim 52 have been rewritten as independent Claim 52. Claims 53-55 are made dependent upon Claim 52. Applicant respectfully requests allowance of Claims 53-55.

Claim 64. Claim 64 is rewritten as independent Claim 64. Claims 65 and 66 are made dependent upon Claim 64. Applicant respectfully requests allowance of Claims 64 and 65 and 66.

5. The Rejections Under 35 U.S.C. Section 102 Are Overcome.

A claim is anticipated only if "each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference." *Verdegaal Bros. v. Union Oil Co. of California, 814 F.2d 628, 631 (Fed. Cir. 1987); MPEP 2131.* "The identical invention must be shown in as complete detail as is contained. . .in the claim." *Richardson v. Suzuki Motor Co., 868 F.2d 1225, 1236 (Fed. Cir. 1989).* Moreover, the elements must be arranged as required by the claim. *En re Bond, 910 F.2d 831 (Fed.Cir. 1990); MPEP 2131.*

A. *Claims 37 and 39 Are Not Anticipated By Brune.*

The Examiner rejected Claims 37 and 39 as being anticipated by *Brune*. Applicant has amended Claim 37 to further include the language "enabling or disabling said one more sensors by execution of a computer code contained in a non-transitory computer readable media communicatively coupled to a processor, said enabling or disabling of said one or more sensors coordinated with a plurality of life stages in a lifespan of said ruminant animal."

Brune does not teach or suggest said enabling or disabling of said one or more sensors coordinated with a plurality of life stages in a lifespan of said ruminant animal.

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 485 of 607

Accordingly, Brune does not anticipate Claims 37 and 39.

B. ***Claims 37, 39, and 41 Are Not Anticipated By Zander.***

The Examiner rejected Claims 37, 39, and 41 as being anticipated by *Zander*. Applicant has amended Claim 37 to further recite "obtaining a bolus configured for oral administration to and retention in the reticulorumen of said ruminant animal." *Zander* does not teach the retention of the bolus in the reticulorumen and would not be capable of "enabling or disabling of said one or more sensors coordinated with a plurality of life stages in a lifespan of said ruminant animal."

Accordingly, Zander does not anticipate Claims 37, 39 or 41.

7. **Request For Telephonic Interview.** Applicant respectfully requests the courtesy of a telephonic interview with the Examiner to address any remaining concerns as to the allowability of Claims 37, 39, 41-43, 45, 46, 49, 50, 52-55, and 64-70.

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 486 of 607

CONCLUSION

Applicant has without prejudice canceled Claims 1-36, 38, 40, 44, 47, 48, 51, and 56-63. Applicant has amended Claims 37, 39, 41-43, 45, 49, 50, 52, and 64-66. Applicant believes that Claims 37, 39, 41-43, 45, 46, 49, 50, 52-55, and 64-70are now in condition for allowance and Applicant requests allowance of same.

Dated this 9 day of January, 2018

Respectfully Submitted,

By: _____

Craig R. Miles
ATTORNEY FOR APPLICANT
USPTO Reg. No. 45,954
CR MILES P.C.
405 Mason Court, Suite 119
Fort Collins, CO 80524
(970) 492-0000 telephone
(970) 492-0003 facsimile

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 487 of 607

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the application of: Nicholas P. Rettedal, Stephen M. Weilnau, Scott R. Cockroft, and Joseph Janus IV

Application No.: 14/738,789

Filed: June 12, 2015

For: Calf Bolus

Attorney Docket No.: bellaUScalf (280-10)

Confirmation No.: 8986

Group Art Unit: 3766

Examiner: Heller, Tammie K.

Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT UNDER 37 C.F.R. §1.97(b)(4)

Applicant respectfully requests entry of the attached Supplemental Information Disclosure Statement under 37 C.F.R. §1.97(b)(4) made in compliance with Section 1.98 during the pendency of the above-identified United States patent application. No fee is required because submission of the supplemental information disclosure statement is made before the mailing date of the first office action after the filing of a request for continued examination under 37 C.F.R. §1.114.

Dated this 9 day of January, 2018

Respectfully Submitted,

CR MILES P.C.

By: _____

Craig R. Miles
ATTORNEY FOR APPLICANT
USPTO Reg. No. 45,954
405 Mason Court, Suite 119
Fort Collins, CO 80524
(970) 492-0000
(970) 492-0003 facsimile

PTO/SB/06 (09-11)
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PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 14/738,789	Filing Date 06/12/2015	☐ To be Mailed

ENTITY: ☐ LARGE ☒ SMALL ☐ MICRO

APPLICATION AS FILED – PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA	RATE ($)	FEE ($)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*	X $ =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*	X $ =	
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).			
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))				
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL	

APPLICATION AS AMENDED – PART II

AMENDMENT		(Column 1)		(Column 2)	(Column 3)	RATE ($)	ADDITIONAL FEE ($)
	01/09/2018	CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA		
	Total (37 CFR 1.16(i))	* 20	Minus	** 20	= 0	X $40 =	0
	Independent (37 CFR 1.16(h))	* 6	Minus	***3	= 3	X $210 =	630
	☐ Application Size Fee (37 CFR 1.16(s))						
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))						
						TOTAL ADD'L FEE	**630**

AMENDMENT		(Column 1)		(Column 2)	(Column 3)	RATE ($)	ADDITIONAL FEE ($)
		CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA		
	Total (37 CFR 1.16(i))	*	Minus	**	=	X $ =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	X $ =	
	☐ Application Size Fee (37 CFR 1.16(s))						
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))						
						TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

SLIE
ROSALIND BALL

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**
If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
14/738,789	06/12/2015	Nicholas P. Rettedal	bellaUScalf (280-10)	8986

39208 7590 04/17/2018

CR MILES, P.C.
CRAIG R. MILES
405 MASON COURT, SUITE 119
FORT COLLINS, CO 80524

EXAMINER	
MARLEN, TAMMIE K	

ART UNIT	PAPER NUMBER
3766	

MAIL DATE	DELIVERY MODE
04/17/2018	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No. 14/738,789	Applicant(s) RETTEDAL ET AL.	
	Examiner Tammie K. Heller	Art Unit 3766	AIA (First Inventor to File) Status Yes

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTHS FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *1/9/2018*.

☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

4)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims*

5)☒ Claim(s) *37,39,41-43,45,46,49,50,52-55 and 64-70* is/are pending in the application.

5a) Of the above claim(s) _____ is/are withdrawn from consideration.

6)☐ Claim(s) _____ is/are allowed.

7)☒ Claim(s) *37,39,41-43,45,46,49,50,52-55 and 64-70* is/are rejected.

8)☐ Claim(s) _____ is/are objected to.

9)☐ Claim(s) _____ are subject to restriction and/or election requirement.

* If any claims have been determined allowable, you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov.

Application Papers

10)☐ The specification is objected to by the Examiner.

11)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

Certified copies:

a)☐ All b)☐ Some** c)☐ None of the:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

** See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)

2) ☒ Information Disclosure Statement(s) (PTO/SB/08a and/or PTO/SB/08b) Paper No(s)/Mail Date *Attached*.

3) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

4) ☐ Other: _____.

DETAILED ACTION

1. The present application, filed on or after March 16, 2013, is being examined under the first inventor to file provisions of the AIA.

Continued Examination Under 37 CFR 1.114

2. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on January 9, 2018 has been entered. By this amendment, claims 37, 39, 41-43, 45, 49, 50, 52, and 64-66 are amended, claims 44, 48, and 51 are cancelled, claims 67-70 are added, and claims 37, 39, 41-43, 45, 46, 49, 50, 52-55, and 64-70 are now pending in the application.

Information Disclosure Statement

3. The information disclosure statement(s) (IDS) submitted on 1/9/2018 has/have been acknowledged and is/are being considered by the Examiner.

Claim Objections

4. Claims 41 and 70 is objected to because of the following informalities:

a. In claim 41, in line 1, the word --claim-- should be inserted after "…method of".

b. In claim 70, it is recommended that the word “respectively” be used in the same manner as in claim 68.

Appropriate correction is required.

Claim Rejections - 35 USC § 112

5. The following is a quotation of 35 U.S.C. 112(b):

> (b) CONCLUSION.—The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the inventor or a joint inventor regards as the invention.

> The following is a quotation of 35 U.S.C. 112 (pre-AIA), second paragraph:
> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

6. Claims 37, 39, 41-43, 45, 46, 49, 50, 52-55, and 64-70 are rejected under 35 U.S.C. 112(b) or 35 U.S.C. 112 (pre-AIA), second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which the inventor or a joint inventor, or for pre-AIA the applicant regards as the invention.

7. In claim 37, it is unclear if the “enabling or disabling…” recitation found on lines 11-14 is intended to be an active method step or is intended to be a function that the bolus is “capable of” performing, as the indentation of the claim makes it appear that the bolus is “capable of” performing the functions of “generating” and “enabling or disabling.” For the purposes of this communication, claim 37 will be considered to only require the single method step of obtaining a bolus, with the bolus being “capable of” performing the recited functions.

8. Claim 39 recites the limitation "said power management module" in line 2. There is insufficient antecedent basis for this limitation in the claim.

9. Claim 39 recites the limitation "a pre-determined set of said one or more physiological parameters sensed by said one or more sensors" in lines 3-4. There is insufficient antecedent basis for this limitation in the claim because claim 37 does not

require that the physiological parameters are sensed by the one or more sensors, but rather requires that a sensor signal is generated which varies based on a corresponding change in one or more physiological parameters.

10. Claim 39 recites the limitation "sensed by said one or more sensors during said plurality of life stages in said lifespan of said ruminant animal" in lines 3-4. There is insufficient antecedent basis for this limitation in the claim because claim 37 does not require that the sensor signal is sensed during the plurality of life stages in said lifespan of said ruminant animal, but rather that the enabling or disabling of the sensors is coordinated with the plurality of life stages in the lifespan of said ruminant animal.

11. Claim 41 recites the limitation "activation of said bolus" in line 3. There is insufficient antecedent basis for this limitation in the claim because the claims fail to previously recite activating said bolus.

12. Claim 43 recites the limitation "a ruminant animal" in line 4. It is unclear if this is the same, or a different, ruminant animal as that recited in line 2 of the claim.

13. Claim 43 recites the limitation "said radio signal" in lines 11-12. There is insufficient antecedent basis for this limitation in the claim.

14. Claim 43 recites the limitation "a radio signal" in line 13. It is unclear if this is the same, or a different, radio signal as that recited in lines 11-12.

15. Claim 45 recites the limitation "a ruminant animal" in line 5. It is unclear if this is the same, or a different, ruminant animal as that recited in lines 1-2 of the claim.

16. Claim 45 recites the limitation "the power source" in line 12. There is insufficient antecedent basis for this limitation in the claim.

17. Claim 46 recites the limitation "the power source" in lines 2-3. There is insufficient antecedent basis for this limitation in the claim.

18. Claim 52 recites the limitation "a ruminant animal" in line 4. It is unclear if this is the same, or a different, ruminant animal as that recited in line 2 of the claim.

19. Claim 64 recites the limitation “generating a sensor signal from one or more sensors” in line 6. It is unclear if the bolus is to include the sensors, or if the sensors are separate from the bolus.

20. Claim 66 recites the limitation "said re-programming said computer code to offset said difference" in lines 1-2. There is insufficient antecedent basis for this limitation in the claim.

21. Claim 66 recites the limitation "said difference" in line 2. There is insufficient antecedent basis for this limitation in the claim.

22. Claim 66 recites the limitation "said amount of energy remaining" in line 2. There is insufficient antecedent basis for this limitation in the claim.

23. Claim 66 recites the limitation "the power source" in line 3. There is insufficient antecedent basis for this limitation in the claim.

24. Claim 66 recites the limitation "said amount of energy required by said bolus" in line 3. There is insufficient antecedent basis for this limitation in the claim.

25. Claim 66 recites the limitation "said pre-determined period of time" in lines 3-4. There is insufficient antecedent basis for this limitation in the claim.

26. Claim 67 recites the limitation "a ruminant animal" in line 4. It is unclear if this is the same, or a different, ruminant animal as that recited in line 1 of the claim.

27. Claim 67 recites the limitation "activating said bolus upon occurrence of said pre-selected activation code which exceeds said first pre-selected activation match threshold" in lines 10-11. Claims 8-9 of the claim require comparing a sensor signal to "a first pre-selected activation code having a first pre-selected activation match threshold." The step recited on lines 10-11 is thus unclear, as the pre-selected activation code is not compared to the first pre-selected activation match threshold, but rather the sensor signal is compared to a first pre-selected activation code that *has* a first pre-selected activation match threshold.

28. Claim 67 recites the limitation "said pre-selected activation code" in line 10. There is insufficient antecedent basis for this limitation in the claim.

29. Claim 68 recites the limitation "comparing a second sensor signal" in line 2. There is insufficient antecedent basis for this limitation in the claim because a second sensor signal has not been previously recited as being generated.

30. Claim 68 recites the limitation "generation of said first and second sensor signals" in line 4. There is insufficient antecedent basis for this limitation in the claim.

31. Claim 70 recites the limitation "comparing a second sensor signal" in line 2. There is insufficient antecedent basis for this limitation in the claim because a second sensor signal has not been previously recited as being generated.

32. Claim 70 recites the limitation "generation of said first and second sensor signals" in line 4. There is insufficient antecedent basis for this limitation in the claim.

Claim Rejections - 35 USC § 101

33. 35 U.S.C. 101 reads as follows:

> Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

34. Claims 37, 39, 41, 42, and 64-66 are rejected under 35 U.S.C. 101 because the claimed invention is directed to non-statutory subject matter. The claim(s) does/do not fall within at least one of the four categories of patent eligible subject matter because the claims fail the machine-or-transformation test because they do not require that the method be implemented by a particular machine, as there is only a single method step, obtaining a bolus, which could be done by hand. Furthermore, the claims do not require that the method particularly transform a particular article, as there is no transformation that occurs at all. With respect to claims 37, 39, 41, 42, and 64-66, and based upon consideration of all of the relevant factors with respect to the claim as a whole, the claim is held to claim an abstract idea, and is therefore rejected as ineligible subject matter under 35 U.S.C. § 101. The recitation of a machine or transformation is not sufficient and the claim, as a whole, relates to abstract ideas, rather than practical application of those ideas. In particular, the method is not tied to another statutory class (such as a particular apparatus) and it does not transform underlying subject matter to a different state or thing. Accordingly, the method of claims 37, 39, 41, 42, and 64-66 are not limited to a particular practical application because no machine or transformation is present in the claim.

35. Claim 45 is rejected under 35 U.S.C. 101 because the claimed invention is directed to a judicial exception (i.e., a law of nature, a natural phenomenon, or an abstract idea) without significantly more. Claim 45 is directed to an abstract idea. The claim does not include additional elements that are sufficient to amount to significantly

more than the judicial exception because the claims are analogous to the case Elec. Power Grp., LLC v. Alstom S.A. (Fed. Cir. 2016) which contains the following analysis: Information as such is an intangible. See Microsoft Corp. v. AT & T Corp., 550 U.S. 437, 451 n.12 (2007). Accordingly, we have treated collecting information, including when limited to particular content (which does not change its character as information), as within the realm of abstract ideas. See, e.g., Internet Patents, 790 F.3d at 1349; OIP Techs., Inc. v. Amazon.com, Inc., 788 F.3d 1359, 1363 (Fed. Cir. 2015). In a similar vein, we have treated analyzing information by steps people go through in their minds, or by mathematical algorithms, without more, as essentially mental processes within the abstract-idea category. See, e.g., TLI Commc'ns, 823 F.3d at 613; Digitech, 758 F.3d at 1351; SmartGene, Inc. v. Advanced Biological Labs., SA, 555 F. App'x 950, 955 (Fed. Cir. 2014); Bancorp Servs., L.L.C. v. Sun Life Assurance Co. of Canada (U.S.), 687 F.3d 1266, 1278 (Fed. Cir. 2012); CyberSource Corp. v. Retail Decisions, Inc., 654 F.3d 1366, 1372 (Fed. Cir. 2011); SiRF Tech., Inc. v. Int'l Trade Comm'n, 601 F.3d 1319, 1333 (Fed. Cir. 2010); see also Mayo, 132 S. Ct. at 1301; Parker v. Flook, 437 U.S. 584, 589–90 (1978); Gottschalk v. Benson, 409 U.S. 63, 67 (1972); Diamond v. Diehr, 450 U.S. 175 (1981). And we have recognized that merely presenting the results of abstract processes of collecting and analyzing information, without more (such as identifying a particular tool for presentation), is abstract as an ancillary part of such collection and analysis. See, e.g., Content Extraction, 776 F.3d at 1347; Ultramercial, Inc. v. Hulu, LLC, 772 F.3d 709, 715 (Fed. Cir. 2014). Here, the claims are clearly focused on the combination of those abstract-idea processes. The advance they purport

to make is a process of gathering and analyzing information of a specified content, and not any particular assertedly inventive technology for performing those functions. They are therefore directed to an abstract idea.

Claim Rejections - 35 USC § 102

36. In the event the determination of the status of the application as subject to AIA 35 U.S.C. 102 and 103 (or as subject to pre-AIA 35 U.S.C. 102 and 103) is incorrect, any correction of the statutory basis for the rejection will not be considered a new ground of rejection if the prior art relied upon, and the rationale supporting the rejection, would be the same under either status.

37. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (a)(1) the claimed invention was patented, described in a printed publication, or in public use, on sale or otherwise available to the public before the effective filing date of the claimed invention.

38. Claims 37, 39, 41, 42, and 64-66, as best understood, are rejected under 35 U.S.C. 102(a)(1) as being anticipated by Brune (U.S. Patent No. 6,371,927, previously cited). Regarding claim 37, Brune discloses a method of monitoring the physiological parameters of a ruminant animal (see Abstract), comprising: obtaining a bolus 2/20/50 configured for oral administration to and retention in the reticulorumen of said ruminant animal (see Figures 1, 5-7, and 12, col. 3, ln. 10-12, and col. 4, ln. 53-56). Regarding the recitation “said bolus capable of generating a sensor signal from one or more sensors which varies based on a corresponding change in one or more physiological parameters of said ruminant animal; and enabling or disabling said one or more sensors

by execution of a computer code contained in a non-transitory computer readable media communicatively coupled to a processor, said enabling or disabling of said one or more sensors coordinated with a plurality of life stages in a lifespan of said ruminant animal", it has been held that the recitation that an element is "capable of" performing a function is not a positive limitation but only requires the ability to so perform. It does not constitute a limitation in any patentable sense. *In re Hutchison,* 69 USPQ 138.

39. Regarding claim 39, Brune discloses enabling or disabling said one or more sensors based upon a pre-determined set of said one or more physiological parameters to be sensed, the enablement of the diagnostic sensors after the target condition is met (see col. 6, ln. 47-57).

40. Regarding claims 41 and 42, the claims further limit the function that the bolus of claim 37 is "capable of" performing and, as such, fail to further limit the claimed invention over that of the prior art.

41. Regarding claim 64, Brune discloses a method of monitoring the physiological parameters of a ruminant animal (see Abstract), comprising: obtaining a bolus 2/20/50 configured for oral administration to said ruminant animal (see Figures 1, 5-7, and 12 and col. 3, ln. 10-12). Regarding the recitation "said bolus capable of: generating a sensor signal from one or more sensors which varies based on a corresponding change in one or more physiological parameters of said ruminant animal; enabling or disabling said one or more sensors by execution of a computer code contained in a non-transitory computer readable media communicatively coupled to a processor; receiving radio signal containing programming data; and re-programming said computer code

contained within said non-transitory computer readable medium", it has been held that the recitation that an element is "capable of" performing a function is not a positive limitation but only requires the ability to so perform. It does not constitute a limitation in any patentable sense. *In re Hutchison,* 69 USPQ 138.

42. Regarding claims 65 and 66, the claims further limit the function that the bolus of claim 64 is "capable of" performing and, as such, fail to further limit the claimed invention over that of the prior art.

Allowable Subject Matter

43. Claims 43, 45, 46, 49, 50, 52-55, and 67-70 would be allowable if rewritten to overcome the rejection(s) under 35 U.S.C. 112(b) or 35 U.S.C. 112 (pre-AIA), 2nd paragraph, and 35 USC 101 set forth in this Office action.

Response to Arguments

44. Regarding the previous rejection of the claims under 35 USC 112(b), the Applicant argues that the rejections are overcome. However, the amendments made to the claims have necessitated new rejections under this statute.

45. Regarding the previous rejection of the claims under 35 USC 101, the Applicant argues that the rejections are overcome. However, the Examiner respectfully disagrees and these rejections remain, as set out above. Regarding claim 37, the Applicant indicates that claim 37 is amended to overcome the rejection under 35 USC 101 by adding the language "enabling or disabling of said one or more sensors coordinated with a plurality of life stages in a lifespan of said ruminant animal." However, as

discussed above, the "enabling or disabling" is recited as being a capability of the bolus, and not as being an active method step. As such, the rejection remains.

46. Regarding the previous rejection with respect to Brune, the Applicant argues that Brune does not teach or suggest said enabling or disabling of said one or more sensors coordinated with a plurality of life stages in a lifespan of said ruminant animal. As discussed above, the "enabling or disabling" is recited as being a capability of the bolus, and not as being an active method step.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Tammie K. Heller whose telephone number is (571)272-1986. The examiner can normally be reached on Monday through Friday from 7am until 3:30 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carl H. Layno can be reached on 571-272-4949. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Tammie K Heller/
Primary Examiner, Art Unit 3766

SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT BY APPLICANT	Application Number	14/738,789
	Filling Date	June 12, 2015
	First Named Inventor	Nicholas P. Rettedal
	Art Unit	3766
	Examiner Name	Heller, Tammie K.
	Attorney Docket Number	bellaUScalf (280-10)
Sheet 1 of 1	Express Mail Label No.:	-

UNITED STATES PATENT PUBLICATION DOCUMENTS

EXAMINER INITIALS	DOCUMENT NUMBER	PUBLICATION DATE MM-DD-YYYY	NAME OF PATENTEE OR APPLICANT
	2008/0314325	12-25-2008	Hempstead et al.

EXAMINER SIGNATURE:	DATE CONSIDERED:
/TAMMIE K HELLER/	04/12/2018

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /T.K.H/

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
S1	0	(("BELLA") near3 ("TECHNOLOGIES") near3 ("LLC")).AANM.	USPAT	OR	ON	2016/10/27 08:47
S2	0	(("RETTEDAL") near3 ("Nicholas")).INV.	EPO; JPO; DERWENT	OR	ON	2016/10/27 08:47
S3	4	(("RETTEDAL") near3 ("Nicholas")).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2016/10/27 08:47
S4	0	(("WEILNAU") near3 ("Stephen")).INV.	EPO; JPO; DERWENT	OR	ON	2016/10/27 08:47
S5	4	(("WEILNAU") near3 ("Stephen")).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2016/10/27 08:47
S6	0	(("COCKROFT") near3 ("Scott")).INV.	EPO; JPO; DERWENT	OR	ON	2016/10/27 08:47
S7	4	(("COCKROFT") near3 ("Scott")).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2016/10/27 08:47
S8	1	(("JANUS") near3 ("Joseph")).INV.	EPO; JPO; DERWENT	OR	ON	2016/10/27 08:47
S9	3	(("JANUS") near3 ("Joseph")).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2016/10/27 08:47
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S13	6	("20040155782" | "20070156016" | "20090187392" | "20100030025" | "5532692" | "6702185").PN.	US-PGPUB; USPAT	OR	ON	2016/10/27 08:59
S14	3941	A61B5/073.cpc.	US-	OR	ON	2016/10/27

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S16	11236	A61B5/0031.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2016/10/27 09:26
S17	3306	A61D7/00.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2016/10/27 09:26
S18	2920	A01K11/006.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2016/10/27 09:26
S19	399	A01K11/007.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2016/10/27 09:26
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S26	1246	S25 and (mouth oral$6 swallow$6 animal)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2016/10/27 09:47
S27	1245	S26 and sens$6	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2016/10/27 09:47

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S35	85	(S24) and S32	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2016/10/27 09:57
S36	86	S33 S35	US-PGPUB; USPAT; USOCR; FPRS;	OR	ON	2016/10/27 09:57

			EPO; JPO; DERWENT			
S37	86	(US-20020050248-$ or US-20030188689-$ or US-20050000458-$ or US-20080270173-$ or US-20120158463-$ or US-20080190369-$ or US-20130151310-$ or US-20090031961-$ or US-20090307111-$ or US-20110161125-$ or US-20090031960-$ or US-20070131175-$ or US-20070157888-$ or US-20090030279-$ or US-20080146871-$ or US-20140309503-$ or US-20090030293-$ or US-20130013031-$ or US-20080114224-$ or US-20080112885-$ or US-20140200418-$ or US-20080161660-$ or US-20140343378-$ or US-20090131768-$ or US-20090131769-$ or US-20090131776-$).did. or (US-20090131777-$ or US-20090137886-$ or US-20090137887-$ or US-20090143659-$ or US-20090178459-$ or US-20090182217-$ or US-20140058235-$ or US-20140088391-$ or US-20160198978-$ or US-20020132226-$ or US-20080269664-$ or US-20130043975-$ or US-20130043993-$ or US-20130043974-$ or US-20130043991-$ or US-20130046153-$ or US-20130046477-$ or US-20150297116-$ or US-20110295079-$ or US-20040032957-$ or US-20040171915-$ or US-20150374262-$ or US-20110130658-$).did. or (US-6805075-$ or US-6135055-$ or US-7726258-$ or US-6516746-$ or US-7464666-$ or US-5673647-$ or US-6318289-$ or US-8028657-$ or US-7464667-$ or US-7836849-$ or US-8261694-$ or US-7827934-$ or US-8474405-$ or US-7748345-$ or US-7347161-$ or US-7607405-$ or US-6000361-$ or US-8588887-$ or US-8512241-$ or US-9173592-$ or US-8287453-$ or US-8886273-$ or US-8275438-$ or US-8298142-$ or US-8447376-$ or US-8449464-$).did. or (US-8478377-$ or US-8562528-$ or US-8626257-$ or US-8615284-$ or US-8617058-$ or US-8816814-$ or US-8599009-$ or US-8723640-$ or US-8514067-$ or US-8663105-$ or US-7118529-$).did.	US-PGPUB; USPAT	OR	ON	2016/10/27 09:57
S38	86	S37 and (sens$6 with (((turn turned turning) near3 ("on" "off")) (enabl$6 and disabl$6)))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2016/10/27 09:58
S39	25	(US-20100030025-$ or US-20090187392-$ or US-20090182207-$ or US-20080236500-$ or US-20070156016-$ or US-20040133131-$ or US-20090048498-$ or US-20070161851-$ or US-20070088194-$ or US-20090171178-$ or	US-PGPUB; USPAT	OR	ON	2016/10/27 10:13

		US-20090030279-$ or US-20080269664-$ or US-20090030293-$).did. or (US-8694091-$ or US-8640712-$ or US-8588887-$ or US-6371927-$ or US-5984875-$ or US-5963132-$ or US-5482008-$ or US-9420941-$ or US-8979758-$ or US-8195304-$ or US-8512241-$ or US-8663105-$).did.				
S40	13	S39 and ((power near3 manage$6) (sens$6 with (((turn turned turning) near3 ("on" "off")) (enabl$6 and disabl$6))))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2016/10/27 10:14
S41	29	("20040133131" | "20050134452" | "20050145187" | "20080104209" | "20080236500" | "20090182207" | "20110212782" | "20110301437" | "20120068848" | "20130197323" | "20130231188" | "20140368338" | "5482008" | "5818354" | "5963132" | "5984875" | "6059733" | "6099482" | "6371927" | "7441515" | "7962096" | "8001168" | "8545436" | "8547248" | "8588887" | "8640712" | "8694091" | "8771201" | "8823515" | "us-" | "us-" | "us-" | "us-" | "us-" | "us-" | "us-" | "us-" | "us-" | "us-" | "us-" | "us-" | "us-" | "us-" | "us-" | "us-" | "us-" | "us-" | "us-" | "us-" | "us-" | "us-" | "us-" | "us-").PN.	US-PGPUB; USPAT	OR	ON	2016/10/27 17:41
S42	1	("6085751").PN.	US-PGPUB; USPAT	OR	ON	2016/10/27 17:41
S43	6	("20040155782" | "20070156016" | "20090187392" | "20100030025" | "5532692" | "6702185").PN.	US-PGPUB; USPAT	OR	ON	2016/10/27 17:41
S44	3941	A61B5/073.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2016/10/27 17:41
S45	3064	A61B5/076.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2016/10/27 17:41
S46	11236	A61B5/0031.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2016/10/27 17:41
S47	3306	A61D7/00.cpc.	US-PGPUB; USPAT; USOCR;	OR	ON	2016/10/27 17:41

			FPRS; EPO; JPO; DERWENT			
S48	2920	A01K11/006.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2016/10/27 17:41
S49	399	A01K11/007.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2016/10/27 17:41
S50	819	A01K11/008.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2016/10/27 17:41
S51	36	S41 S42 S43	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2016/10/27 17:41
S52	691	("20010035902" | "20010051766" | "20020107444" | "20020128542" | "20020138009" | "20020156356" | "20020165592" | "20020173718" | "20020177779" | "20020188323" | "20020193669" | "20030013370" | "20030018280" | "20030043263" | "20030045790" | "20030077223" | "20030114742" | "20030139661" | "20030174208" | "20030195400" | "20030195415" | "20030214579" | "20030216622" | "20040032187" | "20040032957" | "20040054278" | "20040073087" | "20040109488" | "20040114856" | "20040122315" | "20040133131" | "20040162501" | "20040171915" | "20040181155" | "20040193029" | "20040199222" | "20040202339" | "20040204744" | "20040236182" | "20040258328" | "20050025368" | "20050043634" | "20050065441" | "20050075555" | "20050075559" | "20050088299" | "20050110881" | "20050143624" | "20050143644" | "20050148816" | "20050159643" | "20050159789" | "20050187433" | "20050222490" | "20050228259" | "20050256430" | "20050266074" | "20050272974" | "20050281446" | "20060004256" | "20060009819" | "20060030754" |	US-PGPUB; USPAT; USOCR	OR	ON	2016/10/27 17:41

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S53	22984	(S44 S45 S46) or (S47 S48 S49 S50)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2016/10/27 17:41
S54	355	(S51 S52 S53) and ((power energy) near3 (remain$6 left))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2016/10/27 17:41
S55	0	(("BELLA") near3 ("TECHNOLOGIES") near3 ("LLC")).AANM.	USPAT	OR	ON	2016/10/27 17:52
S56	0	(("RETTEDAL") near3 ("Nicholas")).INV.	EPO; JPO; DERWENT	OR	ON	2016/10/27 17:52
S57	4	(("RETTEDAL") near3 ("Nicholas")).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2016/10/27 17:52
S58	0	(("WEILNAU") near3 ("Stephen")).INV.	EPO; JPO; DERWENT	OR	ON	2016/10/27 17:52
S59	4	(("WEILNAU") near3 ("Stephen")).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2016/10/27 17:52
S60	0	(("COCKROFT") near3 ("Scott")).INV.	EPO; JPO; DERWENT	OR	ON	2016/10/27 17:52
S61	4	(("COCKROFT") near3 ("Scott")).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2016/10/27 17:52
S62	1	(("JANUS") near3 ("Joseph")).INV.	EPO; JPO; DERWENT	OR	ON	2016/10/27 17:52
S63	3	(("JANUS") near3 ("Joseph")).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2016/10/27 17:52
S64	8	(S55 S56 S57 S58 S59 S60 S61 S62 S63)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2016/10/27 17:52
S65	0	S64 and ((power energy) near3 (remain$6 left))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2016/10/27 17:52
S67	4234	animal with (lifespan$6 (life adj span$6) (life near3 stag$6))	US-PGPUB; USPAT;	OR	ON	2017/06/06 14:52

			USOCR; FPRS; EPO; JPO; DERWENT			
S68	1297	(animal with (lifespan$6 (life adj span$6) (life near3 stag$6))) same (power control controlled controlling controller sens$6 coordin$8)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2017/06/06 15:00
S69	1297	(animal with (lifespan$6 (life adj span$6) (life near3 stag$6))) same (power control controlled controlling controller sens$6 coordin$8)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2017/06/06 15:01
S70	29	("20040133131" | "20050134452" | "20050145187" | "20080104209" | "20080236500" | "20090182207" | "20110212782" | "20110301437" | "20120068848" | "20130197323" | "20130231188" | "20140368338" | "5482008" | "5818354" | "5963132" | "5984875" | "6059733" | "6099482" | "6371927" | "7441515" | "7962096" | "8001168" | "8545436" | "8547248" | "8588887" | "8640712" | "8694091" | "8771201" | "8823515" | "us-" | "us-" | "us-" | "us-" | "us-" | "us-" | "us-" | "us-" | "us-" | "us-" | "us-" | "us-" | "us-" | "us-" | "us-" | "us-" | "us-" | "us-" | "us-" | "us-").PN.	US-PGPUB; USPAT	OR	ON	2017/06/06 15:45
S71	1	("6085751").PN.	US-PGPUB; USPAT	OR	ON	2017/06/06 15:45
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S73	4306	A61B5/073.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2017/06/06 15:45
S74	3329	A61B5/076.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2017/06/06 15:45
S75	12005	A61B5/0031.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2017/06/06 15:45
S76	3647	A61D7/00.cpc.	US-	OR	ON	2017/06/06

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S77	3316	A01K11/006.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2017/06/06 15:45
S78	440	A01K11/007.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2017/06/06 15:45
S79	905	A01K11/008.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2017/06/06 15:45
S80	36	S70 S71 S72	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2017/06/06 15:45
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S83	9409	(S80 S81 S82) and (time timed timer timing)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2017/06/06 15:45
S84	9414	(S80 S81 S82) and (time timed timer timing lifespan)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2017/06/06 15:45
S85	4782	(S80 S81 S82) and ((sens$6 enabl$6 disabl$6 ((turn power) adj ("on" "off"))) with (time timed timer timing lifespan))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2017/06/06 15:54
S86	1627	(S80 S81 S82) and ((enabl$6 disabl$6 ((turn power) adj ("on" "off"))) with (time timed timer timing lifespan))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2017/06/06 15:55
S87	1	("6416782").PN.	US-PGPUB; USPAT	OR	ON	2017/07/03 10:11
S88	13	(("6416782") or ("20010001176") or ("20020128542") or ("20100302039") or ("20070136154") or ("20140240088")).PN.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	OFF	2017/07/03 10:13
S89	4	(("20060185605") or ("20070271320")).PN.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	OFF	2017/07/03 10:27
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EAST Search History (Interference)

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Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
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	Examiner	Art Unit
	TAMMIE K HELLER	3766

CPC- SEARCHED		
Symbol	Date	Examiner
A61B 5/073, 076, 0031	10/27/2016	TKH
A61D 7/00	10/27/2016	TKH
A01K 11/006-008	10/27/2016	TKH
Updated above	7/3/2017	TKH
Updated above	4/12/2018	TKH

CPC COMBINATION SETS - SEARCHED		
Symbol	Date	Examiner

US CLASSIFICATION SEARCHED			
Class	Subclass	Date	Examiner

* See search history printout included with this form or the SEARCH NOTES box below to determine the scope of the search.

SEARCH NOTES		
Search Notes	Date	Examiner
Inventor name search	10/27/2016	TKH
Text-limited search -- see search history printout	10/27/2016	TKH
Updated above	7/3/2017	TKH
Updated above	4/12/2018	TKH

INTERFERENCE SEARCH			
US Class/ CPC Symbol	US Subclass / CPC Group	Date	Examiner

	/TAMMIE K HELLER/ Primary Examiner.Art Unit 3766

PTO/AIA/80 (07-17)
Approved for use through 01/31/2018. OMB 0651-0035
U.S. Patent and Trademark Office, U.S. DEPARTMENT OF COMMERCE
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POWER OF ATTORNEY TO PROSECUTE APPLICATIONS BEFORE THE USPTO

I hereby revoke all previous powers of attorney given in the application identified in the attached statement under 37 CFR 3.73(c).

I hereby appoint:

[X] Practitioners associated with Customer Number: 114661

OR

[ ] Practitioner(s) named below (if more than ten patent practitioners are to be named, then a customer number must be used):

Name	Registration Number	Name	Registration Number

As attorney(s) or agent(s) to represent the undersigned before the United States Patent and Trademark Office (USPTO) in connection with any and all patent applications assigned only to the undersigned according to the USPTO assignment records or assignment documents attached to this form in accordance with 37 CFR 3.73(c).

Please change the correspondence address for the application identified in the attached statement under 37 CFR 3.73(c) to:

[X] The address associated with Customer Number: 114661

OR

[ ]

Firm or individual name		
Address		
City	State	Zip
Country		
Telephone	Email	

Assignee name and address: ST Reproductive Technologies, LLC
22575 State Highway 6 South
Navasota TX 77868

A copy of this form, together with a statement under 37 CFR 3.73(c) (Form PTO/AIA/96 or equivalent) is required to be filed in each application in which this form is used. The statement under 37 CFR 3.73(c) may be completed by one of the practitioners appointed in this form, and must identify the application in which this Power of Attorney is to be filed.

SIGNATURE of Assignee of Record

The individual whose signature and title is supplied below is authorized to act on behalf of the assignee.

Signature	Date
Name Juan Moreno	Telephone 936-870-3960
Title CEO, ST Reproductive Technologies, LLC	

This collection of information is required by 37 CFR 1.31, 1.32, and 1.33. The information is required to obtain or retain a benefit by the public, which is to update (and by the USPTO to process) the file of a patent or reexamination proceeding. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 18 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 3.

PTO/AIA/96 (08-12)
Approved for use through 01/31/2013. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

STATEMENT UNDER 37 CFR 3.73(c)

Applicant/Patent Owner: ST Reproductive Technologies, LLC

Application No./Patent No.: 14/738,789 Filed/Issue Date: June 12 2015

Titled: Calf Bolus

ST Reproductive Technologies, LLC, a Limited Liability Company

(Name of Assignee) (Type of Assignee, e.g., corporation, partnership, university, government agency, etc.)

states that, for the patent application/patent identified above, it is (choose **one** of options 1, 2, 3 or 4 below):

1. ☑ The assignee of the entire right, title, and interest.

2. ☐ An assignee of less than the entire right, title, and interest (check applicable box):

   ☐ The extent (by percentage) of its ownership interest is _____%. Additional Statement(s) by the owners holding the balance of the interest must be submitted to account for 100% of the ownership interest.

   ☐ There are unspecified percentages of ownership. The other parties, including inventors, who together own the entire right, title and interest are:

   Additional Statement(s) by the owner(s) holding the balance of the interest must be submitted to account for the entire right, title, and interest.

3. ☐ The assignee of an undivided interest in the entirety (a complete assignment from one of the joint inventors was made). The other parties, including inventors, who together own the entire right, title, and interest are:

   Additional Statement(s) by the owner(s) holding the balance of the interest must be submitted to account for the entire right, title, and interest.

4. ☐ The recipient, via a court proceeding or the like (*e.g.*, bankruptcy, probate), of an undivided interest in the entirety (a complete transfer of ownership interest was made). The certified document(s) showing the transfer is attached.

The interest identified in option 1, 2 or 3 above (not option 4) is evidenced by either (choose **one** of options A or B below):

A. ☐ An assignment from the inventor(s) of the patent application/patent identified above. The assignment was recorded in the United States Patent and Trademark Office at Reel _____, Frame _____, or for which a copy thereof is attached.

B. ☑ A chain of title from the inventor(s), of the patent application/patent identified above, to the current assignee as follows:

1. From: NICHOLAS P. RETTEDAL To: BELLA TECHNOLOGIES, LLC

   The document was recorded in the United States Patent and Trademark Office at

   Reel 035900, Frame 0406, or for which a copy thereof is attached.

2. From: STEPHEN M. WEILNAU To: BELLA TECHNOLOGIES, LLC

   The document was recorded in the United States Patent and Trademark Office at

   Reel 035900, Frame 0406, or for which a copy thereof is attached.

This collection of information is required by 37 CFR 3.73(b). The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450**.

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

PTO/AIA/96 (08-12)
Approved for use through 01/31/2013. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

STATEMENT UNDER 37 CFR 3.73(c)

3. From: SCOTT R. COCKROFT To: BELLA TECHNOLOGIES, LLC

The document was recorded in the United States Patent and Trademark Office at
Reel 035900, Frame 0406, or for which a copy thereof is attached.

4. From: JOSEPH JANUS IV To: BELLA TECHNOLOGIES, LLC

The document was recorded in the United States Patent and Trademark Office at
Reel 035900, Frame 0406, or for which a copy thereof is attached.

5. From: BELLA TECHNOLOGIES, LLC To: ST REPRODUCTIVE TECHNOLOGIES, LLC

The document was recorded in the United States Patent and Trademark Office at
Reel 045824, Frame 0134, or for which a copy thereof is attached.

6. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at
Reel _____, Frame _____, or for which a copy thereof is attached.

☐ Additional documents in the chain of title are listed on a supplemental sheet(s).

☐ As required by 37 CFR 3.73(c)(1)(i), the documentary evidence of the chain of title from the original owner to the assignee was, or concurrently is being, submitted for recordation pursuant to 37 CFR 3.11.

[NOTE: A separate copy (i.e., a true copy of the original assignment document(s)) must be submitted to Assignment Division in accordance with 37 CFR Part 3, to record the assignment in the records of the USPTO. See MPEP 302.08]

The undersigned (whose title is supplied below) is authorized to act on behalf of the assignee.

/Ryan Christensen/	May 30, 2018
Signature	Date
Ryan Christensen	60,291
Printed or Typed Name	Title or Registration Number

Privacy Act Statement

The **Privacy Act of 1974 (P.L. 93-579)** requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (*i.e.*, GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Doc Code: R46C.REQ
Document Description: Request under 37 CFR 1.46(c) to correct, update or change the applicant.

PTO/AIA/41 (04-15)
Approved for use through 11/30/2020. OMB 0651-0031
U.S. Patent and Trademark Office, U.S. DEPARTMENT OF COMMERCE
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REQUEST TO CORRECT OR UPDATE THE NAME OF THE APPLICANT UNDER 37 CFR 1.46(c)(1), OR CHANGE THE APPLICANT UNDER 37 CFR 1.46(c)(2)
(FOR USE ONLY IN APPLICATIONS FILED ON OR AFTER SEPTEMBER 16, 2012)

Application Number	14/738,789
Filing Date	June 12 2015
First Named Inventor	Nicholas P. Rettedal
Art Unit	3762
Examiner Name	MARLEN, TAMMIE K
Practitioner Docket Number	RT-22 (US-1)

To: Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Applicant hereby **requests that the name of the applicant be corrected or updated under 37 CFR 1.46(c)(1), or that the applicant be changed under 37 CFR 1.46(c)(2),** in the above-identified application. **Requests under 37 CFR 1.46(c)(1) or (c)(2) cannot be submitted after payment of the issue fee or if the application has been patented.**

Please check the applicable box(es) below.

☐ 1. This request is to **correct or update the name of the applicant** (**under 37 CFR 1.46(c)(1)**) and includes:

☐ An application data sheet (ADS) in accordance with 37 CFR 1.76(c) with the corrected or updated information shown with markings (*e.g.*, underlining for insertions, strikethrough for deletions). A Corrected Web-based ADS may be used.

Note: Requests under 37 CFR 1.46(c)(1) may be filed to correct typographical errors in the name of the § 1.46 applicant, or for updating the name of the § 1.46 applicant (*i.e.*, where there is no change in the applicant itself but just in the applicant's name). See the Manual of Patent Examining Procedure (MPEP) section 605.01.

■ 2. This request is to **change the applicant** (**under 37 CFR 1.46(c)(2)**) and includes:

■ An application data sheet (ADS) in accordance with 37 CFR 1.76(c) that identifies the changes with proper markings (underlining for insertions and strikethrough for deletions). A Corrected Web-based ADS may be used.

■ A Statement Under 37 CFR 3.73(c) (Form PTO/AIA/96 or equivalent). See MPEP 325.

I am the

☐ applicant* ■ attorney or agent of record Registration number 60,291 ☐ attorney or agent acting under 37 CFR 1.34 Registration number _____

Signature /Ryan Christensen/
Typed or printed name Ryan Christensen
Date May 30, 2018

NOTE: This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4 for signature requirements and certifications. *Juristic entities must be represented by a patent practitioner (See 37 CFR 1.31, applicable to any paper filed on or after September 16, 2012 that is presented on behalf of a juristic entity, regardless of application filing date). Submit multiple forms if more than one signature is required, see below**.

■ ** Total of 1 forms are submitted.

This collection of information is required by 37 CFR 1.36. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

Privacy Act Statement

The **Privacy Act of 1974 (P.L. 93-579)** requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (*i.e.*, GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the application of: Nicholas P. Rettedal, Stephen M. Weilnau, Scott R. Cockroft, and Joseph Janus IV	**Confirmation No.:**
Application No.:	**Group Art Unit:**
Filed:	**Examiner:**
For: Calf Bolus	
Attorney Docket No.: ~~bellaUScalf (280-10)~~ RT-22 (US-1)	

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

APPLICATION DATA SHEET UNDER 37 CFR 1.76

Secrecy Order in Parent Application::	No

Inventor Information

Inventor::	**1**
Prefix::	
Given Name:	Nicholas
Middle Name::	P.
Family Name::	Rettedal
Suffix::	
Residence Information::	US Residency
City of Residence::	Loveland
State or Province of Residence::	CO
Country of Residence::	US
Street of Mailing Address::	1701 E 15th Street
City of Mailing Address::	Loveland

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 527 of 607

State or Province of Mailing Address::	CO
Postal or Zip Code of Mailing Address::	80538
Country::	US

Inventor::	**2**
Prefix::	
Given Name:	Stephen
Middle Name::	M.
Family Name::	Weilnau
Suffix::	
Residence Information::	US Residency
City of Residence::	Greeley
State or Province of Residence::	CO
Country of Residence::	US
Street of Mailing Address::	1937 Montview Drive
City of Mailing Address::	Greeley
State or Province of Mailing Address::	CO
Postal or Zip Code of Mailing Address::	80631
Country::	US

Inventor::	**3**
Prefix::	
Given Name:	Scott
Middle Name::	R.
Family Name::	Cockroft
Suffix::	
Residence Information::	US Residency
City of Residence::	Greeley
State or Province of Residence::	CO
Country of Residence::	US

Street of Mailing Address::	27712 County Road 62
City of Mailing Address::	Greeley
State or Province of Mailing Address::	CO
Postal or Zip Code of Mailing Address::	80631
Country::	US

Inventor::	**4**
Prefix::	
Given Name:	Joseph
Middle Name::	
Family Name::	Janus
Suffix::	IV
Residence Information::	US Residency
City of Residence::	Loveland
State or Province of Residence::	CO
Country of Residence::	US
Street of Mailing Address::	125 E 23rd Street
City of Mailing Address::	Loveland
State or Province of Mailing Address::	CO
Postal or Zip Code of Mailing Address::	80538
Country::	US

Correspondence Information

Name::	CR MILES P.C.
Correspondence Customer Number::	39208
Electronic Mail::	intentionally left blank
Street of Mailing Address::	405 Mason Court, Suite 119
City of Mailing Address::	Fort Collins
State or Province of Mailing Address::	Colorado
Postal or Zip Code of Mailing Address::	80524

Telephone::	(970) 492-0000
Fax::	(970) 492-0003

Application Information

Title::	Calf Bolus
Attorney Docket Number::	~~bellaUScalf (280-10)~~ RT-22 (US-1)
Small Entity::	Yes
Application Type::	Non-Provisional
Subject Matter::	Utility
Total Drawing Sheets::	5
Suggested Figure for Publication::	1

Publication Information

Request for Early Publication::	No
Request Not To Publish::	No

Representative Information

Customer Number::	~~39208~~ 114661
Attorney Name::	~~Craig R. Miles~~
Registration Number::	~~45,954~~

Domestic Priority Information None

Foreign Priority Information None

Statement Under 37 C.F.R 1.55 or 1.78 for AIA: No

This Application (1) claims priority to or the benefit of an application filed before March 16, 2013 and (2) also contains, or contained at any time, a claim to a claimed invention that has an effective filing date on or after March 16, 2013.

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 530 of 607

Authorization to Permit Access: No

The undersigned hereby grants the USPTO authority to provide the European Patent Office (EPO), the Japan patent Office (JPO), the Korean Intellectual Property Office (KIPO), the World Intellectual Property Office (WIPO), and any other intellectual property offices in which the foreign application claiming priority to the instant patent application is filed access to the instant patent application.

Applicant Information

Applicant Authority Type::	Assignee
Applicant is an Organization::	Yes
Applicant Name::	~~Bella Technologies, LLC~~ ST Reproductive Technologies, LLC
Street of Mailing Address for Applicant::	~~27906 Weld County Road 388~~ 22575 State Highway 6 South
City of Mailing Address for Applicant::	~~Kersey~~ Navasota
State/Province of Mailing Address for Applicant::	~~CO~~ TX
Postal Code of Mailing Address for Applicant::	~~80644~~ 77868
Country::	US
Phone Number for Applicant::	~~intentionally left blank~~ (936) 870-3960
Fax Number for Applicant::	~~intentionally left blank~~ 936-870-3115
E-mail Address for Applicant::	~~intentionally left blank~~ patents@stgen.com

Assignee Information:

Assignee is an Organization::	Yes
Assignee Name::	~~Bella Technologies, LLC~~ ST Reproductive Technologies, LLC
Street of Mailing Address for Assignee::	~~27906 Weld County Road 388~~ 22575 State Highway 6 South
City of Mailing Address for Assignee::	~~Kersey~~ Navasota
State/Province of Mailing Address for Assignee::	~~CO~~ TX
Postal Code of Mailing Address for Assignee::	~~80644~~ 77868
Country::	US
Phone Number for Assignee::	~~intentionally left blank~~ (936) 870-3960
Fax Number for Assignee::	~~intentionally left blank~~ 936-870-3115
E-mail Address for Assignee::	~~intentionally left blank~~ patents@stgen.com

Dated this 12 day of June, 2015

Respectfully Submitted,

By: _____

Craig R. Miles
ATTORNEY FOR APPLICANT
USPTO Reg. No. 45,954
CR MILES, P.C.
405 Mason Court, Suite 119
Fort Collins, CO 80524
(970) 492-0000 telephone
(970) 492-0003 facsimile

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 532 of 607

Electronic Acknowledgement Receipt

EFS ID:	32754131
Application Number:	14738789
International Application Number:	
Confirmation Number:	8986
Title of Invention:	Calf Bolus
First Named Inventor/Applicant Name:	Nicholas P. Rettedal
Customer Number:	39208
Filer:	Ryan Scot Christensen/Justin Wood
Filer Authorized By:	Ryan Scot Christensen
Attorney Docket Number:	bellaUScalf (280-10)
Receipt Date:	30-MAY-2018
Filing Date:	12-JUN-2015
Time Stamp:	17:18:54
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Power of Attorney	ExecutedPOA.pdf	695118 a8cca85b069025864 2f7afb11d3d05e6363baba4	no	1
Warnings:					

Information:					
2	Assignee showing of ownership per 37 CFR 3.73	Statementunder373.pdf	142098 eba7d6e9934fc73fcdbb27b374af56162b09a13c	no	3
Warnings:					
Information:					
3	Miscellaneous Incoming Letter	ChangeofApplicant.pdf	216541 9a6c5513dc226ca18de39fe6677bfd796e745aec	no	2
Warnings:					
Information:					
4	Application Data Sheet	MarkedupADS.pdf	197675 220b9d60417cccace051f4f783345398f7518d58	no	6
Warnings:					
Information:					
This is not an USPTO supplied ADS fillable form					
		Total Files Size (in bytes):	1251432		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
14/738,789	06/12/2015	Nicholas P. Rettedal	bellaUScalf (280-10)

CONFIRMATION NO. 8986

39208
CR MILES, P.C.
CRAIG R. MILES
405 MASON COURT, SUITE 119
FORT COLLINS, CO 80524

POWER OF ATTORNEY NOTICE

OC000000100021344

Date Mailed: 06/06/2018

NOTICE REGARDING CHANGE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 05/30/2018.

- The Power of Attorney to you in this application has been revoked by the applicant. Future correspondence will be mailed to the new address of record(37 CFR 1.33).

Questions about the contents of this notice and the requirements it sets forth should be directed to the Office of Data Management, Application Assistance Unit, at **(571) 272-4000** or **(571) 272-4200** or **1-888-786-0101**.

/cnguyen/

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
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Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
14/738,789	06/12/2015	Nicholas P. Rettedal	RT-22 (US-1)

CONFIRMATION NO. 8986

114661
XY, LLC
22575 State Highway 6 South
Navasota, TX 77868

POA ACCEPTANCE LETTER

OC000000100021362

Date Mailed: 06/06/2018

NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 05/30/2018.

The Power of Attorney in this application is accepted. Correspondence in this application will be mailed to the above address as provided by 37 CFR 1.33.

Questions about the contents of this notice and the requirements it sets forth should be directed to the Office of Data Management, Application Assistance Unit, at **(571) 272-4000** or **(571) 272-4200** or **1-888-786-0101**.

/cnguyen/

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY.DOCKET.NO	TOT CLAIMS	IND CLAIMS
14/738,789	06/12/2015	3762	1360	RT-22 (US-1)	20	1

CONFIRMATION NO. 8986

CORRECTED FILING RECEIPT

114661
XY, LLC
22575 State Highway 6 South
Navasota, TX 77868

OC000000106021396

Date Mailed: 06/06/2018

Receipt is acknowledged of this non-provisional patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF APPLICANT, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection. Please verify the accuracy of the data presented on this receipt. **If an error is noted on this Filing Receipt, please submit a written request for a Filing Receipt Correction. Please provide a copy of this Filing Receipt with the changes noted thereon. If you received a "Notice to File Missing Parts" for this application, please submit any corrections to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections**

Inventor(s)

Nicholas P. Rettedal, Loveland, CO;
Stephen M. Weilnau, Greeley, CO;
Scott R. Cockroft, Greeley, CO;
Joseph Janus IV, Loveland, CO;

Applicant(s)

ST Reproductive Technologies, LLC, Navasota, TX;

Assignment For Published Patent Application

ST Reproductive Technologies, LLC, Navasota, TX

Power of Attorney: The patent practitioners associated with Customer Number 114661

Domestic Applications for which benefit is claimed - None.
A proper domestic benefit claim must be provided in an Application Data Sheet in order to constitute a claim for domestic benefit. See 37 CFR 1.76 and 1.78.

Foreign Applications for which priority is claimed (You may be eligible to benefit from the **Patent Prosecution Highway** program at the USPTO. Please see http://www.uspto.gov for more information.) - None.
Foreign application information must be provided in an Application Data Sheet in order to constitute a claim to foreign priority. See 37 CFR 1.55 and 1.76.

Permission to Access Application via Priority Document Exchange: No

Permission to Access Search Results: No

Applicant may provide or rescind an authorization for access using Form PTO/SB/39 or Form PTO/SB/69 as appropriate.

If Required, Foreign Filing License Granted: 06/23/2015

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 14/738,789**

Projected Publication Date: Not Applicable

Non-Publication Request: No

Early Publication Request: No
**** SMALL ENTITY ****
Title

Calf Bolus

Preliminary Class

600

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications: No

PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES

Since the rights granted by a U.S. patent extend only throughout the territory of the United States and have no effect in a foreign country, an inventor who wishes patent protection in another country must apply for a patent in a specific country or in regional patent offices. Applicants may wish to consider the filing of an international application under the Patent Cooperation Treaty (PCT). An international (PCT) application generally has the same effect as a regular national patent application in each PCT-member country. The PCT process **simplifies** the filing of patent applications on the same invention in member countries, but **does not result** in a grant of "an international patent" and does not eliminate the need of applicants to file additional documents and fees in countries where patent protection is desired.

Almost every country has its own patent law, and a person desiring a patent in a particular country must make an application for patent in that country in accordance with its particular laws. Since the laws of many countries differ in various respects from the patent law of the United States, applicants are advised to seek guidance from specific foreign countries to ensure that patent rights are not lost prematurely.

Applicants also are advised that in the case of inventions made in the United States, the Director of the USPTO must issue a license before applicants can apply for a patent in a foreign country. The filing of a U.S. patent application serves as a request for a foreign filing license. The application's filing receipt contains further information and guidance as to the status of applicant's license for foreign filing.

Applicants may wish to consult the USPTO booklet, "General Information Concerning Patents" (specifically, the section entitled "Treaties and Foreign Patents") for more information on timeframes and deadlines for filing foreign patent applications. The guide is available either by contacting the USPTO Contact Center at 800-786-9199, or it can be viewed on the USPTO website at http://www.uspto.gov/web/offices/pac/doc/general/index.html.

For information on preventing theft of your intellectual property (patents, trademarks and copyrights), you may wish to consult the U.S. Government website, http://www.stopfakes.gov. Part of a Department of Commerce initiative, this website includes self-help "toolkits" giving innovators guidance on how to protect intellectual property in specific

countries such as China, Korea and Mexico. For questions regarding patent enforcement issues, applicants may call the U.S. Government hotline at 1-866-999-HALT (1-866-999-4258).

LICENSE FOR FOREIGN FILING UNDER

Title 35, United States Code, Section 184

Title 37, Code of Federal Regulations, 5.11 & 5.15

GRANTED

The applicant has been granted a license under 35 U.S.C. 184, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" followed by a date appears on this form. Such licenses are issued in all applications where the conditions for issuance of a license have been met, regardless of whether or not a license may be required as set forth in 37 CFR 5.15. The scope and limitations of this license are set forth in 37 CFR 5.15(a) unless an earlier license has been issued under 37 CFR 5.15(b). The license is subject to revocation upon written notification. The date indicated is the effective date of the license, unless an earlier license of similar scope has been granted under 37 CFR 5.13 or 5.14.

This license is to be retained by the licensee and may be used at any time on or after the effective date thereof unless it is revoked. This license is automatically transferred to any related applications(s) filed under 37 CFR 1.53(d). This license is not retroactive.

The grant of a license does not in any way lessen the responsibility of a licensee for the security of the subject matter as imposed by any Government contract or the provisions of existing laws relating to espionage and the national security or the export of technical data. Licensees should apprise themselves of current regulations especially with respect to certain countries, of other agencies, particularly the Office of Defense Trade Controls, Department of State (with respect to Arms, Munitions and Implements of War (22 CFR 121-128)); the Bureau of Industry and Security, Department of Commerce (15 CFR parts 730-774); the Office of Foreign AssetsControl, Department of Treasury (31 CFR Parts 500+) and the Department of Energy.

NOT GRANTED

No license under 35 U.S.C. 184 has been granted at this time, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" DOES NOT appear on this form. Applicant may still petition for a license under 37 CFR 5.12, if a license is desired before the expiration of 6 months from the filing date of the application. If 6 months has lapsed from the filing date of this application and the licensee has not received any indication of a secrecy order under 35 U.S.C. 181, the licensee may foreign file the application pursuant to 37 CFR 5.15(b).

SelectUSA

The United States represents the largest, most dynamic marketplace in the world and is an unparalleled location for business investment, innovation, and commercialization of new technologies. The U.S. offers tremendous resources and advantages for those who invest and manufacture goods here. Through SelectUSA, our nation works to promote and facilitate business investment. SelectUSA provides information assistance to the international investor community; serves as an ombudsman for existing and potential investors; advocates on behalf of U.S. cities, states, and regions competing for global investment; and counsels U.S. economic development organizations on investment attraction best practices. To learn more about why the United States is the best country in the world to develop

technology, manufacture products, deliver services, and grow your business, visit http://www.SelectUSA.gov or call +1-202-482-6800.

PTO/AIA/80 (07-17)
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POWER OF ATTORNEY TO PROSECUTE APPLICATIONS BEFORE THE USPTO

I hereby revoke all previous powers of attorney given in the application identified in the attached statement under 37 CFR 3.73(c).

I hereby appoint:

[X] Practitioners associated with Customer Number: 114662

OR

[ ] Practitioner(s) named below (if more than ten patent practitioners are to be named, then a customer number must be used):

Name	Registration Number	Name	Registration Number

As attorney(s) or agent(s) to represent the undersigned before the United States Patent and Trademark Office (USPTO) in connection with any and all patent applications assigned only to the undersigned according to the USPTO assignment records or assignment documents attached to this form in accordance with 37 CFR 3.73(c).

Please change the correspondence address for the application identified in the attached statement under 37 CFR 3.73(c) to:

[X] The address associated with Customer Number: 114662

OR

[ ]

Firm or individual name		
Address		
City	State	Zip
Country		
Telephone	Email	

Assignee name and address: ST Reproductive Technologies, LLC
22575 State Highway 6 South
Navasota TX 77868

A copy of this form, together with a statement under 37 CFR 3.73(c) (Form PTO/AIA/96 or equivalent) is required to be filed in each application in which this form is used. The statement under 37 CFR 3.73(c) may be completed by one of the practitioners appointed in this form, and must identify the application in which this Power of Attorney is to be filed.

SIGNATURE of Assignee of Record

The individual whose signature and title is supplied below is authorized to act on behalf of the assignee.

Signature	Date
Name Juan Moreno	Telephone 936-870-3960
Title CEO, ST Reproductive Technologies, LLC	

This collection of information is required by 37 CFR 1.31, 1.32, and 1.33. The information is required to obtain or retain a benefit by the public, which is to update (and by the USPTO to process) the file of a patent or reexamination proceeding. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 18 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

PTO/AIA/96 (08-12)
Approved for use through 01/31/2013. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

STATEMENT UNDER 37 CFR 3.73(c)

Applicant/Patent Owner: ST Reproductive Technologies, LLC

Application No./Patent No.: 14/738,789 Filed/Issue Date: June 12 2015

Titled: Calf Bolus

ST Reproductive Technologies, LLC, a Limited Liability Company

(Name of Assignee) (Type of Assignee, e.g., corporation, partnership, university, government agency, etc.)

states that, for the patent application/patent identified above, it is (choose **one** of options 1, 2, 3 or 4 below):

1. ☑ The assignee of the entire right, title, and interest.

2. ☐ An assignee of less than the entire right, title, and interest (check applicable box):

   ☐ The extent (by percentage) of its ownership interest is _____%. Additional Statement(s) by the owners holding the balance of the interest must be submitted to account for 100% of the ownership interest.

   ☐ There are unspecified percentages of ownership. The other parties, including inventors, who together own the entire right, title and interest are:

   Additional Statement(s) by the owner(s) holding the balance of the interest must be submitted to account for the entire right, title, and interest.

3. ☐ The assignee of an undivided interest in the entirety (a complete assignment from one of the joint inventors was made). The other parties, including inventors, who together own the entire right, title, and interest are:

   Additional Statement(s) by the owner(s) holding the balance of the interest must be submitted to account for the entire right, title, and interest.

4. ☐ The recipient, via a court proceeding or the like (*e.g.*, bankruptcy, probate), of an undivided interest in the entirety (a complete transfer of ownership interest was made). The certified document(s) showing the transfer is attached.

The interest identified in option 1, 2 or 3 above (not option 4) is evidenced by either (choose **one** of options A or B below):

A. ☐ An assignment from the inventor(s) of the patent application/patent identified above. The assignment was recorded in the United States Patent and Trademark Office at Reel _____, Frame _____, or for which a copy thereof is attached.

B. ☑ A chain of title from the inventor(s), of the patent application/patent identified above, to the current assignee as follows:

1. From: NICHOLAS P. RETTEDAL To: BELLA TECHNOLOGIES, LLC

   The document was recorded in the United States Patent and Trademark Office at

   Reel 035900, Frame 0406, or for which a copy thereof is attached.

2. From: STEPHEN M. WEILNAU To: BELLA TECHNOLOGIES, LLC

   The document was recorded in the United States Patent and Trademark Office at

   Reel 035900, Frame 0406, or for which a copy thereof is attached.

This collection of information is required by 37 CFR 3.73(b). The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450**.

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

PTO/AIA/96 (08-12)
Approved for use through 01/31/2013. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

STATEMENT UNDER 37 CFR 3.73(c)

3. From: SCOTT R. COCKROFT To: BELLA TECHNOLOGIES, LLC

The document was recorded in the United States Patent and Trademark Office at
Reel 035900, Frame 0406, or for which a copy thereof is attached.

4. From: JOSEPH JANUS IV To: BELLA TECHNOLOGIES, LLC

The document was recorded in the United States Patent and Trademark Office at
Reel 035900, Frame 0406, or for which a copy thereof is attached.

5. From: BELLA TECHNOLOGIES, LLC To: ST REPRODUCTIVE TECHNOLOGIES, LLC

The document was recorded in the United States Patent and Trademark Office at
Reel 045824, Frame 0134, or for which a copy thereof is attached.

6. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at
Reel _____, Frame _____, or for which a copy thereof is attached.

☐ Additional documents in the chain of title are listed on a supplemental sheet(s).

☐ As required by 37 CFR 3.73(c)(1)(i), the documentary evidence of the chain of title from the original owner to the assignee was, or concurrently is being, submitted for recordation pursuant to 37 CFR 3.11.

[NOTE: A separate copy (i.e., a true copy of the original assignment document(s)) must be submitted to Assignment Division in accordance with 37 CFR Part 3, to record the assignment in the records of the USPTO. See MPEP 302.08]

The undersigned (whose title is supplied below) is authorized to act on behalf of the assignee.

/Ryan Christensen/	June 8, 2018
Signature	Date
Ryan Christensen	60,291
Printed or Typed Name	Title or Registration Number

Privacy Act Statement

The **Privacy Act of 1974 (P.L. 93-579)** requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (*i.e.*, GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Electronic Acknowledgement Receipt

EFS ID:	32848790
Application Number:	14738789
International Application Number:	
Confirmation Number:	8986
Title of Invention:	Calf Bolus
First Named Inventor/Applicant Name:	Nicholas P. Rettedal
Customer Number:	114661
Filer:	Ryan Scot Christensen/Justin Wood
Filer Authorized By:	Ryan Scot Christensen
Attorney Docket Number:	RT-22 (US-1)
Receipt Date:	08-JUN-2018
Filing Date:	12-JUN-2015
Time Stamp:	17:11:41
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Power of Attorney	6-8-18ExecutedPOA.pdf	691034 c59f12670d3bd0a6f67572a07b2de60f55edf253	no	1
Warnings:					

Information:					
2	Assignee showing of ownership per 37 CFR 3.73	Statementunder373.pdf	104312 e76cbf614386eb096bbd7037d3eb3a9b95b34145	no	3
Warnings:					
Information:					
		Total Files Size (in bytes):	795346		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.
National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.
New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
14/738,789	06/12/2015	Nicholas P. Rettedal	RT-22 (US-1)

CONFIRMATION NO. 8986

114661
XY, LLC
22575 State Highway 6 South
Navasota, TX 77868

POWER OF ATTORNEY NOTICE

OC000000100215237

Date Mailed: 06/13/2018

NOTICE REGARDING CHANGE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 06/08/2018.

- The Power of Attorney to you in this application has been revoked by the applicant. Future correspondence will be mailed to the new address of record(37 CFR 1.33).

Questions about the contents of this notice and the requirements it sets forth should be directed to the Office of Data Management, Application Assistance Unit, at **(571) 272-4000** or **(571) 272-4200** or **1-888-786-0101**.

/vnguyen/

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
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Address: COMMISSIONER FOR PATENTS
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14/738,789	06/12/2015	Nicholas P. Rettedal	RT-22 (US-1)

CONFIRMATION NO. 8986

114662
ST Reproductive Technologies, LLC
22575 State Highway 6 South
Navasota, TX 77868

POA ACCEPTANCE LETTER

OC000000100215303

Date Mailed: 06/13/2018

NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 06/08/2018.

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Questions about the contents of this notice and the requirements it sets forth should be directed to the Office of Data Management, Application Assistance Unit, at **(571) 272-4000** or **(571) 272-4200** or **1-888-786-0101**.

/vnguyen/

PTO/SB/06 (09-11)
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PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 14/738,789	Filing Date 06/12/2015	☐ To be Mailed

ENTITY: ☐ LARGE ☑ SMALL ☐ MICRO

APPLICATION AS FILED - PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA		RATE ($)	FEE ($)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A		N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A		N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A		N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*		x $40 =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*		x $210 =	
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).				
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))					
* If the difference in column 1 is less than zero, enter "0" in column 2.				TOTAL	

APPLICATION AS AMENDED - PART II

AMENDMENT	07/17/2018	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA		RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	* 19	Minus	** 20	= 0		x $50 =	0
	Independent (37 CFR 1.16(h))	* 6	Minus	*** 6	= 0		x $230 =	0
	☐ Application Size Fee (37 CFR 1.16(s))							
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							
							TOTAL ADD'L FEE	0

AMENDMENT		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA		RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	*	Minus	**	=		x $0 =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=		x $0 =	
	☐ Application Size Fee (37 CFR 1.16(s))							
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							
							TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.	SLIE
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".	TIMOTHY COLE
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".	
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.	

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the application of: Nicholas P. Rettedal	**Confirmation No.:** 8986
Application No.: 14/738,789	
Filed: June 12, 2015	**Group Art Unit:** 3766
For: Calf Bolus	
Attorney Docket No.: RT-22	**Examiner:** Marlen, Tammie K

Filed Via EFS
Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

RESPONSE TO NON-FINAL OFFICE ACTION

In response to the Non-Final Office Action dated April 17, 2018, having a shortened statutory period set to expire on July 17, 2018, Applicant requests consideration of the remarks and amendments appended hereto. No fees are due with this response. In the event of any miscalculation or error, including fee calculations, the Commissioner is hereby authorized to deduct and/or refund any fees as might be appropriate from Deposit Account Number **50-5531**.

Amendments in the Claims begin on page 2 of this response.
Remarks begin on page 8 of this response.

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 550 of 607

CLAIM AMENDMENTS

It is respectfully requested that the claims be amended without prejudice, without admission, without surrender of subject matter, and without intention of creating any estoppel as to equivalents, as follows. This listing of claims will replace all prior versions, and listings, of claims in the application.

Listing of Claims:

1-36. (Canceled)

37. (Currently Amended) A method of monitoring the physiological parameters of a ruminant animal, comprising:

~~obtaining a~~ disposing a bolus ~~configured for oral administration to and retention~~ in the reticulorumen of said ruminant animal; ~~, said bolus capable of~~

~~generating a sensor signal from one or more sensors which varies based on a corresponding change in one or more physiological parameters of said ruminant animal; and~~

enabling or disabling [[said]] 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, said enabling or disabling of said one or more sensors coordinated with a plurality of life stages in a lifespan of said ruminant animal;

generating a sensor signal from said one of more sensors when enabled, where said sensor signal varies based on a corresponding change in one or more physiological parameters of said ruminant animal; and

transmitting encoded physiological data indicative of the physiological parameters of said ruminant animal.

38. (Canceled)

39. (Currently Amended) The method of claim 37, wherein the step of enabling or disabling ~~said~~ one or more sensors in said bolus is performed by operation of [[said]] a power management module based upon a comparison of the sensor signal to a pre-determined set of [[said]] one or

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 551 of 607

more physiological parameters ~~sensed by said one or more sensors~~ during said plurality of life stages in said lifespan of said ruminant animal.

40. (Canceled)

41. (Currently Amended) The method of claim 37, wherein the step of ~~said~~ enabling or disabling ~~of said~~ one or more sensors in said bolus ~~coordinated with a plurality of life stages in a lifespan of said ruminant animal~~ further comprises assessing elapsed time from an activation of said bolus.

42. (Currently Amended) The method of claim 37, wherein said plurality of life stages in said life span of said ruminant animal comprise a first life stage prior to ~~attaining~~ puberty and a second life stage ~~after attaining~~ commencing with puberty.

43. (Currently Amended) A method of monitoring physiological parameters of a ruminant animal, comprising:

generating a sensor signal from one or more sensors contained in a bolus orally administered to [[a]] said ruminant animal, said sensor signal varies based on a corresponding change in one or more physiological parameters of said ruminant animal;

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; and

storing said encoded physiological data in a non-transitory computer readable media,

enabling a radio signal generator located within said bolus;

activating said radio signal generator at pre-determined intervals to generate ~~said~~ a radio signal to carry said encoded physiological data; and

generating [[a]] said radio signal having a frequency of between about 700MHz to about 1GHz.

44. (Canceled)

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 552 of 607

45. (Currently Amended) A method of monitoring physiological parameters of a ruminant animal, comprising:

determining a remaining amount of energy stored in ~~an energy~~ a power source located within a bolus orally administered to [[a]] said ruminant animal;

determining an amount of energy required by said bolus to operate through a pre-determined period of time based on current programming of a computer code contained in a non-transitory computer readable media contained in said bolus;

comparing said amount of energy required by said bolus to operate through said pre-determined period of time to said remaining amount of energy stored in said ~~energy~~ power source; and

calculating a difference in said amount of energy remaining in the power source and said amount of energy required by said bolus to operate through said pre-determined period of time; and

performing one or more power regulation events to offset said difference in said amount of energy remaining in the power source and said amount of energy required by said bolus to operate through said pre-determined period of time.

46. (Canceled)

47. (Canceled)

48. (Canceled)

49. (Previously Presented) The method of claim 43, wherein said frequency is selected from the group consisting of: between about 700 MHz to about 800MHz, 750 MHz to about 850MHz, about 800 MHz to about 900MHz, 850 MHz to about 950MHz, 900 MHz to about 1GHz.

50. (Previously Presented) The method of claim 49, 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.

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 553 of 607

51. (Canceled)

52. (Currently Amended) A method of monitoring physiological parameters of a ruminant animal, comprising:

generating a sensor signal from one or more sensors contained in a bolus orally administered to [[a]] said ruminant animal, said sensor signal varies based on a corresponding change in one or more physiological parameters of said ruminant animal;

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;

storing said encoded physiological data in a non-transitory computer readable media;

enabling a radio signal generator located within said bolus;

activating said radio signal generator to generate a radio signal to carry said encoded physiological data; and

transmitting [[a]] 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.

53. (Original) The method of claim 52, 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.

54. (Original) The method of claim 53, wherein said antenna further comprises one or more vias interconnecting said pair of electrically conductive loops.

55. (Original) The method of claim 54, wherein said antenna further comprises a non-conductive sheet material disposed between said pair of electrically conductive loops.

56-63. (Canceled)

64. (Currently Amended) A method of monitoring physiological parameters of a ruminant animal, comprising:

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 554 of 607

~~obtaining~~ administering a bolus ~~configured for oral administration~~ to said ruminant animal~~, said bolus capable of:~~

~~generating a sensor signal from one or more sensors which varies based on a corresponding change in one or more physiological parameters of said ruminant animal;~~

enabling or disabling ~~said~~ 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;

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;

receiving a radio signal containing programming data; and

re-programming said computer code contained within said non-transitory computer readable medium based on the radio signal containing programming data.

65. (Previously Presented) The method of claim 64, wherein said re-programming said computer code is based upon a pre-determined set of said physiological parameters to be sensed during a stage in a life cycle of said ruminant animal.

66. (Currently Amended) The method of claim 64, wherein said re-programming said computer code further comprises ~~to offset~~ offsetting ~~said~~ a difference in ~~said~~ an amount of energy remaining in ~~the~~ a power source and ~~said~~ an amount of energy required by said bolus to operate through ~~said~~ a pre-determined period of time.

67. (Currently Amended) A method of monitoring physiological parameters of a ruminant animal, comprising:

generating a sensor signal from a first sensor located within a bolus ~~configured for oral administration to~~ disposed in the reticulorumen of [[a]] said ruminant animal;

analyzing said sensor signal generated by said first sensor by execution of a power management module contained in a non-transitory computer readable medium communicatively coupled to a processor contained within said bolus;

comparing said sensor signal from said first sensor to ~~a first pre-selected activation code having~~ a first pre-selected activation match threshold contained within a first pre-selected

activation code; and

activating said bolus ~~upon occurrence of said pre-selected activation code which exceeds said~~ when the first pre-selected activation match threshold contained within the first pre-selected activation code is met.

68. (Currently Amended) The method of claim 67, further comprising:

generating a second sensor signal from a second sensor located within the bolus disposed in the reticulorumen of said ruminant animal;

comparing [[a]] the second sensor signal from [[a]] the second sensor to a second pre-selected activation code having a second pre-selected activation match threshold; and

activating said bolus ~~upon generation of~~ when said first and second sensor signals from said first and second sensors ~~which by comparison to said first and said second pre-selected activation codes, respectively , exceeds~~ meet said first pre-selected activation match threshold and said second pre-selected activation match ~~thresholds~~ threshold respectively.

69. (Currently Amended) The method of ~~any one of claims~~ claim 67, further comprising orally administering said bolus to said ruminant animal.

70. (Currently Amended) The method of claim 69, further comprising:

generating a second sensor signal from a second sensor located within a bolus disposed in the reticulorumen of said ruminant animal;

comparing [[a]] the second sensor signal from [[a]] the second sensor to a second pre-selected activation code having a second pre-selected activation match threshold; and

activating said bolus ~~upon generation of~~ when said first and second sensor signals from said first and second sensors ~~which by comparison to said first and said second pre-selected activation codes exceeds~~ meet said first pre-selected activation match threshold and said second pre-selected activation match threshold respectively.

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 556 of 607

REMARKS

This paper is intended as a full and complete response to the Non-Final Office Action dated April 17, 2018 ("Office Action"), having a shortened statutory period set to expire on July 17, 2018. Applicant respectfully requests entry of the following amendments and consideration of the following remarks.

Claims 37, 39, 41-43, 45, 46, 49, 50, 52-55, and 64-70 are pending.

Claims 1-36, 38, 40, 44, 47, 48, 51 and 56-63 were previously canceled.

Claim 46 is canceled with this response.

Claims 37, 39, 41-43, 45, 52, 64, 66-69, and 70 are amended with this response.

Claim Objections

The Office Action objects to claims 41 and 70 for various formalities. Reconsideration is requested in light of the current amendments.

Claim Rejections – 35 U.S.C. § 112(b)

Claims 37, 39, 41-43, 45, 46, 49, 50, 52-55, and 64-70 stand rejected under 35 U.S.C. § 112(b) for allegedly failing to particularly point out and distinctly claim the what Applicant regards as the invention. Reconsideration of each of these rejections is respectfully requested in light of the current amendments.

Claim Rejections – 35 U.S.C. § 101

Claims 37, 39, 41, 42 and 64-66 stand rejected under 35 U.S.C. § 101 as directed to non-statutory subject matter.

As amended, claim 37 now affirmatively requires the steps of "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, said enabling or disabling of said one or more sensors coordinated with a plurality of life stages in a lifespan of said ruminant animal;" "generating a sensor signal from said one of more sensors when enabled, where said sensor signal varies based on a corresponding change in one or more physiological parameters of

said ruminant animal;" and "transmitting encoded physiological data indicative of the physiological parameters of said ruminant animal."

As amended, claim 64 now affirmatively requires the steps of "enabling or disabling one more sensors in said bolus by execution of a computer code contained in a non-transitory computer readable media communicatively coupled to a processor;" 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; "receiving a radio signal containing programming data;" and "re-programming said computer code contained within said non-transitory computer readable medium based on the radio signal containing programming data."

Each of amended claims 37 and 64 now omit the "capable of" language and more clearly falls into the patentable category of a process as each explicitly requires multiple steps.

Claim 45 stands rejected as directed to a judicial exception. With this response, the limitations of claim 46 have been incorporated into claim 45. As such, this rejection has been overcome.

Reconsideration of each of these rejections is respectfully requested at this time.

Claim Rejections – 35 U.S.C. § 102

Claims 37, 39, 41, 42 and 64-66 stand rejected as anticipated by U.S. Patent 6,371,927 (Brune).

With this response, the "capable of" language has been removed and claim 37 now affirmatively requires the steps of "enabling or disabling one more sensors in said bolus by execution of a computer code contained in a non-transitory computer readable media communicatively coupled to a processor, said enabling or disabling of said one or more sensors coordinated with a plurality of life stages in a lifespan of said ruminant animal;" "generating a sensor signal from said one of more sensors when enabled, where said sensor signal varies based on a corresponding change in one or more physiological parameters of said ruminant animal."

Brune fails to disclose the claimed combination of method steps, as arranged in the claim, and therefore fails to anticipate amended claim 37. Claims 39, 41, and 42 depend from claim 37 and include all the limitations thereof. As such, Brune fails to anticipate claims 39, 41, and 42 for these same reasons.

With this response, the "capable of" language has been removed and claim 64 now

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC
Page 558 of 607

affirmatively requires the steps of "enabling or disabling one more sensors in said bolus by execution of a computer code contained in a non-transitory computer readable media communicatively coupled to a processor;" 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;" receiving a radio signal containing programming data;" and "re-programming said computer code contained within said non-transitory computer readable medium based on the radio signal containing programming data."

Brune fails to disclose these claimed method steps, as arranged in the claim, and therefore fails to anticipate amended claim 64. Claims 65 and 66 depend from claim 64 and include all the limitations thereof. As such, Brune fails to anticipate claims 65, and 66 for these same reasons.

Reconsideration of the rejections under 35 U.S.C. § 102 is requested for at least the reasons set forth above. The absence of additional patentability arguments should not be construed as either a disclaimer of such arguments or that such arguments are believed to be meritless.

Conclusion

Examiner is invited to call the undersigned attorney for a telephonic interview, if such an interview can help expedite any remaining issues in this application. Applicant believes no additional fees are due at this time. In the event of any miscalculation or error, including fee calculations, the Commissioner is hereby authorized to deduct and/or refund any fees as might be appropriate from Deposit Account Number **50-5531**.

Dated this 17th day of July, 2018.

Respectfully Submitted,

By: /Ryan Christensen/

Ryan Christensen, USPTO Reg. No. 60,291
ATTORNEY FOR APPLICANT
22575 State Highway 6 South
Navasota, Texas 77868
(936) 870-3960 telephone
(936) 870-3963 facsimile
Customer Number: 87602

Electronic Acknowledgement Receipt	
EFS ID:	33202661
Application Number:	14738789
International Application Number:	
Confirmation Number:	8986
Title of Invention:	Calf Bolus
First Named Inventor/Applicant Name:	Nicholas P. Rettedal
Customer Number:	114662
Filer:	Ryan Scot Christensen/Justin Wood
Filer Authorized By:	Ryan Scot Christensen
Attorney Docket Number:	RT-22 (US-1)
Receipt Date:	17-JUL-2018
Filing Date:	12-JUN-2015
Time Stamp:	16:50:01
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		OAreply.pdf	144342 be8ba47c54e5a20b5f00c61ca57ecab25e98eb47	yes	10

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Amendment/Req. Reconsideration-After Non-Final Reject	1	1
	Claims	2	7
	Applicant Arguments/Remarks Made in an Amendment	8	10
Warnings:			
Information:			
	Total Files Size (in bytes):	144342	

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If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.
National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.
New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

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NOTICE OF ALLOWANCE AND FEE(S) DUE

114662 7590 11/07/2018
ST Reproductive Technologies, LLC
22575 State Highway 6 South
Navasota, TX 77868

EXAMINER
MARLEN, TAMMIE K

ART UNIT	PAPER NUMBER
3792	

DATE MAILED: 11/07/2018

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
14/738,789	06/12/2015	Nicholas P. Rettedal	RT-22 (US-1)	8986

TITLE OF INVENTION: Calf Bolus

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	SMALL	$500	$0	$0	$500	02/07/2019

THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. PROSECUTION ON THE MERITS IS CLOSED. THIS NOTICE OF ALLOWANCE IS NOT A GRANT OF PATENT RIGHTS. THIS APPLICATION IS SUBJECT TO WITHDRAWAL FROM ISSUE AT THE INITIATIVE OF THE OFFICE OR UPON PETITION BY THE APPLICANT. SEE 37 CFR 1.313 AND MPEP 1308.

THE ISSUE FEE AND PUBLICATION FEE (IF REQUIRED) MUST BE PAID WITHIN THREE MONTHS FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. THIS STATUTORY PERIOD CANNOT BE EXTENDED. SEE 35 U.S.C. 151. THE ISSUE FEE DUE INDICATED ABOVE DOES NOT REFLECT A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE IN THIS APPLICATION. IF AN ISSUE FEE HAS PREVIOUSLY BEEN PAID IN THIS APPLICATION (AS SHOWN ABOVE), THE RETURN OF PART B OF THIS FORM WILL BE CONSIDERED A REQUEST TO REAPPLY THE PREVIOUSLY PAID ISSUE FEE TOWARD THE ISSUE FEE NOW DUE.

HOW TO REPLY TO THIS NOTICE:

I. Review the ENTITY STATUS shown above. If the ENTITY STATUS is shown as SMALL or MICRO, verify whether entitlement to that entity status still applies.

If the ENTITY STATUS is the same as shown above, pay the TOTAL FEE(S) DUE shown above.

If the ENTITY STATUS is changed from that shown above, on PART B - FEE(S) TRANSMITTAL, complete section number 5 titled "Change in Entity Status (from status indicated above)".

For purposes of this notice, small entity fees are 1/2 the amount of undiscounted fees, and micro entity fees are 1/2 the amount of small entity fees.

II. PART B - FEE(S) TRANSMITTAL, or its equivalent, must be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). If you are charging the fee(s) to your deposit account, section "4b" of Part B - Fee(s) Transmittal should be completed and an extra copy of the form should be submitted. If an equivalent of Part B is filed, a request to reapply a previously paid issue fee must be clearly made, and delays in processing may occur due to the difficulty in recognizing the paper as an equivalent of Part B.

III. All communications regarding this application must give the application number. Please direct all communications prior to issuance to Mail Stop ISSUE FEE unless advised to the contrary.

IMPORTANT REMINDER: Maintenance fees are due in utility patents issuing on applications filed on or after Dec. 12, 1980. It is patentee's responsibility to ensure timely payment of maintenance fees when due. More information is available at www.uspto.gov/PatentMaintenanceFees.

PTOL-85 (Rev. 02/11)

PART B - FEE(S) TRANSMITTAL

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By mail, send to: **Mail Stop ISSUE FEE**
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

By fax, send to: **(571)-273-2885**

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

114662 7590 11/07/2018
ST Reproductive Technologies, LLC
22575 State Highway 6 South
Navasota, TX 77868

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being transmitted to the USPTO via EFS-Web or by facsimile to (571) 273-2885, on the date indicated below.

(Typed or printed name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
14/738,789	06/12/2015	Nicholas P. Rettedal	RT-22 (US-1)	8986

TITLE OF INVENTION: Calf Bolus

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	SMALL	$500	$0	$0	$500	02/07/2019

EXAMINER	ART UNIT	CLASS-SUBCLASS
MARLEN, TAMMIE K	3792	600-301000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).

❑ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.

❑ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-09 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list

(1) The names of up to 3 registered patent attorneys or agents OR, alternatively,

(2) The name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

1 _____

2 _____

3 _____

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document must have been previously recorded, or filed for recordation, as set forth in 37 CFR 3.11 and 37 CFR 3.81(a). Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE (B) RESIDENCE: (CITY and STATE OR COUNTRY)

Please check the appropriate assignee category or categories (will not be printed on the patent) : ❑ Individual ❑ Corporation or other private group entity ❑ Government

4a. Fees submitted: ❑Issue Fee ❑Publication Fee (if required) ❑Advance Order - # of Copies _____

4b. Method of Payment: *(Please first reapply any previously paid fee shown above)*

❑ Electronic Payment via EFS-Web ❑ Enclosed check ❑ Non-electronic payment by credit card (Attach form PTO-2038)

❑ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment to Deposit Account No. _____

5. **Change in Entity Status** (from status indicated above)

❑ Applicant certifying micro entity status. See 37 CFR 1.29 — NOTE: Absent a valid certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.

❑ Applicant asserting small entity status. See 37 CFR 1.27 — NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.

❑ Applicant changing to regular undiscounted fee status. — NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

NOTE: This form must be signed in accordance with 37 CFR 1.31 and 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature _____ Date _____

Typed or printed name _____ Registration No. _____

PTOL-85 Part B (08-18) Approved for use through 01/31/2020 OMB 0651-0033 U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
14/738,789	06/12/2015	Nicholas P. Rettedal	RT-22 (US-1)	8986

114662 7590 11/07/2018
ST Reproductive Technologies, LLC
22575 State Highway 6 South
Navasota, TX 77868

EXAMINER	
MARLEN, TAMMIE K	

ART UNIT	PAPER NUMBER
3792	

DATE MAILED: 11/07/2018

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)
(Applications filed on or after May 29, 2000)

The Office has discontinued providing a Patent Term Adjustment (PTA) calculation with the Notice of Allowance.

Section 1(h)(2) of the AIA Technical Corrections Act amended 35 U.S.C. 154(b)(3)(B)(i) to eliminate the requirement that the Office provide a patent term adjustment determination with the notice of allowance. See Revisions to Patent Term Adjustment, 78 Fed. Reg. 19416, 19417 (Apr. 1, 2013). Therefore, the Office is no longer providing an initial patent term adjustment determination with the notice of allowance. The Office will continue to provide a patent term adjustment determination with the Issue Notification Letter that is mailed to applicant approximately three weeks prior to the issue date of the patent, and will include the patent term adjustment on the patent. Any request for reconsideration of the patent term adjustment determination (or reinstatement of patent term adjustment) should follow the process outlined in 37 CFR 1.705.

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at 1-(888)-786-0101 or (571)-272-4200.

PTOL-85 (Rev. 02/11)

OMB Clearance and PRA Burden Statement for PTOL-85 Part B

The Paperwork Reduction Act (PRA) of 1995 requires Federal agencies to obtain Office of Management and Budget approval before requesting most types of information from the public. When OMB approves an agency request to collect information from the public, OMB (i) provides a valid OMB Control Number and expiration date for the agency to display on the instrument that will be used to collect the information and (ii) requires the agency to inform the public about the OMB Control Number's legal significance in accordance with 5 CFR 1320.5(b).

The information collected by PTOL-85 Part B is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 30 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450. Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Notice of Allowability	Application No. 14/738,789	Applicant(s) RETTEDAL ET AL.	
	Examiner Tammie K. Marlen	Art Unit 3792	AIA (First Inventor to File) Status Yes

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to *the amendment filed on July 17, 2018*.
   ☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on_____.
2. ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.
3. ☒ The allowed claim(s) is/are *37,39,41-43,45,49,50,52-55 and 64-70*. As a result of the allowed claim(s), you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov.
4. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

   Certified copies:

   a) ☐ All b) ☐ Some *c) ☐ None of the:
      1. ☐ Certified copies of the priority documents have been received.
      2. ☐ Certified copies of the priority documents have been received in Application No. _____ .
      3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

   * Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
   ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.

   Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).
6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☐ Notice of References Cited (PTO-892)
2. ☐ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date _____
3. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
4. ☐ Interview Summary (PTO-413), Paper No./Mail Date _____ .
5. ☐ Examiner's Amendment/Comment
6. ☐ Examiner's Statement of Reasons for Allowance
7. ☐ Other _____.

/Tammie K Marlen/
Primary Examiner, Art Unit 3792

Bibliographic Data

Application No: 14/738,789

Foreign Priority claimed: ○ Yes ◉ No

35 USC 119 (a-d) conditions met: ☐ Yes ☑ No ☐ Met After Allowance

Verified and Acknowledged: /TAMMIE K MARLEN/ (Examiner's Signature) | (Initials)

Title: Calf Bolus

FILING or 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
06/12/2015	600	3792	RT-22 (US-1)
RULE			

APPLICANTS

ST Reproductive Technologies, LLC, Navasota, TX, UNITED STATES

INVENTORS

Nicholas P. Rettedal Loveland, CO, UNITED STATES

Stephen M. Weilnau Greeley, CO, UNITED STATES

Scott R. Cockroft Greeley, CO, UNITED STATES

Joseph Janus IV, Loveland, CO, UNITED STATES

CONTINUING DATA

FOREIGN APPLICATIONS

IF REQUIRED, FOREIGN LICENSE GRANTED**

06/23/2015

**** SMALL ENTITY ****

STATE OR COUNTRY

UNITED STATES

ADDRESS

ST Reproductive Technologies, LLC
22575 State Highway 6 South
Navasota, TX 77868
UNITED STATES

FILING FEE RECEIVED

$730

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	14738789	RETTEDAL ET AL.
	Examiner	Art Unit
	TAMMIE K MARLEN	3792

CPC- SEARCHED		
Symbol	Date	Examiner
A61B 5/073, 076, 0031	10/27/2016	TKH
A61D 7/00	10/27/2016	TKH
A01K 11/006-008	10/27/2016	TKH
Updated above	7/3/2017	TKH
Updated above	4/12/2018	TKH
Updated above	11/2/2018	TKM

CPC COMBINATION SETS - SEARCHED		
Symbol	Date	Examiner

US CLASSIFICATION SEARCHED			
Class	Subclass	Date	Examiner

* See search history printout included with this form or the SEARCH NOTES box below to determine the scope of the search.

SEARCH NOTES		
Search Notes	Date	Examiner
Inventor name search	10/27/2016	TKH
Text-limited search -- see search history printout	10/27/2016	TKH
Updated above	7/3/2017	TKH
Updated above	4/12/2018	TKH
Updated above	11/2/2018	TKM

INTERFERENCE SEARCH

	/TAMMIE K MARLEN/ Primary Examiner.Art Unit 3792

US Class/ CPC Symbol	US Subclass / CPC Group	Date	Examiner
	PGPUB text search -- see interference search printout	11/2/2018	TKM

	/TAMMIE K MARLEN/ Primary Examiner.Art Unit 3792

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	5172	(lifespan$6 (life adj span$6) (life near3 stag$6) puberty) with (enabl$6 disabl$6 ((turn turned turning) adj ("on" "off")))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2018/11/02 14:02
L2	4205	L1 and @ad<="20150612"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2018/11/02 14:02
L3	162	(mouth oral$6 swallow$6 bolus reticulorumen) and (ruminant animal) and 2	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2018/11/02 14:13
L4	378	(ruminant animal) and 2	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2018/11/02 14:13
L5	3827	2 not 4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2018/11/02 14:14
L6	426	(ruminant animal cattle cow steer bull buffalo goat sheep deer antelope giraffe yak okapi chevotain) and 2	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2018/11/02 14:16
L25	429	(US-20110153221-$ or US-20100153016-$ or US-20020022772-$ or US-20030013942-$ or US-20030139655-$ or US-20160205894-$ or US-20050090718-$ or US-20160360994-$ or US-20050032034-$ or US-20090132465-$ or US-20040039258-$ or US-20150282460-$ or US-20090254327-$ or US-20060147947-$ or US-20030135096-$ or	US-PGPUB; USPAT; FPRS; EPO; DERWENT	OR	ON	2018/11/02 14:16

		US-20120303286-$ or US-20110093298-$ or US-20110246405-$ or US-20100304396-$ or US-20120185175-$ or US-20110082847-$ or US-20110020404-$ or US-20020061314-$ or US-20100278846-$ or US-20060093627-$ or US-20060068414-$).did. or (US-20070196850-$ or US-20070087021-$ or US-20110171185-$ or US-20110286978-$ or US-20150106962-$ or US-20050226897-$ or US-20080216185-$ or US-20130004946-$ or US-20090106852-$ or US-20030082597-$ or US-20090223457-$ or US-20110253052-$ or US-20020124805-$ or US-20060051767-$ or US-20100015043-$ or US-20100175627-$ or US-20060018911-$ or US-20040242518-$ or US-20090124567-$ or US-20130160713-$ or US-20140060440-$ or US-20150034015-$ or US-20050005866-$ or US-20030111018-$ or US-20090226586-$ or US-20110067636-$ or US-20110171353-$).did. or (US-20040083979-$ or US-20050260311-$ or US-20150132853-$ or US-20080134980-$ or US-20130104253-$ or US-20020001842-$ or US-20040199935-$ or US-20090255001-$ or US-20060032449-$ or US-20150078995-$ or US-20110191869-$ or US-20120060229-$ or US-20180139924-$ or US-20150109128-$ or US-20140023684-$ or US-20150109104-$ or US-20150109112-$ or US-20150112885-$ or US-20150116106-$ or US-20150116107-$ or US-20150116108-$ or US-20150116109-$ or US-20150120015-$ or US-20150120596-$ or US-20150120598-$ or US-20150127712-$ or US-20150145643-$).did. or (US-20150154850-$ or US-20150156030-$ or US-20150156031-$ or US-20100173024-$ or US-20140079836-$ or US-20050008617-$ or US-20030175954-$ or US-20040248296-$ or US-20090303052-$ or US-20150053366-$ or US-20150061859-$ or US-20080107656-$ or US-20140242140-$ or US-20040009273-$ or US-20050013776-$ or US-20130046005-$ or US-20060240046-$ or US-20080131461-$ or US-20090285879-$ or US-20110081383-$ or US-20120014994-$ or US-20160252530-$ or US-20170145398-$ or US-20020038464-$ or US-20050033735-$ or US-20070099179-$ or US-20080109418-$).did. or (US-20110189306-$ or US-20120069131-$ or US-20060121448-$ or US-20090148426-$ or US-20110214191-$ or US-20120136403-$ or US-20150225718-$ or US-20160046934-$ or US-20080177685-$ or US-20090234109-$ or US-20150079069-$ or US-20160158386-$ or US-20030064494-$ or				

		US-20140235547-$ or US-20050233435-$ or US-20100210004-$ or US-20110097771-$ or US-20110294876-$ or US-20140380523-$ or US-20160190844-$ or US-20040005582-$ or US-20070105796-$ or US-20070275010-$ or US-20020034499-$ or US-20030206863-$ or US-20040126321-$ or US-20050238585-$).did. or (US-20110145946-$ or US-20150060108-$ or US-20150176021-$ or US-20150294325-$ or US-20030225718-$ or US-20040202667-$ or US-20070117035-$ or US-20070196757-$ or US-20090029407-$ or US-20090220960-$ or US-20100025238-$ or US-20100030045-$ or US-20100112553-$ or US-20110217730-$ or US-20130280653-$ or US-20140275899-$ or US-20140289536-$ or US-20150159191-$ or US-20160199419-$ or US-20170112866-$ or US-20170216339-$ or US-20050271591-$ or US-20070011109-$ or US-20070240161-$ or US-20070269381-$ or US-20080306571-$ or US-20090144129-$).did. or (US-20090144130-$ or US-20090144144-$ or US-20090144168-$ or US-20090144801-$ or US-20090150405-$ or US-20090254148-$ or US-20100048670-$ or US-20110045584-$ or US-20120067592-$ or US-20120282685-$ or US-20120282686-$ or US-20120282687-$ or US-20130295138-$ or US-20150248614-$ or US-20150297506-$ or US-20150369482-$ or US-20160362151-$ or US-20040177002-$ or US-20050079608-$ or US-20060102096-$ or US-20060118710-$ or US-20060197653-$ or US-20070043632-$ or US-20070083144-$ or US-20080048406-$ or US-20090132003-$ or US-20090311680-$).did. or (US-20100025948-$ or US-20100070345-$ or US-20100208998-$ or US-20110092875-$ or US-20110171688-$ or US-20110221260-$ or US-20110258788-$ or US-20120131755-$ or US-20130267811-$ or US-20130267812-$ or US-20130267813-$ or US-20140154690-$ or US-20150185207-$ or US-20160157760-$ or US-20030170783-$ or US-20040117864-$ or US-20040234551-$ or US-20050103619-$ or US-20060157426-$ or US-20080254417-$ or US-20090054473-$ or US-20090068625-$ or US-20090127204-$ or US-20090227931-$ or US-20100043632-$ or US-20100085774-$ or US-20110000126-$).did. or (US-20120255420-$ or US-20130057665-$ or US-20130142872-$ or US-20130173494-$ or US-20130178424-$ or US-20130308675-$ or US-20140009561-$ or US-20140073574-$ or US-20150051234-$ or US-20150056374-$					

		or US-20150190927-$ or US-20150315124-$ or US-20150343002-$ or US-20160192600-$ or US-20170044308-$ or US-20170227665-$ or US-20170322333-$).did. or (US-7970552-$ or US-7873482-$ or US-6537213-$ or US-7029441-$ or US-6287254-$ or US-7797145-$ or US-6730023-$ or US-8060354-$ or US-7552039-$ or US-8224587-$ or US-8234099-$ or US-7548839-$ or US-7865343-$ or US-7134995-$ or US-4481137-$ or US-6269770-$ or US-6306385-$ or US-7622271-$ or US-9980471-$ or US-6699654-$ or US-6536373-$ or US-6319708-$ or US-6526913-$ or US-7819083-$ or US-8322306-$ or US-4624917-$).did. or (US-7575883-$ or US-7771961-$ or US-8573157-$ or US-8899178-$ or US-6976450-$ or US-6637368-$ or US-8015944-$ or US-6766765-$ or US-9131707-$ or US-9580683-$ or US-5921200-$ or US-7530328-$ or US-5087712-$ or US-5854067-$ or US-5891717-$ or US-7134402-$ or US-8993332-$ or US-9950002-$ or US-9953514-$ or US-5718894-$ or US-9600645-$ or US-9626841-$ or US-9640055-$ or US-9652912-$ or US-9711036-$ or US-9881474-$ or US-9959727-$).did. or (US-9960929-$ or US-9978238-$ or US-6495355-$ or US-5874304-$ or US-5968750-$ or US-6020192-$ or US-7795026-$ or US-9616110-$ or US-7887812-$ or US-8877213-$ or US-8952048-$ or US-9867853-$ or US-7001735-$ or US-9183560-$ or US-9499817-$ or US-9029524-$ or US-9518263-$ or US-6068261-$ or US-5558094-$ or US-5891725-$ or US-8847008-$ or US-9714430-$ or US-6156292-$ or US-6620404-$ or US-8012457-$ or US-8586005-$ or US-6485950-$).did. or (US-6875420-$ or US-7037697-$ or US-9018445-$ or US-9783818-$ or US-5550157-$ or US-5611344-$ or US-5853698-$ or US-5877195-$ or US-6132699-$ or US-7156049-$ or US-7257563-$ or US-7811733-$ or US-7951582-$ or US-8383797-$ or US-8685613-$ or US-8700114-$ or US-9449191-$ or US-9594611-$ or US-10092589-$ or US-5837221-$ or US-6821780-$ or US-8261277-$ or US-8309698-$ or US-8569051-$ or US-8617875-$ or US-8628956-$ or US-9855985-$).did. or (US-4352883-$ or US-4391909-$ or US-5393524-$ or US-5393781-$ or US-5409688-$ or US-5573751-$ or US-5897879-$ or US-5999908-$ or US-7133834-$ or US-7154084-$ or US-7222078-$ or US-					

		7620565-$ or US-7621543-$ or US-7939008-$ or US-7973155-$ or US-8009918-$ or US-8348285-$ or US-8444586-$ or US-8739862-$ or US-9448145-$ or US-9615779-$ or US-9843388-$ or US-9931065-$ or US-4421187-$ or US-5299046-$ or US-5792932-$).did. or (US-6523027-$ or US-6601233-$ or US-6609128-$ or US-6633878-$ or US-6704873-$ or US-6718535-$ or US-7100195-$ or US-7120232-$ or US-7182843-$ or US-7253333-$ or US-7547391-$ or US-8398917-$ or US-8426710-$ or US-8623819-$ or US-8714803-$ or US-8865650-$ or US-8994776-$ or US-9074316-$ or US-9144324-$ or US-9303233-$ or US-9440356-$ or US-9592231-$).did. or (CN-103125436-$ or RU-2554149-$ or RU-2013130910-$ or RU-2553883-$ or RU-2013130617-$ or RU-2554147-$ or RU-2013131397-$ or CA-2360651-$ or EP-1927349-$ or JP-WO2007034852-$ or EP-1927349-$ or EP-0605477-$ or EP-0605477-$ or CN-103749539-$ or WO-9621421-$ or CN-101531177-$).did. or (EP-1927349-$ or WO-9621421-$).did. or (WO-0100650-$ or WO-0060929-$ or US-20120303286-$ or CN-103125436-$ or WO-2007012541-$ or WO-2016179626-$ or CA-2559967-$ or RU-2554149-$ or WO-2015077005-$ or RU-2553883-$ or RU-2554147-$ or WO-2015021513-$ or US-20110167507-$ or WO-2015004499-$ or KR-2005017213-$ or JP-2009106432-$ or KR-2016131615-$ or DE-102006036215-$ or US-7389957-$ or BR-201104715-$).did.				
L26	426	L1 and 25	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2018/11/02 14:16
L27	2	("2016/0360994").URPN.	USPAT	OR	ON	2018/11/02 14:52
L49	29	("20040133131" | "20050134452" | "20050145187" | "20080104209" | "20080236500" | "20090182207" | "20110212782" | "20110301437" | "20120068848" | "20130197323" | "20130231188" | "20140368338" | "5482008" | "5818354" | "5963132" | "5984875" | "6059733" | "6099482" | "6371927" | "7441515" | "7962096" | "8001168" | "8545436" | "8547248" | "8588887" | "8640712" | "8694091" | "8771201" | "8823515" | "us-" | "us-" | "us-" | "us-" | "us-" | "us-" | "us-" | "us-" | "us-" | "us-" | "us-" | "us-" | "us-" | "us-" | "us-" | "us-" | "us-" | "us-" | "us-" | "us-" | "us-").PN.	US-PGPUB; USPAT	OR	ON	2018/11/02 14:56
L50	1	("6085751").PN.	US-	OR	ON	2018/11/02

			PGPUB; USPAT			14:56
L51	6	("20040155782" | "20070156016" | "20090187392" | "20100030025" | "5532692" | "6702185").PN.	US-PGPUB; USPAT	OR	ON	2018/11/02 14:56
L52	4802	A61B5/073.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2018/11/02 14:56
L53	3866	A61B5/076.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2018/11/02 14:56
L54	13657	A61B5/0031.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2018/11/02 14:56
L55	4196	A61D7/00.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2018/11/02 14:56
L56	3837	A01K11/006.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2018/11/02 14:56
L57	481	A01K11/007.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2018/11/02 14:56
L58	1176	A01K11/008.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2018/11/02 14:56
L59	36	L49 L50 L51	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2018/11/02 14:56

L64	766	("20010035902" | "20010051766" | "20020107444" | "20020128542" | "20020138009" | "20020156356" | "20020165592" | "20020173718" | "20020177779" | "20020188323" | "20020193669" | "20030013370" | "20030018280" | "20030043263" | "20030045790" | "20030077223" | "20030114742" | "20030139661" | "20030174208" | "20030195400" | "20030195415" | "20030214579" | "20030216622" | "20040032187" | "20040032957" | "20040054278" | "20040073087" | "20040109488" | "20040114856" | "20040122315" | "20040133131" | "20040162501" | "20040171915" | "20040181155" | "20040193029" | "20040199222" | "20040202339" | "20040204744" | "20040236182" | "20040258328" | "20050025368" | "20050043634" | "20050065441" | "20050075555" | "20050075559" | "20050088299" | "20050110881" | "20050143624" | "20050143644" | "20050148816" | "20050159643" | "20050159789" | "20050187433" | "20050222490" | "20050228259" | "20050256430" | "20050266074" | "20050272974" | "20050281446" | "20060004256" | "20060009819" | "20060030754" | "20060045118" | "20060074275" | "20060092908" | "20060116584" | "20060132599" | "20060147037" | "20060155174" | "20060158512" | "20060173361" | "20060177291" | "20060184039" | "20060192889" | "20060193505" | "20060231110" | "20060252371" | "20070002604" | "20070043310" | "20070060979" | "20070078335" | "20070088194" | "20070123772" | "20070161851" | "20070213659" | "20070260133" | "20070282156" | "20080077440" | "20080213355" | "20080236500" | "20080316020" | "20090048498" | "20090187392").PN. OR ("20090281395" | "20100016756" | "20100045309" | "3144017" | "3216411" | "3229684" | "3340866" | "3841756" | "3893111" | "3934584" | "3948249" | "4165033" | "4206766" | "4247758" | "4262632" | "4305402" | "4333072" | "4399821" | "4411274" | "4471354" | "4493290" | "4537150" | "4695435" | "4750490" | "4784155" | "4844076" | "4854328" | "4865044" | "4895165" | "4987897" | "4992794" | "5024221" | "5025550" | "5111799" | "5211129" | "5217011" | "5223851" | "5241924" | "5251326" | "5265603" | "5267033" | "5279607" | "5281855" | "5329498" | "5341149" | "5395366" | "5415181" | "5481262" | "5482008" | "5499626" | "5522865" |	US-PGPUB; USPAT; USOCR	OR	ON	2018/11/02 14:56

		"5528557" | "5542431" | "5559757" | "5572410" | "5583432" | "5604531" | "5634432" | "5653239" | "5697384" | "5741311" | "5744898" | "5792048" | "5794226" | "5796827" | "5833603" | "5853005" | "5872516" | "5984875" | "6012415" | "6059733" | "6076016" | "6099482" | "6104913" | "6115636" | "6198965" | "6211799" | "6239724" | "6240312" | "6371927" | "6380858" | "6428469" | "6431175" | "6486588" | "6504286" | "6577893" | "6584348" | "6597320" | "6607301" | "6628989" | "6702755" | "6709387" | "6720709" | "6754472" | "6764446" | "6836377" | "6845190" | "6847844" | "6867753" | "6904308" | "6934573" | "6936003" | "6939292" | "6944316" | "6950690" | "6984205" | "7009634" | "7024248" | "7039453" | "7076284" | "7104952" | "7109859" | "7118529" | "7118531" | "7119814" | "7122001" | "7135342" | "7140766" | "7142908" | "7160258" | "7161164" | "7195588" | "7200253" | "7201872").PN. OR ("7245954" | "7295226" | "7307544" | "7336833" | "7354397" | "7938775" | "8517961" | "D321069").PN. OR ("2004/0133131" | "2007/0156016" | "2008/0236500" | "2009/0182207" | "2009/0187392" | "2010/0030025" | "5482008" | "5963132" | "5984875" | "6371927" | "8588887" | "8640712" | "8694091").URPN.				
L65	28615	(L52 L53 L54) or (L55 L56 L57 L58)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2018/11/02 14:56
L66	10	(L59 L64 L65) and 1	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2018/11/02 14:56
S1	0	(("BELLA") near3 ("TECHNOLOGIES") near3 ("LLC")).AANM.	USPAT	OR	ON	2016/10/27 08:47
S2	0	(("RETTEDAL") near3 ("Nicholas")).INV.	EPO; JPO; DERWENT	OR	ON	2016/10/27 08:47
S3	4	(("RETTEDAL") near3 ("Nicholas")).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2016/10/27 08:47
S4	0	(("WEILNAU") near3 ("Stephen")).INV.	EPO; JPO; DERWENT	OR	ON	2016/10/27 08:47
S5	4	(("WEILNAU") near3 ("Stephen")).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2016/10/27 08:47

S6	0	(("COCKROFT") near3 ("Scott")).INV.	EPO; JPO; DERWENT	OR	ON	2016/10/27 08:47
S7	4	(("COCKROFT") near3 ("Scott")).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2016/10/27 08:47
S8	1	(("JANUS") near3 ("Joseph")).INV.	EPO; JPO; DERWENT	OR	ON	2016/10/27 08:47
S9	3	(("JANUS") near3 ("Joseph")).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2016/10/27 08:47
S10	29	("20040133131" | "20050134452" | "20050145187" | "20080104209" | "20080236500" | "20090182207" | "20110212782" | "20110301437" | "20120068848" | "20130197323" | "20130231188" | "20140368338" | "5482008" | "5818354" | "5963132" | "5984875" | "6059733" | "6099482" | "6371927" | "7441515" | "7962096" | "8001168" | "8545436" | "8547248" | "8588887" | "8640712" | "8694091" | "8771201" | "8823515" | "us-" | "us-" | "us-" | "us-" | "us-" | "us-" | "us-" | "us-" | "us-" | "us-" | "us-" | "us-" | "us-" | "us-" | "us-" | "us-" | "us-" | "us-" | "us-" | "us-").PN.	US-PGPUB; USPAT	OR	ON	2016/10/27 08:48
S12	1	("6085751").PN.	US-PGPUB; USPAT	OR	ON	2016/10/27 08:48
S13	6	("20040155782" | "20070156016" | "20090187392" | "20100030025" | "5532692" | "6702185").PN.	US-PGPUB; USPAT	OR	ON	2016/10/27 08:59
S14	3941	A61B5/073.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2016/10/27 09:25
S15	3064	A61B5/076.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2016/10/27 09:25
S16	11236	A61B5/0031.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2016/10/27 09:26
S17	3306	A61D7/00.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO;	OR	ON	2016/10/27 09:26

			DERWENT			
S18	2920	A01K11/006.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2016/10/27 09:26
S19	399	A01K11/007.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2016/10/27 09:26
S20	819	A01K11/008.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2016/10/27 09:26
S21	205	(S14 S15 S16) and (S17 S18 S19 S20)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2016/10/27 09:26
S22	36	S10 S12 S13	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2016/10/27 09:26
S23	691	("20010035902" | "20010051766" | "20020107444" | "20020128542" | "20020138009" | "20020156356" | "20020165592" | "20020173718" | "20020177779" | "20020188323" | "20020193669" | "20030013370" | "20030018280" | "20030043263" | "20030045790" | "20030077223" | "20030114742" | "20030139661" | "20030174208" | "20030195400" | "20030195415" | "20030214579" | "20030216622" | "20040032187" | "20040032957" | "20040054278" | "20040073087" | "20040109488" | "20040114856" | "20040122315" | "20040133131" | "20040162501" | "20040171915" | "20040181155" | "20040193029" | "20040199222" | "20040202339" | "20040204744" | "20040236182" | "20040258328" | "20050025368" | "20050043634" | "20050065441" | "20050075555" | "20050075559" | "20050088299" | "20050110881" | "20050143624" | "20050143644" | "20050148816" | "20050159643" | "20050159789" |	US-PGPUB; USPAT; USOCR	OR	ON	2016/10/27 09:31

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S24	22984	(S14 S15 S16) or (S17 S18 S19 S20)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2016/10/27 09:44
S25	2333	(S22 S23 S24) and ((power near3 manage$6) (sens$6 with (((turn turned turning) near3 ("on" "off")) enabl$6 disabl$6)))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2016/10/27 09:46
S26	1246	S25 and (mouth oral$6 swallow$6 animal)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2016/10/27 09:47
S27	1245	S26 and sens$6	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2016/10/27 09:47
S28	273	(S22 S23) and ((power near3 manage$6) (sens$6 with (((turn turned turning) near3 ("on" "off")) enabl$6 disabl$6)))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2016/10/27 09:48
S29	281	(S21 S22 S23) and ((power near3 manage$6) (sens$6 with (((turn turned turning) near3 ("on" "off")) enabl$6 disabl$6)))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2016/10/27 09:48
S30	93	(S21 S22 S23) and ((power near3 manage$6) (sens$6 with (((turn turned turning) near3 ("on" "off")) (enabl$6 and disabl$6))))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2016/10/27 09:50
S31	353	(S22 S23 S24) and ((power near3 manage$6))	US-PGPUB; USPAT; USOCR; FPRS;	OR	ON	2016/10/27 09:51

			EPO; JPO; DERWENT			
S32	1460	(mouth oral$6 swallow$6) and animal and (sens$6 with (((turn turned turning) near3 ("on" "off")) (enabl$6 and disabl$6)))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2016/10/27 09:56
S33	9	(S22 S23) and S32	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2016/10/27 09:57
S34	0	(S21) and S32	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2016/10/27 09:57
S35	85	(S24) and S32	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2016/10/27 09:57
S36	86	S33 S35	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2016/10/27 09:57
S37	86	(US-20020050248-$ or US-20030188689-$ or US-20050000458-$ or US-20080270173-$ or US-20120158463-$ or US-20080190369-$ or US-20130151310-$ or US-20090031961-$ or US-20090307111-$ or US-20110161125-$ or US-20090031960-$ or US-20070131175-$ or US-20070157888-$ or US-20090030279-$ or US-20080146871-$ or US-20140309503-$ or US-20090030293-$ or US-20130013031-$ or US-20080114224-$ or US-20080112885-$ or US-20140200418-$ or US-20080161660-$ or US-20140343378-$ or US-20090131768-$ or US-20090131769-$ or US-20090131776-$).did. or (US-20090131777-$ or US-20090137886-$ or US-20090137887-$ or US-20090143659-$ or US-20090178459-$ or US-20090182217-$ or US-20140058235-$ or US-20140088391-$ or US-20160198978-$ or US-20020132226-$ or US-20080269664-$ or US-20130043975-$ or US-20130043993-$ or US-20130043974-$ or US-20130043991-$ or US-	US-PGPUB; USPAT	OR	ON	2016/10/27 09:57

		20130046153-$ or US-20130046477-$ or US-20150297116-$ or US-20110295079-$ or US-20040032957-$ or US-20040171915-$ or US-20150374262-$ or US-20110130658-$).did. or (US-6805075-$ or US-6135055-$ or US-7726258-$ or US-6516746-$ or US-7464666-$ or US-5673647-$ or US-6318289-$ or US-8028657-$ or US-7464667-$ or US-7836849-$ or US-8261694-$ or US-7827934-$ or US-8474405-$ or US-7748345-$ or US-7347161-$ or US-7607405-$ or US-6000361-$ or US-8588887-$ or US-8512241-$ or US-9173592-$ or US-8287453-$ or US-8886273-$ or US-8275438-$ or US-8298142-$ or US-8447376-$ or US-8449464-$).did. or (US-8478377-$ or US-8562528-$ or US-8626257-$ or US-8615284-$ or US-8617058-$ or US-8816814-$ or US-8599009-$ or US-8723640-$ or US-8514067-$ or US-8663105-$ or US-7118529-$).did.				
S38	86	S37 and (sens$6 with (((turn turned turning) near3 ("on" "off")) (enabl$6 and disabl$6)))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2016/10/27 09:58
S39	25	(US-20100030025-$ or US-20090187392-$ or US-20090182207-$ or US-20080236500-$ or US-20070156016-$ or US-20040133131-$ or US-20090048498-$ or US-20070161851-$ or US-20070088194-$ or US-20090171178-$ or US-20090030279-$ or US-20080269664-$ or US-20090030293-$).did. or (US-8694091-$ or US-8640712-$ or US-8588887-$ or US-6371927-$ or US-5984875-$ or US-5963132-$ or US-5482008-$ or US-9420941-$ or US-8979758-$ or US-8195304-$ or US-8512241-$ or US-8663105-$).did.	US-PGPUB; USPAT	OR	ON	2016/10/27 10:13
S40	13	S39 and ((power near3 manage$6) (sens$6 with (((turn turned turning) near3 ("on" "off")) (enabl$6 and disabl$6))))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2016/10/27 10:14
S41	29	("20040133131" | "20050134452" | "20050145187" | "20080104209" | "20080236500" | "20090182207" | "20110212782" | "20110301437" | "20120068848" | "20130197323" | "20130231188" | "20140368338" | "5482008" | "5818354" | "5963132" | "5984875" | "6059733" | "6099482" | "6371927" | "7441515" | "7962096" | "8001168" | "8545436" | "8547248" | "8588887" | "8640712" | "8694091" | "8771201" | "8823515" | "us-" | "us-" |	US-PGPUB; USPAT	OR	ON	2016/10/27 17:41

		"us-" | "us-" | "us-" | "us-" | "us-" | "us-" | "us-" | "us-" | "us-" | "us-" | "us-" | "us-" | "us-" | "us-" | "us-" | "us-" | "us-").PN.				
S42	1	("6085751").PN.	US-PGPUB; USPAT	OR	ON	2016/10/27 17:41
S43	6	("20040155782" | "20070156016" | "20090187392" | "20100030025" | "5532692" | "6702185").PN.	US-PGPUB; USPAT	OR	ON	2016/10/27 17:41
S44	3941	A61B5/073.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2016/10/27 17:41
S45	3064	A61B5/076.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2016/10/27 17:41
S46	11236	A61B5/0031.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2016/10/27 17:41
S47	3306	A61D7/00.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2016/10/27 17:41
S48	2920	A01K11/006.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2016/10/27 17:41
S49	399	A01K11/007.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2016/10/27 17:41
S50	819	A01K11/008.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2016/10/27 17:41
S51	36	S41 S42 S43	US-PGPUB;	OR	ON	2016/10/27 17:41

			USPAT; USOCR; FPRS; EPO; JPO; DERWENT			
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S54	355	(S51 S52 S53) and ((power energy) near3 (remain$6 left))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2016/10/27 17:41
S55	0	(("BELLA") near3 ("TECHNOLOGIES") near3 ("LLC")).AANM.	USPAT	OR	ON	2016/10/27 17:52
S56	0	(("RETTEDAL") near3 ("Nicholas")).INV.	EPO; JPO; DERWENT	OR	ON	2016/10/27 17:52
S57	4	(("RETTEDAL") near3 ("Nicholas")).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2016/10/27 17:52
S58	0	(("WEILNAU") near3 ("Stephen")).INV.	EPO; JPO; DERWENT	OR	ON	2016/10/27 17:52

S59	4	(("WEILNAU") near3 ("Stephen")).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2016/10/27 17:52
S60	0	(("COCKROFT") near3 ("Scott")).INV.	EPO; JPO; DERWENT	OR	ON	2016/10/27 17:52
S61	4	(("COCKROFT") near3 ("Scott")).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2016/10/27 17:52
S62	1	(("JANUS") near3 ("Joseph")).INV.	EPO; JPO; DERWENT	OR	ON	2016/10/27 17:52
S63	3	(("JANUS") near3 ("Joseph")).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2016/10/27 17:52
S64	8	(S55 S56 S57 S58 S59 S60 S61 S62 S63)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2016/10/27 17:52
S65	0	S64 and ((power energy) near3 (remain$6 left))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2016/10/27 17:52
S67	4234	animal with (lifespan$6 (life adj span$6) (life near3 stag$6))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2017/06/06 14:52
S68	1297	(animal with (lifespan$6 (life adj span$6) (life near3 stag$6))) same (power control controlled controlling controller sens$6 coordin$8)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2017/06/06 15:00
S69	1297	(animal with (lifespan$6 (life adj span$6) (life near3 stag$6))) same (power control controlled controlling controller sens$6 coordin$8)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2017/06/06 15:01
S70	29	("20040133131" | "20050134452" | "20050145187" | "20080104209" | "20080236500" | "20090182207" | "20110212782" | "20110301437" | "20120068848" | "20130197323" | "20130231188" | "20140368338" | "5482008" | "5818354" | "5963132" | "5984875" | "6059733" | "6099482" | "6371927" | "7441515" | "7962096" |	US-PGPUB; USPAT	OR	ON	2017/06/06 15:45

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S73	4306	A61B5/073.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2017/06/06 15:45
S74	3329	A61B5/076.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2017/06/06 15:45
S75	12005	A61B5/0031.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2017/06/06 15:45
S76	3647	A61D7/00.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2017/06/06 15:45
S77	3316	A01K11/006.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2017/06/06 15:45
S78	440	A01K11/007.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2017/06/06 15:45
S79	905	A01K11/008.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2017/06/06 15:45

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S83	9409	(S80 S81 S82) and (time timed timer timing)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2017/06/06 15:45
S84	9414	(S80 S81 S82) and (time timed timer timing lifespan)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2017/06/06 15:45
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S86	1627	(S80 S81 S82) and ((enabl$6 disabl$6 ((turn power) adj ("on" "off"))) with (time timed timer timing lifespan))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2017/06/06 15:55
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S88	13	(("6416782") or ("20010001176") or ("20020128542") or ("20100302039") or ("20070136154") or ("20140240088")).PN.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	OFF	2017/07/03 10:13
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S92	5172	(lifespan$6 (life adj span$6) (life near3 stag$6) puberty) with (enabl$6 disabl$6 ((turn turned turning) adj ("on" "off")))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2018/11/02 10:35

11/2/2018 3:14:38 PM
C:\Users\theller\Documents\EAST\Workspaces\14738789_2.wsp

Smaxtec Exhibit 1010
Smaxtec, Inc. v. ST Reproductive Tech, LLC

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	14738789	RETTEDAL ET AL.
	Examiner	**Art Unit**
	TAMMIE K MARLEN	3792

CPC						
Symbol					**Type**	**Version**
A61B		5	/	073	F	2013-01-01
A61B		5	/	01	A	2013-01-01
A61B		5	/	02055	I	2013-01-01
A61B		5	/	024	A	2013-01-01
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A61B		5	/	6861	I	2013-01-01
A61B		5	/	0031	I	2013-01-01
A61B		5	/	4238	I	2013-01-01
A61B		2503	/	40	A	2013-01-01
A61B		2560	/	0209	A	2013-01-01
A01K		11	/	007	I	2013-01-01
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CPC Combination Sets							
Symbol					**Type**	**Set**	**Ranking**	**Version**
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			/					

NONE		**Total Claims Allowed:**	
(Assistant Examiner)	(Date)	19	
/TAMMIE K MARLEN/ Primary Examiner.Art Unit 3792	11/02/2018	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	1

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	14738789	RETTEDAL ET AL.
	Examiner	**Art Unit**
	TAMMIE K MARLEN	3792

US ORIGINAL CLASSIFICATION		INTERNATIONAL CLASSIFICATION										
CLASS	SUBCLASS	CLAIMED					NON-CLAIMED					
		A	6	1	B	5 / 07 (2006.01.01)						
CROSS REFERENCE(S)												
CLASS	SUBCLASS (ONE SUBCLASS PER BLOCK)											

NONE		Total Claims Allowed:	
(Assistant Examiner)	(Date)	19	
/TAMMIE K MARLEN/ Primary Examiner.Art Unit 3792	11/02/2018	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	1

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	14738789	RETTEDAL ET AL.
	Examiner	**Art Unit**
	TAMMIE K MARLEN	3792

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original
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7	50	15	66												
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9	52	17	68												

NONE		**Total Claims Allowed:**	
(Assistant Examiner)	(Date)	19	
/TAMMIE K MARLEN/ Primary Examiner.Art Unit 3792	11/02/2018	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	1

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), by mail or fax, or via EFS-Web.

By mail, send to: **Mail Stop ISSUE FEE**
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

By fax, send to: **(571)-273-2885**

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

114662 7590 11/07/2018
ST Reproductive Technologies, LLC
22575 State Highway 6 South
Navasota, TX 77868

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being transmitted to the USPTO via EFS-Web or by facsimile to (571) 273-2885, on the date indicated below.

(Typed or printed name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
14/738,789	06/12/2015	Nicholas P. Rettedal	RT-22 (US-1)	8986

TITLE OF INVENTION: Calf Bolus

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	SMALL	$500	$0	$0	$500	02/07/2019

EXAMINER	ART UNIT	CLASS-SUBCLASS
MARLEN, TAMMIE K	3792	600-301000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).

☐ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.

☐ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-09 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list

(1) The names of up to 3 registered patent attorneys or agents OR, alternatively,

(2) The name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

1 Ryan Christensen
2 Hashim Rahman
3

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document must have been previously recorded, or filed for recordation, as set forth in 37 CFR 3.11 and 37 CFR 3.81(a). Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE	(B) RESIDENCE: (CITY and STATE OR COUNTRY)
ST Reproductive Technologies LLC	Navasota, TX

Please check the appropriate assignee category or categories (will not be printed on the patent) : ☐ Individual ☑ Corporation or other private group entity ☐ Government

4a. Fees submitted: ☑ Issue Fee ☐ Publication Fee (if required) ☐ Advance Order - # of Copies _____

4b. Method of Payment: *(Please first reapply any previously paid fee shown above)*

☑ Electronic Payment via EFS-Web ☐ Enclosed check ☐ Non-electronic payment by credit card (Attach form PTO-2038)

☑ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment to Deposit Account No. 50-5531

5. **Change in Entity Status** (from status indicated above)

☐ Applicant certifying micro entity status. See 37 CFR 1.29 — NOTE: Absent a valid certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.

☐ Applicant asserting small entity status. See 37 CFR 1.27 — NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.

☑ Applicant changing to regular undiscounted fee status. — NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

NOTE: This form must be signed in accordance with 37 CFR 1.31 and 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature / Ryan Christensen / Date January 31, 2019

Typed or printed name Ryan Christensen Registration No. 60,291

PTOL-85 Part B (08-18) Approved for use through 01/31/2020 OMB 0651-0033 U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

Electronic Patent Application Fee Transmittal

Application Number:	14738789
Filing Date:	12-Jun-2015
Title of Invention:	Calf Bolus
First Named Inventor/Applicant Name:	Nicholas P. Rettedal
Filer:	Ryan Scot Christensen/Justin Wood
Attorney Docket Number:	RT-22 (US-1)

Filed as Large Entity

Filing Fees for Utility under 35 USC 111(a)

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
UTILITY APPL ISSUE FEE	1501	1	1000	1000

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Extension-of-Time:				
Miscellaneous:				
		Total in USD ($)		**1000**

Electronic Acknowledgement Receipt	
EFS ID:	35016529
Application Number:	14738789
International Application Number:	
Confirmation Number:	8986
Title of Invention:	Calf Bolus
First Named Inventor/Applicant Name:	Nicholas P. Rettedal
Customer Number:	114662
Filer:	Ryan Scot Christensen/Justin Wood
Filer Authorized By:	Ryan Scot Christensen
Attorney Docket Number:	RT-22 (US-1)
Receipt Date:	31-JAN-2019
Filing Date:	12-JUN-2015
Time Stamp:	11:44:25
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	DA
Payment was successfully received in RAM	$1000
RAM confirmation Number	013119INTEFSW00023192505531
Deposit Account	
Authorized User	
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:	

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Issue Fee Payment (PTO-85B)	IssueFeePayment.pdf	127787 2fe31ec5a33ecc2e40db71971466255eeef88a66	no	1
Warnings:					
Information:					
2	Fee Worksheet (SB06)	fee-info.pdf	30066 48c7af15da8b984797875c3b607a1747d7fe08fd	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	157853		

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New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.
National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.
New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	ISSUE DATE	PATENT NO.	ATTORNEY DOCKET NO.	CONFIRMATION NO.
14/738,789	03/19/2019	10231644	RT-22 (US-1)	8986

114662 7590 02/27/2019

ST Reproductive Technologies, LLC
22575 State Highway 6 South
Navasota, TX 77868

ISSUE NOTIFICATION

The projected patent number and issue date are specified above.

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)
(application filed on or after May 29, 2000)

The Patent Term Adjustment is 0 day(s). Any patent to issue from the above-identified application will include an indication of the adjustment on the front page.

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (http://pair.uspto.gov).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Application Assistance Unit (AAU) of the Office of Data Management (ODM) at (571)-272-4200.

APPLICANT(s) (Please see PAIR WEB site http://pair.uspto.gov for additional applicants):

Nicholas P. Rettedal, Loveland, CO;
ST Reproductive Technologies, LLC, Navasota, TX;
Stephen M. Weilnau, Greeley, CO;
Scott R. Cockroft, Greeley, CO;
Joseph Janus IV, Loveland, CO;

The United States represents the largest, most dynamic marketplace in the world and is an unparalleled location for business investment, innovation, and commercialization of new technologies. The USA offers tremendous resources and advantages for those who invest and manufacture goods here. Through SelectUSA, our nation works to encourage and facilitate business investment. To learn more about why the USA is the best country in the world to develop technology, manufacture products, and grow your business, visit SelectUSA.gov.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the application of: Nicholas P. Rettedal	**Confirmation No.:** 8986
Patent No.: 10,231,644	
Issued: March 19, 2019	**Group Art Unit:** 3766
Application No.: 14/738,789	
Filed: June 12, 2015	**Examiner:** Marlen, Tammie K
For: Calf Bolus	
Attorney Docket No.: RT-22 (US-1)	

Commissioner for Patents
ATTN: Certificates of Correction Branch
P.O. Box 1450
Alexandria, VA 22313-1450

REQUEST FOR CERTIFICATE OF CORRECTION UNDER 37 C.F.R. § 1.322

Upon reviewing the above-identified patent, Patentee noted an error in claim 15. Claim 15 should read.

15. The method of claim 13, wherein said re-programming said computer code further comprises offsetting a difference in an amount of energy remaining in a power source and an amount of energy required by said bolus to operate through a pre-determined period of time.

A proposed Certificate of Correction also accompanies this Petition and reflects the above referenced amendment.

The claims filed on July 17, 2018 with the Office Action Reply and allowed by the examiner deleted an occurrence of the word "said" in the above referenced claim. As such, it is believed no fee is due at this time. Patentee respectfully requests granting of the requested Certificate of Correction. In the event of any mistake regarding fees, Applicant hereby authorizes the Commissioner to deduct any related fees for such correction. The Commissioner is authorized to deduct any related fees as may be applicable from Deposit Account **50-5531**.

Dated this 16th day of April 2019,

Respectfully Submitted,

By: /Ryan Christensen/

Ryan Christensen, Reg. 60,291
ATTORNEY FOR APPLICANT
ST Reproductive Technologies, LLC
22575 State Highway 6 South
Navasota, Texas 77868
(936) 870-3960 telephone
(936) 870-3115 facsimile
Customer Number: 114662

PTO/SB/44 (09-07)
Approved for use through 08/31/2013. OMB 0651-0033
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.
(Also Form PTO-1050)

UNITED STATES PATENT AND TRADEMARK OFFICE
CERTIFICATE OF CORRECTION

PATENT NO. : 10,231,644

APPLICATION NO.: 14/738,789

ISSUE DATE : March 19, 2019

INVENTOR(S) : Nicholas P. Rettedal

It is certified that an error appears or errors appear in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

In the Claims

Claim 15 should read:

15. The method of claim 13, wherein said re-programming said computer code further comprises offsetting a difference in an amount of energy remaining in a power source and an amount of energy required by said bolus to operate through a pre-determined period of time.

MAILING ADDRESS OF SENDER (Please do not use customer number below):
ST Reproductive Technologies, LLC, Attn: Ryan Christensen
22575 State Highway 6 South
Navasota, Texas 77868

This collection of information is required by 37 CFR 1.322, 1.323, and 1.324. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1.0 hour to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Attention Certificate of Corrections Branch, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

Electronic Acknowledgement Receipt

EFS ID:	35743595
Application Number:	14738789
International Application Number:	
Confirmation Number:	8986
Title of Invention:	Calf Bolus
First Named Inventor/Applicant Name:	Nicholas P. Rettedal
Customer Number:	114662
Filer:	Ryan Scot Christensen/Justin Wood
Filer Authorized By:	Ryan Scot Christensen
Attorney Docket Number:	RT-22 (US-1)
Receipt Date:	16-APR-2019
Filing Date:	12-JUN-2015
Time Stamp:	18:07:12
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Request for Certificate of Correction	RequestforCertificateofCorrection.pdf	205672 bd848dd1bb4b5291c07c2329004a0812768cee00	no	3

Warnings:

Information:	
Total Files Size (in bytes):	205672

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

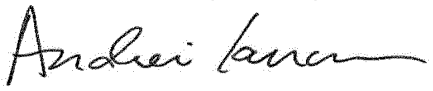
PATENT NO. : 10,231,644 B2
APPLICATION NO. : 14/738789
DATED : March 19, 2019
INVENTOR(S) : Nicholas P. Rettedal

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

In the Claims

Column 22 Line 65 Claim 15 should read:
15. The method of claim 13, wherein said re-programming said computer code further comprises offsetting a difference in an amount of energy remaining in a power source and an amount of energy required by said bolus to operate through a pre-determined period of time.

Signed and Sealed this
Fourteenth Day of May, 2019



Andrei Iancu
Director of the United States Patent and Trademark Office

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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY.DOCKET NO./TITLE	REQUEST ID
14/738,789	06/12/2015	ST Reproductive Technologies, LLC	RT-22 (US-1)	103819

Acknowledgement of Loss of Entitlement to Entity Status Discount

The entity status change request below filed through Private PAIR on 01/23/2020 has been accepted.

CERTIFICATIONS:

Change of Entity Status:

X Applicant changing to regular undiscounted fee status.

NOTE: Checking this box will be taken to be notification of loss of entitlement to small or micro entity status, as applicable.

This portion must be completed by the signatory or signatories making the entity status change in accordance with 37 CFR 1.4(d)(4).

Signature:	/Ryan Christensen/
Name:	Ryan Christensen
Registration Number:	60291