

(19)



Europäisches Patentamt

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Office européen des brevets



(11)

EP 1 485 690 B1

(12)

EUROPEAN PATENT SPECIFICATION

(45) Date of publication and mention
of the grant of the patent:

28.12.2005 Bulletin 2005/52

(21) Application number: **03744449.4**

(22) Date of filing: **14.03.2003**

(51) Int Cl.7: **G01K 13/00**

(86) International application number:
PCT/GB2003/001144

(87) International publication number:
WO 2003/078949 (25.09.2003 Gazette 2003/39)

(54) **THERMOMETER**

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(84) Designated Contracting States:
**AT BE BG CH CY CZ DE DK EE ES FI FR GB GR
HU IE IT LI LU MC NL PT RO SE SI SK TR**

(30) Priority: **16.03.2002 GB 0206260**

(43) Date of publication of application:
15.12.2004 Bulletin 2004/51

(73) Proprietor: **UNIVERSITY OF BRISTOL
Bristol, Avon BS8 1TH (GB)**

(72) Inventor: **BUTTERWORTH, Andrew,
University of Bristol
Langford, North Somerset BS40 5DU (GB)**

(74) Representative: **McQueen, Andrew Peter et al
Stevens, Hewlett & Perkins
1 St. Augustine's Place
Bristol BS1 4UD (GB)**

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- **PATENT ABSTRACTS OF JAPAN vol. 2000, no. 02, 29 February 2000 (2000-02-29) & JP 11 316161 A (MATSUSHITA ELECTRIC IND CO LTD), 16 November 1999 (1999-11-16)**
- **PATENT ABSTRACTS OF JAPAN vol. 2000, no. 04, 31 August 2000 (2000-08-31) & JP 2000 005136 A (NIPPON TELEGR & AMP; TELEPH CORP <NTT>; TOKAI UNIV), 11 January 2000 (2000-01-11)**

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Description

[0001] This invention relates to a thermometer. More particularly, the present invention relates to an indwelling thermometer for clinical use.

[0002] Thermometers are well known in the art for providing an indication of temperature. Generally, thermometers comprise a heat-expandable fluid which is constrained to flow in a tube with indicia printed on the tube along the direction of expansion of the fluid; in use, the temperature is determined by reading the indication adjacent the leading edge of the fluid in the tube.

[0003] Recently, digital thermometers have been developed where a temperature is determined electronically and a digital indication of the temperature is provided.

[0004] More recently, disposable thermometers have been produced where the temperature indication is given using thermochromatic inks for predetermined reference intervals, an approximate temperature being provided by noting which inks have changed colour and which temperature they correlate to.

[0005] European Patent Application No. 0090327 describes an apparatus for determining ovulation in women which comprises a temperature sensor in the form of a tampon which is connection to a thermometer/signalling device worn on the body e.g. on the hip.

[0006] German Patent Application No. DE 4122930 describes a temperature measuring device to be used in connection with the human ear.

[0007] The present invention concerns an indwelling thermometer. In the description which follows the term "indwelling" is intended to define a thermometer which is left in a predetermined place for a long period of time to indicate that a rise in temperature above a predetermined threshold has occurred.

[0008] The invention will be described with particular reference to its preferred application in monitoring the temperature of the mammalian body, however, the invention finds equal utility in other areas where it is desirable to indicate that an unacceptable rise in temperature has occurred, for example in storage areas where spoilage may occur if a given temperature is exceeded.

[0009] In mammals a rise in temperature, especially in core body temperature, may be taken to be an indication of the presence of a pathology or of an infection. An early indication of infection can be vitally important to a farmer where the infection might spread through a herd of animals and early detection may prevent the spread of infection or unnecessary slaughter of uninfected animals.

[0010] In female mammals a temperature rise may also be indicative of ovulation or that oestrus is about to occur in mammals where actual release of the ovum is triggered by penetration. Both of these events are of interest to a farmer, a veterinary or medical practitioner and a woman experiencing difficulties in trying to conceive.

[0011] It is therefore an object of the present invention to provide a device which provides a signal that a rise in temperature above a predetermined threshold has occurred.

[0012] Accordingly, the present invention provides an indwelling thermometer comprising temperature sensing means and signal means for providing a continued indication that a predetermined threshold temperature has been exceeded.

[0013] Advantageously, the provision of a continued signal that the predetermined temperature has been exceeded enables the viewer to establish that the temperature has in fact been exceeded without continual monitoring of the subject. By the term "Continued Signal" as used herein is intended a signal which keeps signalling and does not stop signalling.

[0014] It is a further object of the invention to provide means for establishing that predetermined threshold temperature. Advantageously, this allows for temperature profiles of an individual subject to be established and used to eliminate minor temperature variations due to external temperature, exercise or sleep.

[0015] The signal means may provide a visual, aural, or mechanical indication that the temperature has been exceeded. For example, the signal may be the movement of an indicator device, the illumination/quenching of a light, the release of a marker dye, colour change of a thermochromatic ink, vibration of the thermometer, generation of a radio signal, activation of a buzzer or alarm, or an analogue or a digital telemetry system signal.

[0016] The temperature sensing means may be electronic, chemical or mechanical. For example the temperature sensing means may be a thermochromatic dye, a wax or grease with a specific melting point, a thermodeformable plastics material, a thermocouple linkage, a thermistor or a printed circuit board.

[0017] The thermometer preferably dwells in a body cavity of the subject mammal, for example, the ear cavity or the vagina. Temperatures that are measured in the ear cavity tend to be very accurate since the ear cavity is so close to the brain. However, the thermometer may also be wholly or partially implanted into a subject mammal, for example, it may be implanted beneath the skin.

[0018] It is intended that in its most simple form the thermometer of the invention gives, an indication that the threshold has been exceeded, however, in an alternative embodiment, the invention also provides means for recording the temperature of the subject over a predetermined period of time.

[0019] Preferably, the thermometer comprises a biocompatible material. By the term "biocompatible material" as used herein is intended a material which is suitable for leaving *in situ* in a subject animal for a long period of time without causing irritation, tissue growth, infection or promoting infection or an immunological, including autoimmunological, reaction. The thermometer of the invention may be made of or coated with such a

material. Examples of such materials include surgical grade polymers, such as:

ABS - acrylonitrile-butadiene-styrene terpolymer
 COPE - copolyester elastomer
 EAA - ethylene acrylic acid
 EMA - ethylene methylacrylate
 EVA - ethylene-vinyl-acetate
 HDPE - high-density polyethylene
 HIPS - high-impact polystyrene
 LCP - liquid crystal polymer
 LDPE - low-density polyethylene
 LLDPE - linear low-density polyethylene
 PBT - poly(butylene terephthalate)
 PC - polycarbonate
 PC/ABS - polycarbonate - ABS alloy/blend
 PC/PET - polycarbonate-PET alloy/blend
 PE - polyethylene
 PEI - polyetherimide
 PET - poly(ethylene terephthalate)
 PP - polypropylene
 PPO - poly(phenylene oxide)
 PUR - polyurethane
 PVC - polyvinyl chloride
 SAN - styrene acrylonitrile
 SBC - styrene block copolymer
 SPS - syndiotactic polystyrene
 TPE - thermoplastic elastomer
 TPO - thermoplastic olefin
 TPU - thermoplastic urethane
 ULDPE - ultra low-density polyethylene
 VLDPE - very low-density polyethylene
 Silicone
 Biodegradable Copolymers
 Copolymer Coatings
 Pseudo - Poly(Amino-Acids)
 Ceramic Composites
 Thermoplastic-Fiber Composites
 PYROLYTIC CARBON Pyrolite

[0020] In a first embodiment, the invention simply provides an indication that the predetermined threshold temperature has been exceeded. The thermometer is preferably in the form of an enclosed hollow container comprising two chambers separated by a waisted portion of the container. The container is preferably formed from a biocompatible material. The waisted portion of the container preferably contains the temperature sensing means while one of the chambers contains the signal means.

[0021] In this embodiment the temperature sensing means is a wax or grease, the melting point of which is at or close to the predetermined threshold temperature, and the signal means is preferably a marker dye contained in one chamber of the container only. Preferably, the wax or grease forms a plug in the waisted portion of the container such that the movement of the marker dye between the chambers of the container is prevented.

[0022] Examples of waxes or greases which may be used in the present invention include beeswax, lanolin, petroleum jelly, white petrolatum, spermaceti, cocoa butter, stearic acid, glycerinated gelatin, candelilla wax, carnauba wax, or mixtures of any of these with oils such as sweet almond oil, liquid paraffin or any vegetable oil, especially hydrogenated vegetable oils, fatty acids or polyethylene glycol (PEG).

[0023] Compounds or mixtures which melt at or close to body temperature are widely known in the art in the formation of suppositories, pessaries or some emollients, cosmetics or moisturisers such as lip balms or lipsticks. Hence, the person skilled in the art could readily select a proprietary suppository base formulation for use as the wax or grease of this embodiment of the present invention. For example, a range of suppository bases which melt at temperatures of between 33 and 44°C and are available under the trade name DUB-PP from Stearinerie-Dubois of France, could be used in the present invention.

[0024] In use, the thermometer is applied to the animal in a manner such that the chamber containing the marker dye is held internally in the animal while the other chamber is external of the animal and is visible, when the predetermined threshold temperature is exceeded, the wax or grease melts and allows travel of the marker dye to the visible chamber.

[0025] Preferably, the container is shaped such that the melted wax or grease, when cooled, cannot re-plug the waisted portion of the container, for example the regions adjacent the waisted portion may flare outwardly. Alternatively, the thermometer may be introduced to the subject mammal in a manner such that the chamber holding the marker dye is above the plug and the second, empty chamber hence, when the plug melts, the melted wax or grease will drain into the lower second chamber with the marker dye thereby preventing the waisted portion from becoming resealed.

[0026] The overall shape of the container is not critical although it is preferred that the thermometer does not cause discomfort to the subject mammal and in this respect it is preferred that the container is rounded or elliptical or other shape which does not present undue trauma to the animal. Ideally, the thermometer is shaped such that it is not likely to be easily lost if it is inserted into a body cavity such as the ear or the vagina. Additionally, where appropriate, it is desirable that the chambers are of unequal size to ensure that sufficient marker dye for detection is transferred from one chamber to the other.

[0027] The waisted portion of the thermometer may be a slight waisting of the container or, for more rapid melting of the wax or grease which may be held therein, be a narrow waisting or venturi. Ideally, the waisted portion is a tube of narrow cross-section with respect to the chambers, especially in the above-described embodiment where the temperature sensing means is a wax or grease which melts to allow transfer of a marker dye

from one chamber to the other.

[0028] In order to establish the predetermined reference temperature the invention also provides a kit of thermometers, each thermometer detecting a different specific temperature, whereby in use a user applies a different thermometer to a subject animal each day to establish the range of normal temperature variation throughout a day for that subject animal. When used in this way, the kit provides an indication of the normal temperature range for that animal and allows selection of a thermometer indicating a temperature above the maximum daily variation for the detection of infection or of ovulation.

[0029] Alternatively, the predetermined reference temperature can be determined using an electronic temperature recording device which is introduced to and left to dwell in the subject mammal for a period of time, for example one week or one month, to record the temperature of the individual at selected intervals over that period of time, for example every 20 minutes for one week. An example of a device suitable for this purpose is the device sold under the trade name "Tiny Talk"™ from RS Components Ltd., modified to be smaller and to have sufficient battery power to record the temperature variations for the required length of time.

[0030] In a second embodiment, the thermometer of the present invention is an electronic device in which the temperature sensing means comprise a thermistor and the signal means provide an optical or audible signal.

[0031] Preferably, the temperature sensing means comprise a thermistor set at or close to the predetermined threshold temperature. Alternatively, a bimetallic strip or a printed circuit board or a proprietary device such as those sold under the trade names Tiny tag Transit, Therma Tag or iButton having been modified to provide a continued signal and to be indwelling may be used to sense the temperature.

[0032] In order to ensure that the signal means continues to provide a signal even when the temperature subsequently drops below the reference temperature, the thermometer may further comprise means to prevent cancellation of the signal. Preferably, the cancellation prevention means comprises a latch. The latch may be a diode, a digital to analogue converter, an integrated circuit or a digital latch.

[0033] Preferably, the signal means provide a light output, for example the illumination or extinguishing of an LED or other light source, or a sound output such as the activation of a buzzer, beep or other alarm sound. The activation of the signal is preferably irreversible ensuring that the increased temperature is detected. Alternatively, the signal means may be a radio transmitter which sends a signal to a remote receiving station, the alarm signal being generated at the receiving station. The signal means may also send a mobile telecommunications signal to a mobile telephone, for example in the form of a "text" or SMS message or as a pre-recorded voice message. This allows for remote telemetry

monitoring of, for example, a herd of cows or sheep.

[0034] In this embodiment, it is also desirable to provide means for recording the temperatures sensed by the temperature sensing means. This data may be stored on a memory chip or other data storage device. The data storage may be remote, especially where the signal is sent to a remote receiving station, or can be contained within the device.

[0035] Additionally, a computer program may be used where the program compares the data contained within the signal to stored data, the program may then vary or set the predetermined temperature, for example by means of a discriminating function. In this way, the program can make a decision, based on the received data when compared to the stored data.

[0036] In a third embodiment, the thermometer may be formed from a plastics material with a thermochromatic pigment or ink incorporated therein. In this embodiment the temperature sensing means and the signal means may both be the thermochromatic pigment or ink, or the temperature sensing means may be the thermochromatic pigment or ink, and the signal means may be fixative to prevent the thermochromatic pigment or ink reverting to its original colour.

[0037] The predetermined reference temperature is likely to be in the region of 35 - 44°C, preferably approximately 39°C, since mammalian core temperature is generally in the region of 37 - 38°C. Examples of normal core body temperatures are as follows:-

Animal	°C
Dog	38.9
Cat	38.6
Stallion	37.6
Mare	37.8
Rabbit	39.5
Pig	39.2
Goat	39.1
Sheep	39.1
Dairy cow	38.6
Human	37.3

[0038] Hence, the pre-determined reference temperature which is considered to be indicative of infection or of oestrus will be modified according to which mammal the thermometer will be used with.

[0039] Additionally, the size and shape of the thermometer can be adapted according to the subject mammal it is to be used in.

[0040] Where a visual signal is generated, it is preferable that the externally oriented portion of the ther-

monometer be sufficiently large to be readily seen. For example, in farm animals the thermometer is likely to be read by a farmer when inspecting the cows, such as at milking time. In sheep, the externally oriented portion of the device may be sized so that it can be detected from a distance when herding the sheep. When to be used in the human female it is preferable that the device be shaped and sized similar to a tampon for comfort and ease of use for the user.

[0041] Embodiments of the invention will now be described, by way of example only, with reference to the accompanying drawing of which,

[0042] Figures 1a and 1b show a first embodiment of the thermometer of the invention, and

[0043] Figure 2 is a schematic representation of an electronic version of the thermometer of the present invention.

[0044] Referring to Figure 1 a a thermometer 10 is provided which is in the form of a container having two chambers 12 and 14 separated by a waisted portion 16. The waisted portion 16 is in the form of a narrow tube and contains a plug 18 of a wax having a melting temperature of 40°C for use in dairy cows. The wax used is a standard suppository base wax, e.g. a mixture of stearic acid, cocoa butter and PEG. Chamber 12 contains a marker dye and is much larger than chamber 14 to ensure transfer of the marker dye to chamber 14 on removal, by melting, of the plug 18. The thermometer 10 is made from a medical grade plastics material.

[0045] Figure 1 b shows the thermometer 10 of Figure 1 a after the wax plug 18 has melted due to the increase in body temperature above the predetermined threshold temperature of 40°C.

[0046] Referring to Figure 2 an electronic version 20 of the device is shown. The device 20 comprises a sensor 22. The sensor 22 may be a device such as that sold under the trade-name iButton modified to provide a continued signal and to be indwelling for example by being coated with a biocompatible or non-irritant material, linked to an indicator 24, in the form of an LED, by a conductor 26 also coated with a biocompatible or non-irritant material. A latch 28 is interposed between sensor 22 and indicator 24 to prevent cancellation of the signal and thereby to ensure the continued illumination of indicator 24.

[0047] In use, the device is inserted into the vagina of a cow and left in place. When sensor 22 detects a rise in temperature above a predetermined threshold it sends a signal along connector 26 to indicator 24, which illuminates. On visual inspection, the farmer, or a vet, then knows that the temperature of that particular cow has exceeded the threshold temperature and can investigate pyrexia or oestrus in that animal.

[0048] In the human female, the present invention is primarily used for the detection of ovulation rather than to monitor for infection. However, it is still possible to use the invention to monitor infection in this way. It is also preferred that the present invention be usable with-

out the need for a medical practitioner although use under medical supervision is not to be excluded.

[0049] In such a use it is intended that a device of the invention 10,20 is worn *per vaginam* continuously for at least one complete menstrual cycle so that the temperature peak experienced prior to ovulation can be determined and be distinguished from temperature fluctuations due to other causes.

[0050] In one embodiment for this application the user may use a series of disposable indwelling thermometers 10 each of which has a wax or grease 18 which is predetermined to melt at an incrementally higher temperature, for example one at 36.9°C, one at 37.1 °C, one at 37.5°C etc since normal human body temperature varies between 36.8 and 37.3°C, depending on the individual and on the level of activity being undertaken.

[0051] Once the normal temperature of the user has been established thermometers 10 are selected where the wax or grease 18 melts at the ovulation-indicative temperature rise. The thermometer 10 is worn continually until dye 12 can be seen in chamber 14, which is indicative of ovulation. Intercourse can then be timed to improve the chances of conception.

[0052] Using the second embodiment, the thermometer device 20, is again worn *per vaginam* to establish the normal body temperature range of the user. Devices 20 are used where the signaling threshold is varied. This can be done using one device 20 where the temperature threshold can be manually set or by using a series of pre-set, fixed temperature devices. Again, the device 20 is left in place throughout a complete menstrual cycle to establish the ovulation-indicative temperature peak of the user. Then, either the device 20, is set to be at or just below the desired temperature or a device 20 is selected which has a fixed predetermined temperature and operates at or just below the ovulation-indicative temperature of the user.

Claims

1. A vaginal indwelling thermometer comprising temperature sensing means, signal means for providing a continued indication that a predetermined threshold body temperature has been exceeded, and means to store temperature data generated by the temperature sensing means, **characterised in that** the data storage means and the signal means are integral with the temperature sensing means, and wherein the signal means provides a mechanical indication that the temperature has been exceeded.
2. An indwelling thermometer according to claim 1, in which the signal is selected from the group comprising the movement of an indicator device, the release of a marker dye, vibration of the thermometer, and activation of a buzzer or alarm.

3. An indwelling thermometer according to claim 1 or claim 2, in which temperature sensing means is electronic, chemical or mechanical.
4. An indwelling thermometer according to any one of claims 1 to 3, in which the temperature sensing means comprises a thermochromatic dye, a wax or grease with a specific melting point, a thermodeformable plastics material, a thermocouple linkage or a thermistor.
5. An indwelling thermometer according to any preceding claim, in which the thermometer comprises an enclosed hollow container comprising two chambers separated by a waisted portion of the container.
6. An indwelling thermometer according to claim 5, in which the waisted portion of the container contains the temperature sensing means.
7. An indwelling thermometer according to claim 6, in which the temperature sensing means is a wax or grease, the melting point of which is at or close to the predetermined threshold temperature.
8. An indwelling thermometer according to any one of claims 1 to 7, in which the signal means is a marker dye contained in one chamber of the container only.
9. An indwelling thermometer according to any preceding claim, in which the data relates to temperatures below and above the predetermined threshold.
10. An indwelling thermometer according to claim 9, in which the predetermined threshold is selected by a computer program.
11. An indwelling thermometer according to claim 10, in which the program is contained within the thermometer.
12. An indwelling thermometer according to any one of claims 1 to 4, in which the thermometer is formed from a plastics material with a thermochromatic pigment or ink incorporated therein.
13. An indwelling thermometer according to claim 12, in which temperature sensing means comprises the thermochromatic pigment or ink and the signal means comprises a fixative to prevent the thermochromatic pigment or ink reverting to its original colour.
14. A kit of thermometers to establish the predetermined threshold temperature of an individual subject mammal, the kit comprising a series of ther-

мометров according to any preceding claim, each thermometer detecting a different predetermined threshold temperature across a range of temperatures.

15. A kit according to claim 14, in which the temperature range is from 35-45°C.
16. Use of an indwelling thermometer according to any one of claims 1 to 13, in which the mammal is a human.
17. Use of an indwelling thermometer according to claim 16, in a human female.
18. Use according to claim 17 for the detection of ovulation.
19. A method of determining ovulation, the method comprising the steps of inserting a thermometer according to any one of claims 1 to 13 into the ear or vagina of a subject mammal, allowing said thermometer to indwell, and periodically observing the signal means to detect a signal.
20. A method according to claim 19, in which the mammal is a human female.
21. A method of determining infection of a mammal, the method comprising the steps of inserting a thermometer according to any one of claims 1 to 10 into the ear or vagina of a subject mammal, allowing said thermometer to indwell, and periodically observing the signal means to detect a signal.

Patentansprüche

1. Vaginalverweilthermometer, das ein Temperaturfühlmittel, ein Signalmittel zum Erzeugen eines anhaltenden Hinweises darauf, dass ein vorbestimmter Körpertemperaturschwellenwert überschritten wurde, und ein Mittel zum Speichern von Temperaturdaten umfasst, die von dem Temperaturfühlmittel erzeugt werden, **dadurch gekennzeichnet, dass** das Datenspeichermittel, das Signalmittel und das Temperaturfühlmittel eine Einheit bilden, und wobei das Signalmittel einen mechanischen Hinweis darauf gibt, dass die Temperatur überschritten wurde.
2. Verweilthermometer nach Anspruch 1, wobei das Signal ausgewählt ist aus der Gruppe bestehend aus der Bewegung einer Anzeigevorrichtung, der Freisetzung eines Markierungsfarbstoffs, der Vibration des Thermometers und der Aktivierung eines Summers oder Alarmtons.
3. Verweilthermometer nach Anspruch 1 oder An-

spruch 2, wobei das Temperaturfühlmittel elektronisch, chemisch oder mechanisch ist.

4. Verweilthermometer nach einem der Ansprüche 1 bis 3, wobei das Temperaturfühlmittel einen thermochromatischen Farbstoff, Wachs oder Fett mit einem bestimmten Schmelzpunkt, ein wärmeverformbares Kunststoffmaterial, eine Thermopaarverknüpfung oder einen Thermistor umfasst. 5
5. Verweilthermometer nach einem der vorherigen Ansprüche, wobei das Thermometer einen umschlossenen, hohlen Behälter umfasst, der zwei Kammern umfasst, die durch einen eingeschnürten Abschnitt des Behälters getrennt sind. 10
6. Verweilthermometer nach Anspruch 5, wobei der eingeschnürte Abschnitt des Behälters ein Temperaturfühlmittel enthält. 15
7. Verweilthermometer nach Anspruch 6, wobei das Temperaturfühlmittel Wachs oder Fett ist, dessen Schmelzpunkt bei oder nahe dem vorbestimmten Temperaturschwellenwert liegt. 20
8. Verweilthermometer nach einem der Ansprüche 1 bis 7, wobei das Signalmittel ein Markierungsfarbstoff ist, der nur in einer Kammer des Behälters enthalten ist. 25
9. Verweilthermometer nach einem der vorherigen Ansprüche, wobei sich die Daten auf Temperaturen unter und über dem vorbestimmten Schwellenwert beziehen. 30
10. Verweilthermometer nach Anspruch 9, wobei der vorbestimmte Schwellenwert von einem Computerprogramm ausgewählt wird. 35
11. Verweilthermometer nach Anspruch 10, wobei das Programm in dem Thermometer enthalten ist. 40
12. Verweilthermometer nach einem der Ansprüche 1 bis 4, wobei das Thermometer aus einem Kunststoffmaterial mit einem darin enthaltenen thermochromatischen Pigment oder Farbstoff besteht. 45
13. Verweilthermometer nach Anspruch 12, wobei das Temperaturfühlmittel ein(en) thermochromatisches/n Pigment oder Farbstoff umfasst und das Signalmittel ein Fixierungsmittel umfasst, um zu verhindern, dass das/der thermochromatische Pigment oder Farbstoff in seine ursprüngliche Farbe zurückkehrt. 50
14. Thermometersatz zum Ermitteln des vorbestimmten Temperaturschwellenwerts eines individuellen Säugetiers, wobei der Satz eine Reihe von Thermo-

metern nach einem der vorherigen Ansprüche umfasst, wobei jedes Thermometer einen anderen vorbestimmten Temperaturschwellenwert über einen Temperaturbereich erfasst.

15. Satz nach Anspruch 14, wobei der Temperaturbereich zwischen 35 und 45°C liegt.
16. Verwendung eines Verweilthermometers nach einem der Ansprüche 1 bis 13, wobei das Säugetier ein Mensch ist.
17. Verwendung eines Verweilthermometers nach Anspruch 16 bei einem weiblichen Menschen.
18. Verwendung nach Anspruch 17 zur Erfassung des Eisprungs.
19. Verfahren zum Bestimmen des Eisprungs, wobei das Verfahren die folgenden Schritte umfasst: Einsetzen eines Thermometers nach einem der Ansprüche 1 bis 13 in das Ohr oder die Vagina eines Säugetiers, Verweilenlassen des Thermometers und in regelmäßigen Abständen Beobachten des Signalmittels zur Erfassung eines Signals.
20. Verfahren nach Anspruch 19, wobei das Säugetier ein weiblicher Mensch ist.
21. Verfahren zur Bestimmung einer Infektion eines Säugetiers, wobei das Verfahren die folgenden Schritte umfasst: Einsetzen eines Thermometers nach einem der Ansprüche 1 bis 10 in das Ohr oder die Vagina eines Säugetiers, Verweilenlassen des genannten Thermometers und in regelmäßigen Abständen Beobachten des Signalmittels zur Erfassung eines Signals.

Revendications

1. Thermomètre vaginal à demeure comprenant un moyen de détection de la température, un moyen de production de signal pour indiquer en continu qu'un seuil prédéterminé de température corporelle a été dépassé, et un moyen pour enregistrer les données de température générées par le moyen de détection de température, **caractérisé en ce que** le moyen d'enregistrement des données et le moyen de production de signal sont intégrés au moyen de détection de température, et dans lequel le moyen de production de signal fournit une indication mécanique de dépassement de la température.
2. Thermomètre à demeure selon la revendication 1, dans lequel le signal est sélectionné dans le groupe comprenant le déplacement d'un dispositif indica-

teur, la libération d'un colorant marqueur, la vibration du thermomètre, et l'activation d'un bruiteur ou d'une alarme.

3. Thermomètre à demeure selon la revendication 1 ou 2, dans lequel le moyen de détection de température est électronique, chimique ou mécanique. 5
4. Thermomètre à demeure selon l'une quelconque des revendications 1 à 3, dans lequel le moyen de détection de température comprend un colorant thermochromique, une cire ou une graisse à point de fusion spécifique, une matière plastique thermodéformable, une liaison à thermocouple ou une thermistance. 10
5. Thermomètre à demeure selon l'une quelconque des revendications précédentes, dans lequel le thermomètre comprend un contenant creux fermé constitué de deux chambres séparées par une partie pincée du contenant. 20
6. Thermomètre à demeure selon la revendication 5, dans lequel la partie pincée du contenant contient le moyen de détection de température. 25
7. Thermomètre à demeure selon la revendication 6, dans lequel le moyen de détection de température est une cire ou une graisse dont le point de fusion est au seuil de température prédéterminé ou proche de celui-ci. 30
8. Thermomètre à demeure selon l'une quelconque des revendications 1 à 7, dans lequel le moyen de production de signal est un colorant marqueur contenu dans une chambre du contenant seulement. 35
9. Thermomètre à demeure selon l'une quelconque des revendications précédentes, dans lequel les données se rapportent aux températures supérieures et inférieures au seuil prédéterminé. 40
10. Thermomètre à demeure selon la revendication 9, dans lequel le seuil prédéterminé est sélectionné par un programme d'ordinateur. 45
11. Thermomètre à demeure selon la revendication 10, dans lequel le programme est contenu dans le thermomètre. 50
12. Thermomètre à demeure selon l'une quelconque des revendications 1 à 4, dans lequel le thermomètre est formé d'une matière plastique dans laquelle est incorporé un pigment ou une encre thermochromique. 55
13. Thermomètre à demeure selon la revendication 12, dans lequel le moyen de détection de température

comprend le pigment ou l'encre thermochromique et le moyen de production de signal comprend un fixatif pour empêcher le pigment ou encre thermochromique de revenir à sa couleur d'origine.

14. Ensemble de thermomètres prévus pour établir le seuil de température prédéterminé d'un sujet mammifère individuel, l'ensemble comportant une série de thermomètres selon l'une quelconque des revendications précédentes, chaque thermomètre détectant un seuil de température prédéterminé différent sur une plage de températures.
15. Ensemble selon la revendication 14, dans lequel la plage de températures est de 35 à 45°C.
16. Utilisation d'un thermomètre à demeure selon l'une quelconque des revendications 1 à 13, dans laquelle le mammifère est un humain.
17. Utilisation d'un thermomètre à demeure selon la revendication 16 dans un humain de sexe féminin.
18. Utilisation selon la revendication 17 pour la détection de l'ovulation.
19. Procédé de détermination de l'ovulation, le procédé comprenant les étapes consistant à insérer un thermomètre selon l'une quelconque des revendications 1 à 13 dans l'oreille ou le vagin d'un sujet mammifère, à laisser s'installer ledit thermomètre, et à observer périodiquement le moyen de production de signal pour détecter un signal.
20. Procédé selon la revendication 19, dans lequel le mammifère est un humain de sexe féminin.
21. Procédé de détermination de l'infection d'un mammifère, le procédé comprenant les étapes consistant à insérer un thermomètre selon l'une quelconque des revendications 1 à 10 dans l'oreille ou le vagin d'un sujet mammifère, à laisser s'installer ledit thermomètre, et à observer périodiquement le moyen de production de signal pour détecter un signal.

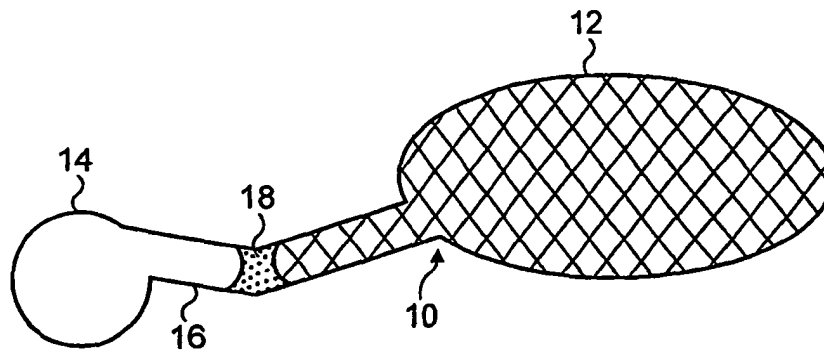


FIG. 1a

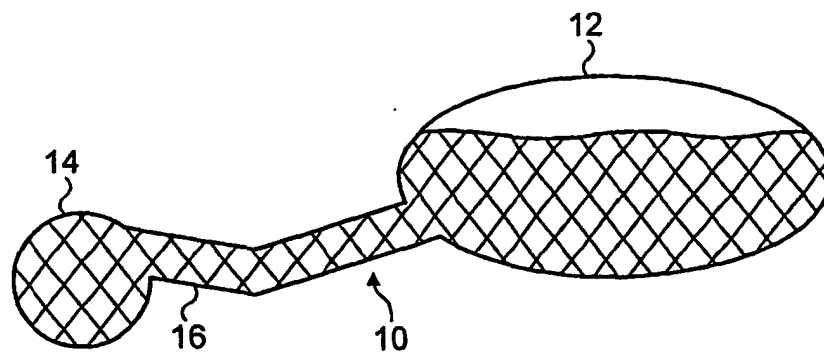


FIG. 1b

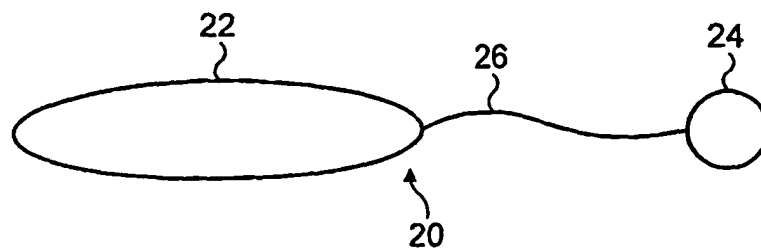


FIG. 2