

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
20 November 2008 (20.11.2008)

PCT

(10) International Publication Number
WO 2008/138076 A2

(51) International Patent Classification:

A61D 17/00 (2006.01)

(21) International Application Number:

PCT/BE2008/000039

(22) International Filing Date:

14 May 2008 (14.05.2008)

(25) Filing Language:

Dutch

(26) Publication Language:

English

(30) Priority Data:

2007/0232

14 May 2007 (14.05.2007) BE

(71) Applicant and

(72) Inventor: TIELENS, Gitte [BE/BE]; Roskamstraat 103,
B-9820 Merelbeke-Gent (BE).

(81) Designated States (*unless otherwise indicated, for every*

kind of national protection available): AE, AG, AL, AM,
AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA,
CH, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE,

EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID,
IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC,
LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN,
MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PG, PH,
PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, SV,
SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN,
ZA, ZM, ZW.

(84) Designated States (*unless otherwise indicated, for every*
kind of regional protection available): ARIPO (BW, GH,
GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM,
ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM),
European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI,
FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MT, NL,
NO, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG,
CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Declaration under Rule 4.17:

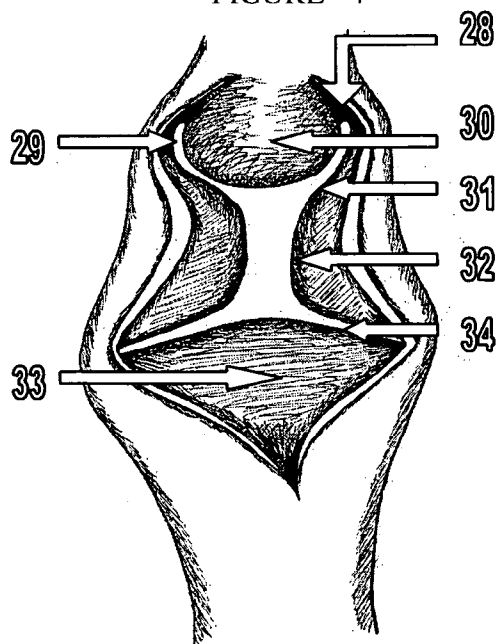
— *of inventorship (Rule 4.17(iv))*

Published:

— *without international search report and to be republished
upon receipt of that report*

(54) Title: DEVICE FOR ANIMALS AND MODE OF OPERATION OF THE DETECTION METHODOLOGY OF THE DE-
VICE TO MONITOR, TO REPORT AND TO ALARM CHANGES OF THE INTRA - ABDOMINAL PRESSURE BY USING
COMMUNICATION TECHNOLOGY

FIGURE 4



(57) Abstract: Device for animals and mode of operation of the detection methodology of this device to monitor, report and alarm changes of the intra-abdominal pressure with communication technology to detect changes of the reproduction, health and disease stage by means of special movements of one or multiple spoons on one ending of the intra-vaginal probe as a response on -and in correlation with- changes in the intra-abdominal pressure. These flexible spoons are localized around the external side of the cervical protrusion. The other ending of the intra-vaginal probe contains one or more legs with one or more feet with -or looking like- one or more barbs.

**DEVICE FOR ANIMALS AND MODE OF OPERATION OF THE DETECTION
METHODOLOGY OF THE DEVICE TO MONITOR, TO REPORT AND TO
ALARM CHANGES OF THE INTRA – ABDOMINAL PRESSURE BY USING
COMMUNICATION TECHNOLOGY.**

5

BACKGROUND OF THE INVENTION

Since the beginning of animal husbandry, cattle farmers have been looking forward to a reliable birth-, heat- and monitoring technology for animals. The advantages of such a device are mentioned in the paragraphs underneath.

Saving time: the farmer doesn't have to submit the animal periodically to a visual inspection to check if the animal is in labour.

Spreading time more efficiently: The time that the farmer is spending now during the nights to monitor his cows can mainly be rescheduled to the day.

Guarantee of the farmer's rest during the nights: the farmer doesn't have to get out of his bed periodically to monitor his animals.

The benefits of being able to monitor cows correctly at home on a computer or via mobile phone technology.

Monitoring multiple animals that can labour at the same time.

The opportunity to call in help of a vet in time to assist in a proper way the animal in labour, to avoid stillborns, to lower the risk of a parturition with a deadly end for the animal in labour, to avoid damaging of the birth canal during parturition and to avoid abnormalities during the puerperium. Resulting in less problem cows having difficulties getting pregnant by being damaged in the birth canal.

Economic benefits by lowering the number of lethal newborns or stillborns, by being present in time to provide assistance. In 50% of the normal calvings help is required... This includes that in 100% of the calvings the farmer has to be actually present! The farmer cannot permit himself to lose lots of calves, as he needs the calves he bred on his own farm to replace the elderly cows he is going to remove. We want to stress the point that statistics have shown that he has to keep the loss during the whole breeding period lower than 5 %. A reliable birth alarm would help to minimize calf loss in herds. 6 to 10 percent of all calves born in beef cow herds in the U.S. die at or soon after birth. About half of those deaths are due to calving difficulty (dystocia). This multi-million dollar annual loss is second only to losses from failing to conceive.

Ability for the farmer to monitor his cows continuously, he can detect certain correlated or not correlated similar occurring changes: e.g.: a dangerous hyperthermia due to bacteria with the risk on abortion.

By detecting certain changes earlier, the farmer is able to act –in teamwork with his vet- utilizing preventive measures rather than incurring the use of drugs. E.g.: in the first example he can give a painkiller that lowers the temperature.

Currently, the majority of the farmers monitor their cows manually by measuring the anal temperature of the animal with the purpose to predict the approaching birth.

Another problem that occurs while farming is the detection of the cows in heat that need to be inseminated. The probability of conceiving is affected by timing of insemination, cow fertility, semen fertility, and inseminator skills. A traditional method of detecting heat (in Latin: 'oestrus') is to observe the cattle for mounting activity. Observation of the cow's behaviour is still the most common used method to detect the heat.

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The primary sign of heat is the cow remains standing while mounted. In the majority of the cases, the farmers rely on the visual observation of cows mounting each other. During each day the farmers are advised by vets to spend 3 times a day at least 20 minutes on heat detection... An advice most farmers cannot fulfil due to lack of time. Furthermore, statistics have proved that 70% of the cows comes in heat between 18.00h o'clock in the evening and 06.00h o'clock in the morning. As a large percentage of mounting activity occurs at night, this causes difficulty for observation. There are big differences noticed between farms, concerning the efficiency of oestrus detection. Good heat detection requires the undivided attention of the observer. Mounts normally last about 7 seconds. As a result observers who perform other tasks such as feeding, scraping alleys and moving cows, while detecting heats, are more likely to miss brief mounts. However, visual observation is labour intensive and difficult to manage by scale enlarging of farms and the daily activities of the farmer.

A beef cattle farmer suffers financial losses due to inefficient heat detection by the profitless feeding of the animal till the new heat appears the next month. A farmer with dairy cows undergoes the financial reflection of a postponed lactation and conceiving may occur the following month. Meanwhile, we may not forget the costs of the sperm and the insemination procedure.

A reduction of the pregnancy rate and thus to a reduced annual milk production results. With cattle, the lactation begins after the birth of the calf. When the cow is not inseminated at the right time, she will not be pregnant. As a consequence, there is a delay of the expected parturition and lactation period.

Another important parameter that can be mentioned in this field is the calving interval, which includes: the time period between the parturition and the heat, the time period between the heat and the pregnancy, and finally the time period of the pregnancy. Poor heat detection for misdiagnosis of heat results in lower pregnancy rates, an increased amount days open, and a longer calving interval. In average, poor heat detection lengthens the calving interval with 30 to 40 days. Under ordinary farm conditions, an estimated 25 to 50 % of heat periods are missed on dairy farms. It was estimated that the failure to detect heat or incorrect heat detection results in losses exceeding US \$ 300 million annually to the dairy industry in the US.

For these reasons, cattle producers are interested in heat detection aids. A critical factor affecting fertility in artificial insemination (AI) programs is the timing of insemination. To achieve maximum genetic gains in a herd, artificial insemination with top proven sires must be used on all cows and replacement heifers. The benefits of AI are clear, however AI is not without its problems, the primary one being heat detection. The ultimate goal of every heat detection program should be to predict the time of ovulation, thus allowing for insemination that will maximize the opportunity for conception. Artificial insemination must be practised at a precise time based on to the appearance of the heat of the specific cow. A successful AI program is based on accurate heat detection. Whether natural service or AI breeding plans are being utilized, simply being accurate with heat detection can help increase reproductive efficiency. Poor or inefficient heat detection is very costly and results in:

- a) A lower annual milk- and calf production,
- b) An increased culling rate of valuable cows,
- c) Therefore less possibilities to remove low productive cows, and -as a consequence- less opportunity to select high productive cows,

- d) More self-created repeat breeder cows,
- e) Higher sperm, insemination and veterinarian costs.

5 Farmers should be able to detect the heat in time with a reliable device, so they can enhance their performance management practices and determine the optimum insemination time.

Furthermore, a monitoring device can also be practical in case cows need to be subject to continuous monitoring, like for example: cows in lock circles subject to the risk of getting infected, getting fever periods and going into abortion. This is a very important
10 contribution to human mankind, not only to provide enough food, but also to improve food safety by being agro-vigilant. Being able to monitor animals as a precaution for breakouts of certain diseases, starts in the stable.

15 DESCRIPTION OF PRIOR ART

Since the beginning of animal husbandry, farmers have been looking forward to a reliable birth-, heat-, and monitoring technology. In general men attempted to follow up the animals subjective by detecting visual signs, such as the lifting up of the tail, the
20 swelling of the vulva, the characteristic laying down of the animal, the muscular activity of the abdomen, and other observations. The detection of those visual signs often got connected to an alarm. The main disadvantage coordinating the current systems, is that the alarm only goes off when the parturition is already happening, which is disadvantageous for calling in medicinal intervention.

25 In the human science, recordings are obtained with a ultrasonic cervimeter, that continuously monitors cervical dilatation from the transit time of ultrasound signals between two piezoelectric crystals attached on the uterine cervix. A small spring-loaded clip allows each crystal to be fixed on the rim of the cervical os. A problem with this measuring technique, applying it to animals, is the fact that the animal walks around or
30 changes its position, which can cause a displacement of the piezoelectric crystals. The ultrasound measuring technique is only accurate when the piezoelectric crystals keep the intended position. Secondly it is a very expensive technique. Thirdly, the clipping of the piezoelectric crystals on the cervical rim is a very exact procedure and has to be done by a trained professional.

35 Part 1: Birth alarm devices

Section 1: Invasive devices concerning the vagina, going in alarm by expulsion of a probe.

40 A pioneer approaching this way of thinking was Harvey, U.S. Pat. No. 3,583,389. He placed an electromagnetic radiation transmitter in an egg-shaped capsule in the birth canal of the animal. The transmitter was programmed to be loaded up or to be unloaded energetically as a response on retaining the premised temperature. By expulsion of the capsule out of the vagina, the temperature decreases and triggers an alarm. Gardner, D.E.
45 Pat. No. 2,214,221 expanded this idea by creating a device that measures differences in temperature and pressure when a probe got expelled out of the vagina, e.g. when the calf or waterbag got expelled and pushes the probe with its claws out of the vagina. An alarm goes off hereafter. Similar ideas are described in the following patents: D.E. Pat. No. 2,416,829, U.S. Pat. No. 4,028,687, A.U. Pat. No. 2,782,477, F.R. Pat. No. 2,413,875,
50 E.P. Pat. No. 0,108,330, F.R. Pat. No. 2,582,507, D.E. Pat. No. 3,529,327, F.R. Pat. No.

2,584,263, U.S. Pat. No. 4,651,137, B.E. Pat. No. 1,007,090, E.P. Pat. No. 0,807,423, U.S. Pat. No. 4,994,665, E.P. Pat. No. 0,807,423.

We mark the disadvantages of the previous mentioned techniques:

- 5 a) No alarm is given before the expulsion phase. Actually, the veterinarian or farmer must be warned some time before the start of certain phases of the birth procedure to be able to be present in time to provide assistance when necessary.
- b) Often no alarm has been given when dystocia manifests.
- c) Not effective for certain breeds of cows: Specific cows, like for example: double muscled cows, cannot labour normally by carrying a calf that is too heavy or too big. Due to this matter they are subject of caesarean sections. These calves will not pass the birth canal and push the device out of the vagina.
- 10 d) Devices that should detect the fluctuation of the intra-vaginal pressure are also described. Measuring the pressure in a vagina is with the existing techniques impossible, because a vagina is a vacuum virtual area. Pressure can be measured in air or liquid, but not in a vacuum area, unless you have a material that can be pressed in.
- 15 e) The described intrauterine devices of conventional construction are, in many instances, spontaneously expelled from the reproductive tract of the animal, while they contain no anchoring technique. Furthermore, certain devices are described that need to be placed inside the cervix of the cow during an extended period of time and therefore expose the normally aseptic uterus (in Latin: 'uterus') to external micro-organisms with the risk on abortion.
- 20

Section 2: Invasive devices, registering the temperature in the vagina.

- 25 Laemmchen and Koller, D.E. Pat. No. 2,559,159, designed a probe with a temperature sensor, that goes in alarm when a certain temperature is reached. Marchand F.R. Pat. No. 2,565,097 connected a flexible thermostatic sensor on one of the endings of a transversal articulating arm, attached to the backhand of the animal to hold this sensor into the vulva. When the temperature changes, an alarm is triggered. A visualisation of temperature changes, is described in G.B. Pat. No. 2,310,803. In U.S. Pat. No. 5,794,625 there also is a monitoring system for animals described which consists a temperature monitoring unit connected to a microcontroller, that is placed in the body of the animal. Measuring the temperature manual with a thermometer is a very old and classic technique, as the temperature increases slightly during the beginning of the parturition, though this technique also has several disadvantages:
- 30
- 35

- a) The body temperature fluctuates physiologically during the whole day and is in the evening 0.5 till 1°C higher.
- b) Secondly, measuring the temperature is only effective when it happens under the following circumstances:
 - 40 ➤ Every day during an equal time period,
 - Daily on the same depth in the vagina or anus,
 - The daily temperature measurements should happen by the same person,
 - Daily with the same thermometer,
 - Every day on the same hour.
- 45

Measuring the anal temperature manually with a thermometer gives a vague idea that the cow is going to labour the following 24 hours, but doesn't offer a representative surveillance about what is actually happening inside the cow. It is only a snapshot.

Section 3: Intra-vaginal devices to monitor the cervix, mainly during the parturition stages.

5 B.E. Pat. No. 1,015,962 describes a probe, inserted in the vagina to measure capacitive the dilation of the structures before the uterus, said the cervix and vagina, said the uterine contractions.

Three comments on the previous statements are mentioned below.

10 First of all it 's proved watery dielectrics can interfere and influence the measuring results of a capacitive detection method. A probe being brought in the vagina is considered by the body of the specific animal as a foreign object. The body reacts immunological by producing more slime, due to a vaginitis. This slime can interfere and influence the expected results of the capacitive measuring method.

15 Secondly, 'uterine contractions' are not the same as a 'dilation of the cervix', and do not always happen simultaneously. During the softening phase, weeks before the uterine contractions begin, the cervix enlarges and this phenomenon can be considered as 'dilation'. The cervix only starts to open up when the uterine contractions occur. Unfortunately it is also not proved whether remainders of uterine contractions are exposed through the vaginal wall movements. A third comment on the statement of this patent is that the vagina does not dilate before the parturition. During the softening, the
20 vaginal tissue becomes more elastic. The histological process consists mainly out of a depolymerisation of the ground substance and the going into solution of the collagen - and elastin fibres. Also a lot of water will be absorbed. The vaginal tissue become more elastic as a result of the weakening, the infiltration of lymphoid cells and the oedema, but stays vacuum. A vacuum area, surrounded by organic tissue, provokes the inner walls of
25 the organic tissue to touch each other, whether the vaginal tissue becomes more elastic or not. There is no area in the vagina of a pregnant animal, filled with air, that can dilate like a balloon. The vagina is a virtual vacuum area.

30 Besides all these categories, there were also invented techniques and devices of a different nature in the matter of a birth alarm. Due to the fact these measuring methods are not focused in the direction of our device, they are not worth mentionable.

The main disadvantage of the current systems, is that the alarm only goes off when the parturition is already happening, which is disadvantageous for calling in medicinal intervention. Farmers and vets should be able to provide help or assistance in time.

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Part 2: Oestrus detection devices

40 The first persons who had the idea to create an intra-vaginal device related to the oestrus were the brothers Dickinson, U.S. Pat. No. 3,811,424. They claim to have invented a device to change and reset the start of the oestrus in cows by exerting pressure on the vaginal wall by means of an attribute on the end of their device, and by using a helical element on top of their device as a uterine and cervical stimulator. As a comment on this device we want to mark the fact that penetrating the cervix can cause intra-cervical and intrauterine infections, adhesions as well as abortion. In U.S. Pat. No. 3,844,276 a probe
45 is described that can measure the electrical resistance of the mucus on the cervix. The idea to lance an anchored probe able to measure the temperature intra-vaginal got described in E.P. Pat. No. 0,068,262. A probe to measure the redox potential of vaginal slime is described in G.B. Pat. No. 2,146,436. The measurement of sodium ions in vaginal mucus with the aid of a probe, got lanced in W.O. Pat. No. 8,804,538. A
50 telemetry device which measures physiological parameters -such as tissue impedance

and temperature- related to the oestrus, got described in U.S. Pat. No. 4,784,155. A shuttle formed probe got described in U.S. Pat. No. 4,770,186. This device would be able to measure the radial expansion of the cervix by means of pins which are driven via a gear by a motor/tacho unit. A pH meter in an intra-vaginal probe got invented by Prospero, E.P. Pat. No. 0,386,649. E.P. Pat. No. 0,498,303 describes a device that can measure the polar impedance of vaginal mucilage. An intra-cervical probe to measure the inside diameter of the cervix, got invented in D.E. Pat. No. 4,217,229. It is a sort of a pencil that requires to be brought in inside the cervix to be able to measure. We want to comment that this can create intra-cervical injuries, adhesions and the transfer risk of micro-organisms to the aseptic uterus. Another remark is that also the cervix is vacuum and the inner walls will touch each other, whether the cervix increases in size while this is interpreted as dilation. Two electrodes that measure the electric conductance of vaginal slime, were described in D.E. Pat. No. 19,609,529. A probe that uses a hydraulic piston that realizes a flexible membrane to stay localized before the cervix, got invented in W.O. Pat. No. 9,926,537. The cervical weakening is measured by means of an optic sensor and processed via a microprocessor. In U.S. Pat. No. 5,916,173 a probe is described with two electrodes in the probe tip. These two electrodes can be placed in a round probe tip that is constructed to fit on the orificium externum of the cervical protrusion. The two electrodes also can be placed in a crater shaped probe tip for engaging the cervical orificium externum and for contacting the tissue of the vaginal fornix. An important goal of this invention is to collect data of the weakening of the cervix during heat periods, as well as during pregnancy. Our remarks follow underneath. Seeing the drawings, the probe is attached to a cable that goes outside the vagina to the receiver. This irritates the cow, who will react by pressing on the probe, attempting to expel it. This behaviour is inconvenient during pregnancy. The cable is connected to a whole construction that will never keep its exact location when the cow goes to lay down. The probe tip can also remove and slide out of the cervix e.g. when the cow is urinating, because of pressure of the urine bladder on the vaginal wall. When the pregnant cow is laying down, the uterus sinks deeper in the pelvis and reduces the vaginal length. The patent doesn't describe flexibility of the elements, which leads to the conclusion that the probe will be irritating or sliding out of the vagina. Also, due to a rotation of the calf in the uterus the cervix can change his location temporary. Not to forget that the vagina is a flexible organ, containing a virtual space, that can behave passive like the movements of a snake. Also mentionable is that this measuring technique is localised inside the cervix, by putting one or two electrodes inside the cervical canal. This is a dangerous action that can cause intra-cervical injuries, and definitely a removal of the cervical slime plug that covers the cervical orificium externum to prevent the income of infective material in the uterus. When we would try to put something inside the cervical canal outside the heat period, without damaging it, this should be done by an experienced vet. Besides that, we want to mark that during the parturition the cervix opens from its cranial uterine side to its caudal vaginal side. Therefore the device cannot be used by a normal person with a basic knowledge of animal reproductive manners. Another important factor to mention is the fact that the cervix effaces the last weeks of the parturition. Measuring up cows manually revealed that the length of the cervix with Holstein Friesian cows the last 4 weeks of the pregnancy can increase, approximately 3 centimetres to 10 centimetres length with a diameter dilation starting from approximately 15 centimetres to 30 centimetres. We empathise that both the size of the cervix as well as its effacing and dilation, is cow dependent. There are lots of differences noticed between cows individually, between cow breeds, between cows with a different calving number, between cows and heifers

and so on. Because the cervix changes its size, the device should be able to adapt itself for not sliding out of the cervix. Another fact, worth to mention, is that the cervix disappears in the vaginal wall during the opening-up phase. The internal cervical walls will keep on touching each other, in this case: surrounding the probe tip, due to the vacuum area in the cervical protrusion.

DETAILED DESCRIPTION OF THE PRESENT INVENTION

10

In general, the invention is made up of a device and a mode of operation featuring the detection methodology of the device to monitor, to report and –if necessary- to alarm changes of the intra-abdominal pressure by using communication technology. The physical changes of the cervical protrusion are a reflection of certain domains of the reproduction status of the animal e.g. the uterine contractions, and some similar occurring changes which can manifest in other parts of the body, whether they are related to the reproductive stage of the cow or not. A primary object of the present invention is to provide a device that will overcome the shortcomings of the prior art devices. And to provide a device that a person, with just a basic knowledge of animal reproductive matters, can use. The device can be used to invite the vet to pass to a clinical investigation after the detection of changes in the normal physiology of the body. Further objects of the invention will appear as the description proceeds. We want to emphasize this device is no diagnostic method that is applied on the body. For this explanation, we refer to the following website:

25 http://www.ordederdierenartsen.be/pdf/Wet_1991.pdf

The Belgian law for practisizing veterinary medicine of 28 August 1991 contains the following phrases:

Article 3, §1.: Practising veterinary medicine consists of performing one or more veterinary acts:

- 30 a) Examining the health status of the animal with the purpose to diagnose and , in the occurring case, handing in a certificate about the animal's status.
b) Tracking diseases of animals;
c) Making a diagnosis, which means SEARCHING FOR THE CAUSES of a disturbance of the anatomical structure and physiological function of the animal.

35 Article 3, §2: For the application of this law, the following are no veterinarian acts:

- b) The usual care for animals, just like the detection of normal anatomical and physiological changes, including every external intervention in order to prevent pathological circumstances.

40 In relation to the phrase above, during the monitoring of normal changes, abnormal changes should be obvious for the farmer, such as an animal being lame. While the vet is the only person allowed to make a diagnosis, firstly having carried out a clinical examination, is the detection, by a device, of disturbances in normal changes valid. Because 'making a diagnosis' is related to the search for a cause of a disturbance. In the higher example it is the job of the veterinarian to investigate the animal and to make a diagnosis. The fact the farmer detected a disturbance in the normal walking of the animal – the lameness- is not the same as making a diagnosis!

45 To the accomplishment of the objects, this invention may be embodied in the form illustrated in the accompanying figures, attention being called to the fact, however, that the figures are illustrative only, and that changes may be made in the specific construction illustrated and described within the scope of the appended claims.

50

The system is based on two main pillars. On one hand there is the probe that is deposited in the vagina of the animal, and on the other hand there is the receiver that receives wireless signals of the probe, analyses them and sends them to one or possibly more computers or mobiles of the persons who follow up the animal or the internet. Multiple receivers may be used, localised in different places inside or outside the stable.

Multiple probes, depending on the present state of technology, after being inserted in multiple animals, can send their measurements to one or more receivers which are connected to one or more computers and/or mobiles and/or the internet. As a consequence, one farmer or vet can monitor multiple animals at the same time. A continuous wireless connection with the receiver is not necessary. The probes are capable of storing their measurements and sending them all to the receiver on being exposed to the wireless connection. This can be very practical for heat detection. During the summer, the cows are on pasture and enter the parlour twice a day to be milked. The probe can store the data when the cow is on pasture. When she comes in the stable and passes the receiver, all the data collected during the hours she had spent on pasture can be transferred to the receiver. The device can also be connected with other (future) computerised farm systems, such as milk robots, gateways to separate cows in heat, etc., but in all situations these systems must be provided with the interface necessary to communicate with this invention. The probe may –but will not necessarily– function with rechargeable batteries which can work continuously for many weeks, depending on the type of battery. There must be a suitable distance between the probe in the vagina of the animal and the receiver. This distance depends on the type of transmitter and receiver, whether there are lots of obstacles between the probe in the vagina and the receiver, other mechanical devices in the neighbourhood, the present state of technology and so on. The measuring sensitive elements can be localised in the spoon, the arm of the spoon, or in the tubing (this is the body) of the probe.

The probe contains on the end which is directed at the cervix, one or more spoons. These will respond by moving specifically under the influence of the changing intra-abdominal pressure. This will be explained later in the text. Besides, the probe contains a built-in temperature sensor to follow up the vaginal temperature. The probe consists of one or more measuring elements which can send their signals periodically to the receiver. The periodicity of sending out the measurements depends on the animal species, said animal species specific speed of going through the parturition phases, and so on. Besides, the measuring elements can be localized in the spoon, the little spoon arm or in the tubing of the probe. For example, but therefore not necessarily: for cows it could send out measurements once each five minutes and for horses once every three minutes. The information can be monitored via a computer and, if necessary, via the internet, by the veterinarian at home. The persons who want to monitor the animal will be notified via computer or mobile phone technology of certain information, like for example, but not limited to, hyperthermia, the preparation phase, the opening-up phase, and so on. The computer can calculate or estimate the moment the animal is expected to labour, but, due to several pathological circumstances that may happen during the parturition phases, predicting birth will never become an exact science.

The probe is capable of sustaining washing, such as with water, soap and disinfectants. The probe can also be produced in various physical formations, e.g.: egg shaped: as long as this conformation is not irritating or painful for the animal and easy to insert in the vagina. The probe contains a rechargeable coil for batteries, if there are reloadable batteries in the probe. On the top of the probe, there are one or more ‘spoons’ attached.

In the paragraph beneath, we will mainly focus on the unique action of the spoon(s).

The vagina of animals is under natural conditions vacuum. The inside of the walls touch each other by the vacuum vaginal effect. The vacuum effect is realized by the pressure in the abdomen, namely: the intra-abdominal pressure. While inserting the probe, we disturb the vacuum effect, and the vagina will fill itself with air. The under-pressure that exists in the vagina will disappear slowly and the site in the vagina, to deposit and apply the probe, occurs. After withdrawal the applicator, or the arm and hand of the person that applied the probe, the intra-abdominal pressure that is the cause of the intra-vaginal under-pressure again comes into effect. Spontaneously, air will exit from the vagina. Because of the intra-abdominal pressure, one or more spoons will be pressed against the external side of the cervical protrusion (in Latin: cervical protrusion). It will be understood that the spoon(s) contain a specific spring action that realizes this movement perfectly and that is adapted to the animal species and, if necessary, the animal race.

Because of changes of the cervical protrusion, like enlarging, shrinking, weakening and the dissolving or disappearing in the vaginal wall, the intra-abdominal pressure changes, and (a) specific movement(s) of the spoon(s) will be realized. These specific movement(s) of the spoon(s) are reached by years of research with different materials and dimensions of the spoon(s). If the spoon(s) are too flexible, they will be bent away on the left side of the internal position in the cow by the gastric movements of the rumen of the cow. If the spoon(s) are not flexible enough, they will not bend under the influence of the executing intra-abdominal pressure. The flexibility of the spoons is a result of years of research and is specific for the animal species and can be specific race dependent. Measuring elements, without any limiting character, can be present in the spoon(s), but also in the base of the spoons, this means in the tubing, said: the body of the probe that is connected with the spoon(s).

Because of the specific notable movements of the spoon(s) that appear as a response to, or in correlation with, changes of the intra-abdominal pressure, signals will be created and the measuring elements are capable to detect these movements. These movements and the changing distance between the spoons are a reflection of changes in the reproduction, disease and health status of the animal. Also, with this device animals can be kept under preventative monitoring during risk periods of infection transfer, like in lock circles.

The major movements of the spoon(s) detect the changes of the reproduction status. Due to this, it will be possible to detect the phase between the opening up phase (when the cervix is absorbed in the vaginal wall) and the expulsion of the waterbag.

Besides, every animal has individual specific movements and/or contractions of the organs which cause individual returning background movements of the spoon(s), beside the major movements of the spoon(s), as a response to the changing intra-abdominal pressure. If these background movements change, this indicates a change in the intra-abdominal pressure. This may also occur: in a sick animal in therapy, e.g., but not limited to: an animal with a tympanic rumen, registering the background movements of the spoons and whether they occur or not.

If these background movements show an increased activity, this indicates a change. It is up to the vet to do a clinical investigation on the animal to find out whether the animal is healing and from which organ or organs the change of the background movements is coming. That is to say: what is the cause of the change. The major movements of the spoon(s) can also be considered as background movements and the other way around. Possible measuring elements that can serve for the mode of operation of the detection methodology can be of any nature, for example, but without any limiting character: strain

- gauges, inductive coils, magnetic measuring elements, hydraulic measuring elements, and so on... The measuring elements in the spoon(s) can be localized in the spoon or in the arm of the spoon, but also in the base of it, this means in the tubing, or said with other words: in the body of the probe which is in connection with the spoon(s). On the other hand, the spoon(s) may be composed out of one or multiple parts, and may be of various geometry and flexibility, which results in the fact that their geometry can also change in the animal. Besides, they can be manufactured of any material. The spoon(s) can be replaced by flexible surfaces of various geometry, flexible strips of various geometry, flexible arms with finger –or hand shaped grab surfaces, and so on.
- 5 The shape of these spoon(s), holder(s) or finger(s), can be of any design and consisting out of one or more parts. The 'spoons' are sized to fit perfectly around the cervical protrusion of the specific animal species and, if necessary, the specific race. It will be understood that the orientation of the 'spoon(s)' is of such nature that they fit perfectly around the external side of the cervical protrusion in the fornix of the vagina.
- 10 It is not necessary for the device to be fitted with 2 or more, 1 spoon may also be used effectively.

Furthermore, the probe that is described in this patent contains no anchor at it's basis in the direction of the closing sphincter of the vagina, but legs with feet (a barb). Both the legs and the feet may be constructed to various geometry and it will be understood that they may also be manufactured from different materials. The feet may be elongated, but also may have the shape of the feet of a frog. It will be understood that the variability in geometry is not limited to the two higher mentioned examples and that the dimensions and the model are adapted to the concerning animal species. The probe may exist of one or more flexible legs and one or more flexible feet, which may include or may be identical to one or more flexible barbs, which all can have a various geometry or existing out of a various geometry. Besides, the probe may also exist out of one or more housings of various geometry which can be one or multipartite, being manufactured out of one or more materials and which may be positioned over a central tubing. The probe itself, may also consist of one or more parts including: spoons, feet, barb(s) and a central tubing which all may be placed on or in each other, like for example, but not limited to: via screw thread connection, a baillonet fastening, a click system, a spring click system, a pivot fixing, ... As example, but without any limiting character: if the housing is two-pieced, it can exist out of an upper part which contains the spoons and an under part which contains the legs and feet (barbs). The under part and upper part may be positioned over the body (tubing) and may be attached to each other. The body of the probe may, in the above mentioned example, also comprise a tubing containing the measuring elements and which can only start to measure when the housing is placed over or on the tubing. It will be understood that multiple variations can exist on this example. Besides, the probe may also be manufactured out of one piece, so that the body, the spoons and the legs with feet (barbs) are connected to each other without the possibility of getting separated out of each other. The probe and the housing can be manufactured out of any material and also be provided out of any measuring technique. At the same time, the vaginal temperature is being measured with a temperature sensor in the probe. Measuring the vaginal temperature is a second source to monitor the animal and which is known already years and belongs to the present state of technology. It is self evident that the length and diameter of the probe is not limited, in certain cases it will be longer or shorter in length, or bigger or smaller in diameter.

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This invention is not only applicable on ruminants, but can also be constructed for other animal species, like for example, but not limited to: horses and camels.

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In order to monitor the animal scientifically, the device must remain in place continuously. For the heat and birth detections it will stay in the animal during a time period of 60 days after being inserted in the vagina.

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I assert the animal device, and the mode of monitoring the animal; using the construction and the detection methodology subject to the intra-abdominal pressure described above, to be new and inventive.

10 A switch can, but not necessary, may be inserted within the basic probe to turn it on or off. Other ways to turn it on or off can also be adapted on the probe, e.g.: turning it on or off via the computer or via the base station or with a manual remote control unit. The probe can be inserted manually into the vagina or via an applicator, especially designed for this device. The applicator consists of a tube which the probe is pushed through. The

15 applicator may, but not necessary will, contain a lightning source to visualise the cervix. The probe transmits its data wireless to one or more receivers nearby the animal. The receiver transmits its data to one or more computers and/or mobiles of the person or persons who want to monitor the animal. If desired, this person or persons will be notified via communication technology when the animal undergoes internal changes.

20 The probe sends its data wireless , but not necessary through the animal, to the receiver. If required, we can recharge the batteries in the probe via a charger coils. For this purpose, the probe needs to be placed in a charging station that is connected to a power source. The receiver, that receives wireless data of the probe inside the animal, may be placed in the base station that is localized in the neighbourhood of the animal, and may

25 function on electricity of the electricity network. The base station may contain one or more charging stations, for the probes, that are connected to a power source.

A warning, via communication technology, is been transmitted to the farmer when the battery/batteries of the probes need to be charged. The base station also contains one or more microcontrollers to receive, analyse, translate, process and transfer the data via

30 communication technology. This may be sent to the person or persons who want to monitor the animal, or to the internet, or to a computer of mobile phone of the relevant individuals. At the same time, multiple probes can be used in multiple animals and send their measurements to the same base station. The receiver(s) may be a part of the base station. One or more base stations can be applied. The probe may be removed manually

35 after it has been inserted for the desired amount of time. The present invention is not only designed for ruminants, but can also be applied to other animal species as long as it contains the possible required modifications for the specific animal specie. To monitor the data via a computer, the computer needs to have special software to process, analyse, to display and store the data, or to send them to a special website on the world wide web,

40 or to an external person, e.g.: the farm veterinarian.

It will be understood that each of the elements described above, or two or more together may also find a useful application in other types of methods differing from the type described above. While certain novel features of this invention have been shown and

45 described and are pointed out in the annexed claims, it is not intended to be limited to the details above, since it will be understood that various omissions, modifications, substitutions and changes in the forms and details of the device illustrated and in its operation can be made by those skilled in the art without departing in any way from the spirit of the present invention.

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DETAILED DESCRIPTION OF FIGURES

DETAILED DESCRIPTION OF FIGURE 1:

THE UTERUS OF A COW THAT IS NOT PREGNANT
DORSAL CROSSECTIONAL VIEW

- 1) Uterus horn (cornua)
- 2) Ostium internum
- 3) Ligamenta Lata (broad ligaments)
- 4) Left ovary
- 5) Urine bladder
- 6) Hymen
- 7) External urethral opening
- 8) Vaginal vestibulum
- 9) Left vulva lip
- 10) Clitoris
- 11) Ventral commissure of the vulva
- 12) Right vulva lip
- 13) Vagina
- 14) Cavum vaginale
- 15) Orificium externum
- 16) Cervix
- 17) Fornix of the vagina
- 18) Broad ligaments
- 19) Right ovary
- 20) Uterus horn (cornua)

DETAILED DESCRIPTION OF FIGURE 2:

A VARIANT OF A PROBE WITHOUT A HOUSING WHICH CONSISTS OUT OF
LEGS WITH FEET AND BARBS
LONGITUDINAL VIEW

- 21) Waterproof tubing
- 22) 'Spoon-arm'
- 23) 'spoon'

DETAILED DESCRIPTION OF FIGURE 3:
A PROBE WITH A HOUSING
LONGITUDINAL VIEW

24) Feet with legs with barbs

25) Tubing of the probe covered by one or more synthetic materials, such as but not limited to: polyurethane and silicone rubber.

26) 'spoonarm'

27) 'spoon'

DETAILED DESCRIPTION OF FIGURE 4:
A PROBE THAT IS PLACED CORRECTLY IN THE ARTIFICIAL VAGINA
DORSAL VIEW

28) Fornix of the vagina. This is the angle formed by the projection of the cervix into the vagina. The fornix may form a complete circle around the cervix, in which the caudal end of the cervical protrusion is continuous with the vagina.

29) 'Spoon'.

30) Cervical protrusion (in Latin: 'cervical protrusion')

31) 'Spoon-arm'

32) Tube covered with a layer of a synthetic material, e.g.: silicone rubber

33) Artificial simulation vagina made of latex rubber

34) Legs of the probe with feet as barbs

DETAILED DESCRIPTION OF FIGURE 5:

THE PROBE VARIANT WITH A REPLACABLE TWO-PIECED HOUSING

- 35) Upper part of the housing which also contains spoons
- 36) Tube or body of the probe
- 37) Bottom part of the housing which contains the legs and feet

CLAIMS

1. Device for animals, and mode of operation of the detection methodology of this device by means of special movements of a spoon on one end of an intra-vaginal probe, as response to or in correlation with the changing intra-abdominal pressure, which contains measuring elements besides a temperature sensor, which may contain rechargeable batteries, and which may contain a housing, with on the other ending of the probe a leg with a foot and containing -or looking like- a barb, by which the spoon lays itself against the external side of the cervical protrusion and by which data are created which can detect changes of the reproduction, disease and health status of the animal and being sent to a receiver nearby the animal which may be a part of the base station which may contain one or more charging stations for the probe and which can send, report and alarm its data to the mobile phones and the, with special software provided, computers of the relevant persons and to the internet.
2. The flexible spoon of claim 1, which may be composed out of one or multiple parts, which may be of various geometry, and can be manufactured out of any kind of material, and may be replaced by example, but not limited to: a flexible surface of various geometry, a flexible strip of various geometry, a flexible arm with finger or hand shaped grab surfaces.
3. The flexible spoon of claim 2, monitors background movements which are specific for the movements of the organs of the individual animal which makes it possible to detect and monitor changes of the disease or health stage of the animal.
4. The flexible spoon of claim 3, which makes major movements as a response to the changing intra-abdominal pressure, and makes it possible to supervise changes of the reproduction stage of the animal.
5. The movements of the flexible spoon of claim 4, in which the major movements also can be considered as background movements and the background movements also can be considered as major movements.
6. The intra-vaginal probe of claim 1, which may be of various geometry and may contain multiple spoons, multiple legs, and multiple feet, containing multiple barbs which all may become of a various geometry or which may consist out of a various geometry.
7. The flexible legs and feet of claim 6, possibly containing or looking like barbs, which can have a various geometry.
8. The measuring elements of claim 1, which may comprise strain gauges, inductive coils, magnetic measuring elements and hydraulic measuring elements.
9. The measuring elements of claim 8, which can detect the movements of the spoon and which can be localized in the spoon or spoon arms, or in the base, or tube, or the body of the probe which is in connection with the spoon.
10. The measuring elements of claim 8 and 9, which may be of any nature.
11. The device of claim 1, which may consist of one piece or out of a central tube that is covered by a one, two or multiple sections housing which contains in its upper part the spoons and in its bottom part the legs with feet like barbs.
12. The possible, but not necessary, multiple sectioned housing of claim 11 which can be positioned in or on each other and can be of a various

- geometry.
13. The probe, tube and housing parts of claim 1, which can be constructed out of any material and which may be provided by any kind of measuring technique.
- 5 14. The device of claim 1, which sends its measurements wireless to a receiver localized in the neighbourhood of the animal.
15. The device of claim 1, which contains one or more receivers which may be a part of one or more base stations and which may contain one or more charging stations.
- 10 16. The receiver of claim 14, which sends its data, reports and alarms them to the mobile phone and the computer, which is provided with special software, of the relevant persons and to the internet.

FIGURE 1

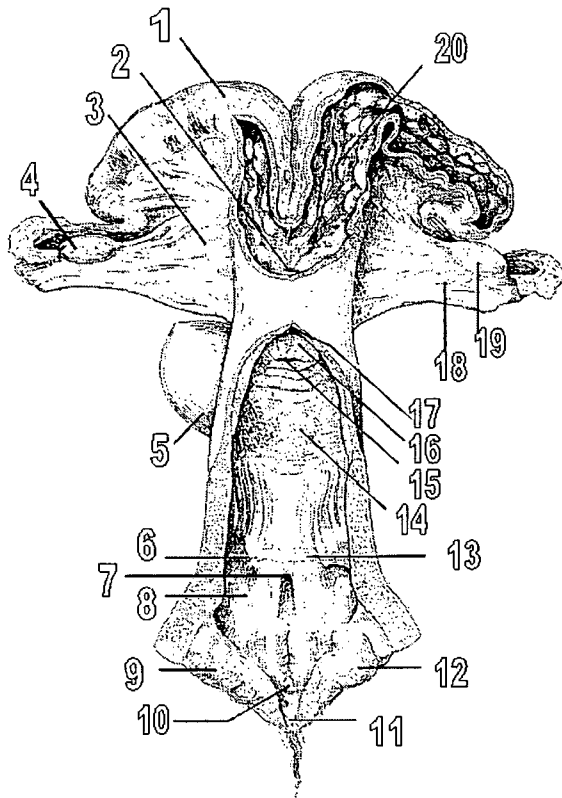


FIGURE 2

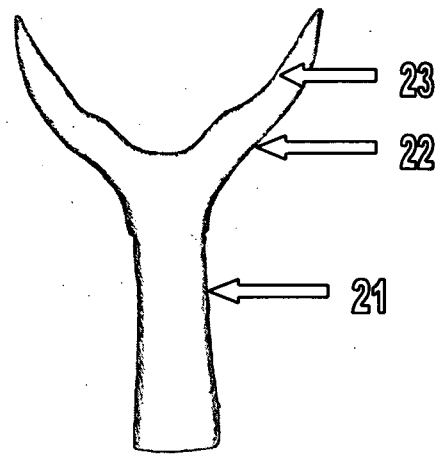


FIGURE 5

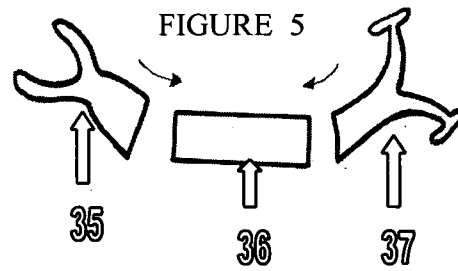


FIGURE 3

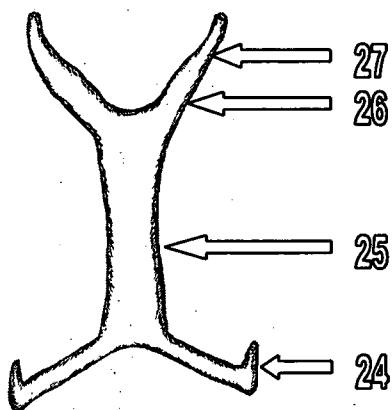


FIGURE 4

