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(54) Title: A BIRTHING SENSOR

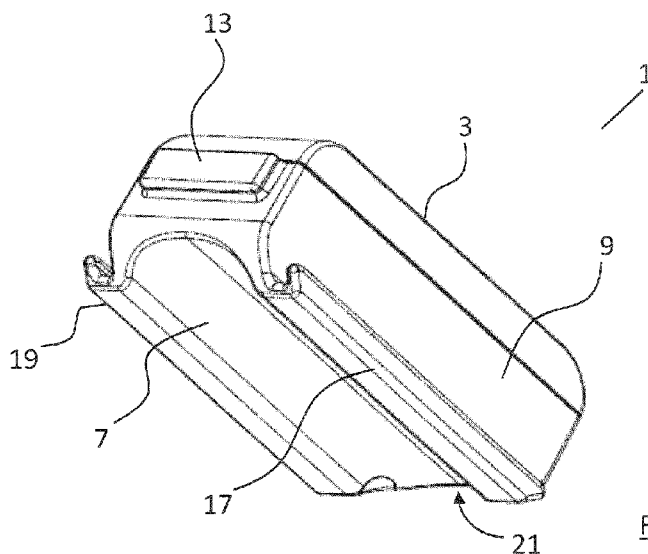


Fig. 3

(57) Abstract: This invention relates to a birthing sensor (1) of the type that is quasi-permanently mounted on a pregnant animal. Birthing sensors are used to monitor the pregnant animal and issue an alert to a farmer or veterinarian when the animal is about to go into labour. Some of the known types of birthing sensor require intervention by a veterinarian in order to implant the birthing sensor into an orifice of the animal. Other birthing sensors are mounted externally but take a long time to mount and furthermore are prone to damage caused by the animal. The birthing sensor (1) described herein comprises a casing (3) and a continuous securing strap (31) that are used to mount the birthing sensor on the tail (30) of the animal. Due to the simplicity of design and construction, the birthing sensor may be mounted with the minimum amount of time, skill and training.



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Title of Invention:**“A birthing sensor”****5 Technical Field:**

This invention relates to a birthing sensor. In particular, this invention relates to a birthing sensor particularly suited for use with cows and heifers.

10 Background Art:

It is known to place birthing sensors about pregnant animals to detect when the animal is about to give birth. These birthing sensors alert the farmer or veterinarian that the birth is imminent and provide them with the opportunity to attend the birth and assist in the
15 delivery if so required. The birthing sensors come in a variety of types that range from temperature sensor probes that are only inserted periodically into an orifice of the animal to quasi-permanently installed sensors such as heart rate monitors that may be mounted on straps that surround the animals body and temperature probes that are ingested or inserted quasi-permanently into an orifice of the animal. Each of the quasi-permanently
20 installed birthing sensors transmits information to a base station or other device that is used to alert the farmer or the veterinarian.

Although many of the known sensors have been commercially successful and have been useful for the farmer or the veterinarian, there are problems with the existing
25 sensors. First of all, the temperature sensor probes that are used periodically are not entirely suitable as they require continuous monitoring of the animal and they require temperature measurements to be taken frequently. This requires the presence of an individual to carry out the test on the animal, often at anti-social times of day or night, which is labour intensive and undesirable.

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Although the other types of birthing sensors that are strapped around the animal or inserted into the animal on a quasi-permanent basis overcome some of the problems with the periodically-used temperature probes, namely that they do not require the presence of the farmer or the veterinarian to take a reading, there are still problems with

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these other types of sensors. First of all, many of the sensors that are inserted into an orifice of the animal require the presence and skills of a veterinarian. This can be time consuming to perform, represents a significant cost to the farmer and indeed the insertion of the sensor can cause distress to the animal thereby putting the animal and the unborn animal in jeopardy. Secondly, many of the known sensors cause discomfort to the animal and there is a tendency of the animal to attempt to remove or dislodge the sensors. These actions can damage the sensors and in other cases can result in a false alert being sent to the farmer or veterinarian causing them to attend to the animal unnecessarily. Thirdly, the known sensors are often relatively time consuming to install on an animal and it is desirable to provide a birthing sensor that may be installed in a matter of moments.

It is an object of the present invention to provide a birthing sensor and a method of securing a birthing sensor to an animal that overcomes at least some of the above-identified problems. It is a further object of the present invention to provide a birthing sensor that provides a useful choice to the consumer.

Summary of Invention

According to the invention there is provided a birthing sensor configured to be mounted on the tail of a pregnant animal, the birthing sensor comprising an elongate sealed casing comprising a top, a bottom, a pair of elongate longitudinal sides and a pair of lateral ends, the birthing sensor further comprising a continuous resiliently deformable securing strap for engagement of the casing and securing the casing in position about a pregnant animals tail, the casing comprising a securing strap engagement means on each longitudinal side of the casing, the securing strap engagement means including a channel-shaped flange extending outwardly from one of the longitudinal sides for releasable engagement of the continuous securing strap thereby trapping the tail of the animal intermediate the continuous securing strap and the bottom of the casing.

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By having such a birthing sensor, the birthing sensor may be installed on an animal in a non-intrusive fashion and without the assistance of a veterinarian. Furthermore, the birthing sensor can be installed by an unskilled individual in a matter of seconds and therefore the minimum amount of distress is caused to the animal. At the same time, due

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to the speed with which the birthing sensor may be mounted on the animal's tail, the animal is not provided with sufficient opportunity to move away from the person installing the sensor or switch their tail so it will be significantly easier and faster to install.

5 In one embodiment of the invention there is provided a birthing sensor in which the securing strap engagement means comprises a second channel shaped flange extending outwardly from the other of the longitudinal sides for releasable engagement of the continuous securing strap. This is seen as a particularly preferred construction that will be simple and inexpensive to manufacture while at the same time being simple to
10 install.

In one embodiment of the invention there is provided a birthing sensor in which the first and second channel-shaped flanges extend substantially along the entire length of the elongate sealed casing.

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In one embodiment of the invention there is provided a birthing sensor in which the continuous securing strap is permanently mounted on the longitudinal side of the casing opposite the longitudinal side of the casing with the channel-shaped flange extending outwardly therefrom. This is seen as a useful alternative embodiment. By permanently
20 mounting the strap along one longitudinal side of the casing, the strap cannot be mislaid after becoming separated from the remainder of the device.

In one embodiment of the invention there is provided a birthing sensor in which the bottom of the casing is provided with a tail-receiving channel extending longitudinally
25 along its length. By providing a channel along the bottom of the casing, the device will form a better fit with the tail of the animal, will be more comfortable for the animal, and will be less likely to become inadvertently dislodged from the animal's tail. Furthermore, by forming a better fit with the tail of the animal, the birthing sensor will be easier to mount on the tail of the animal.

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In one embodiment of the invention there is provided a birthing sensor in which there is provided a padding layer on the bottom of the casing.

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In one embodiment of the invention there is provided a birthing sensor in which there is provided a non-slip layer on the bottom of the casing for contact with the tail of the pregnant animal.

5 In one embodiment of the invention there is provided a method of securing a birthing sensor of the type described herein to the tail of a pregnant animal comprising the steps of: bringing the bottom of the casing into engagement with the tail of the pregnant animal adjacent the base of the tail, looping the continuous resiliently deformable securing strap that is secured to one longitudinal side of the casing around the tail and securing it in
10 position in the channel-shaped flange extending outwardly from the other of the longitudinal sides thereby trapping the tail of the animal intermediate the continuous securing strap and the bottom of the casing. This is seen as a particularly simple and efficient way of mounting a birthing sensor onto a pregnant animal that will require the minimal amount of skill and effort.

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Brief Description of the Drawings:

The invention will now be more clearly understood from the following description of some embodiments thereof given by way of example only with reference to the accompanying
20 drawings, in which:-

Figure 1 is a perspective view taken from one end of a birthing sensor according to the invention;

25 Figure 2 is a perspective view taken from the opposite end of the birthing sensor;

Figure 3 is a perspective view taken from below of the birthing sensor;

Figure 4 is another perspective view taken from below of the birthing sensor;

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Figure 5 is a bottom plan view of the birthing sensor;

Figure 6 is an end view of the birthing sensor;

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Figure 7 is a side view of the birthing sensor;

Figure 8 is an end view of the birthing sensor showing the opposite end to that shown in Figure 6;

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Figure 9 is a top plan view of the birthing sensor;

Figure 10 is a side cross-sectional view along the lines A-A of Figure 9;

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Figure 11 is an end cross-sectional view along the lines B-B of Figure 9;

Figure 12 is an exploded view of the birthing sensor;

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Figures 13(a) to 13(c) are diagrammatic representations of a cow having the birthing sensor mounted on it's tail;

Figure 14 is an enlarged view of the circled portion C in Figure 13(c);

20

Figure 15 is a cross-sectional view along the lines D-D of Figure 14;

Figure 16 is a front view of an alternative embodiment of birthing sensor and attachment means for mounting the birthing sensor onto the tail of an animal;

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Figure 17 is a front view of the birthing sensor mounted in a pouch of the attachment means prior to mounting on the tail of an animal;

Figure 18 is a front view of the birthing sensor and attachment means after being mounted on the tail of an animal;

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Figure 19 is a side view of the birthing sensor and attachment means after being mounted on the tail of an animal;

Figure 20 is a front view of an alternative construction of attachment means for mounting a birthing sensor onto the tail of an animal;

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Figure 21 is a rear view of the alternative construction of attachment means shown in Figure 20;

5 Figure 22 is a front view of the attachment means with a birthing sensor contained therein after being mounted on the tail of an animal; and

Figure 23 is a side view of the attachment means with birthing sensor after being mounted on the tail of an animal.

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Detailed Description of the Drawings:

Referring to Figures 1 to 12 inclusive, there is shown a birthing sensor, indicated generally by the reference numeral 1, comprising a sealed casing 3 having a top 5, a bottom 7, a pair of longitudinal sides 9, 11 and a pair of lateral ends 13, 15. A pair of
15 securing strap engagement means are provided, one on each longitudinal side of the casing. The securing strap engagement means each comprise a channel-shaped flange 17, 19 that extends outwardly from the longitudinal side of the casing and is configured to releasably engage a resiliently deformable continuous securing strap (not shown). The
20 channel-shaped flange 17, 19 extend substantially the entire length of the casing 3.

The bottom 7 of the casing is provided with a channel 21 indent that extends along the length of the casing. A padding layer and a non-slip layer, neither of which are illustrated, are preferably mounted in the channel 21. Referring specifically to Figures 10
25 and 11, it can be seen that internal the casing there is provided a power supply, in this case provided by way of three batteries 23, 25, 27 and a circuit board 29 on which there is mounted sensing components including a microcontroller, a movement sensor provided by way of a three axis accelerometer, and a wireless communications module. The movement sensor detects the movements of the animal and in particular the
30 movements of the animals tail and determines whether, from those movements, that the animal is in labour. If it is determined that the animal is in labour, an alert is transmitted to the farmer or a veterinarian.

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Referring now to Figures 13(a) to 15 inclusive, there are shown various representations of the birthing sensor being mounted on the tail 30, of a cow, 32. First of all, in order to mount the birthing sensor on the tail of a cow, the birthing sensor casing 3 is brought into engagement with the tail of the cow, as illustrated in Figure 13(a), until it is in the desired location on the cow's tail, as illustrated in Figure 13(b). The birthing sensor casing 3 is held in that desired position by the operator (not shown) with one hand while their other hand is used to affix a resiliently deformable continuous securing strap 31 to one of the channel-shaped flanges 17, 19 that extend outwardly from the longitudinal side of the casing 3. When the securing strap 31 has been connected to the channel shaped flange 17, 19, the securing strap 31 is then led around the tail of the animal and secured in place on the other channel shaped flange 17, 19, thereby trapping the tail of the animal intermediate the continuous securing strap and the bottom of the casing, as shown in Figures 13(c), 14 and 15.

The securing strap 31 is preferably a continuous ring of rubber or similar rugged, resiliently deformable material. Preferably, the securing strap will be constructed from a band of latex rubber tubing. The securing strap 31 will hold the casing in position on the cow's tail without causing noticeable discomfort to the cow.

If desired, a pair of sleeves wider than the width of the continuous ring may be provided on the continuous ring of rubber to spread the elastic force of the rubber ring over a larger area. This will prevent the ring from digging into the tail of the animal and causing discomfort to the animal. Instead of a continuous ring of rubber, a strap or band of material with loops at either end for engagement of the channel-shaped flanges 17, 19 can be provided. The strap can be formed from an elasticated material and/or the loops can be constructed from an elasticated material.

The casing is a sealed casing and a rubber seal 33 is provided (as shown in Figure 12) to limit the possibility of there being ingress of dirt or moisture into the casing 3. It will be appreciated that the birthing sensor according to the present invention may be used multiple times on the same or different cows. It is envisaged that the birthing sensor could be used to service up to 25 cows in a herd over the course of a season.

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Referring to Figures 16 to 19 inclusive, there is shown an alternative embodiment of birthing sensor 103 and attachment means 101 according to another aspect of the present invention. According to this second embodiment, the birthing sensor 103 is a relatively thin, cuboid shape construction. The birthing sensor 103 is not provided with the channel shaped flanges for reception of a continuous ring of rubber and preferably has rounded, chamfered edges and/or corners. Instead of providing a continuous ring of rubber for engagement of channel shaped flanges on a birthing sensor, the attachment means 101 comprises a band of flexible material having a pair of straps 105, 107 extending outwardly therefrom and a pouch 109 formed therein. The straps 105, 107 are provided with complementary engagement members, in this case hook and eye fasteners, such as, but not limited solely to, those sold under the registered trademark Velcro®.

In use, the birthing sensor 103 is placed into the pouch 109 (as illustrated in Figure 17) and the attachment means 101 is placed in abutment against the tail of the animal (indicated by the reference numeral 30 in Figure 19). The straps 105, 107 are wound around the tail of the animal and back around the pouch 109, preferably a number of times, thereby securing the birthing sensor in position on the tail of the animal. The lengths of the straps 105, 107 can be provided in a length suitable for purpose and the drawings are not to scale. In order to remove the birthing sensor, the straps 105, 107 are simply unwound and the attachment means and the birthing sensor are separated from the animal's tail.

Indeed, if preferred, the complementary engagement members may be provided on one of the straps 105, with the hooks of the complementary engagement members being mounted on one side of the strap 105 and the eyes of the complementary engagement members being mounted on the other side of the strap 105 opposite to the hooks. In this way, the strap may be looped around the tail and connected back on itself. In such a configuration, with the hooks and eyes both on one single strap 105, the other strap 107 may be omitted altogether or indeed a shorter strap 107 could be provided with or without some complementary engagement members for attachment to some of the complementary engagement members on the other strap 105.

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Referring specifically to Figure 19, there is shown a side view of the birthing sensor 103 and attachment means 101 mounted onto the tail 30 of a cow. It will be understood that the individual parts are not shown to scale and the band of flexible material is shown in exaggerated depth to be clearly visible in the drawings. The width of the band may also
5 be wider than it is shown relative to the other parts in order to spread the load of the attachment means 101 over a larger area which it is believed will have less tendency to irritate the animal and also have less tendency to slip on the animal's tail.

The pouch 109 shown is illustrated as an open mouthed pouch in which the birthing
10 sensor may be slid downwardly into the pouch. It will be understood that a flap (not shown) or other like device may be provided on the attachment means located above the pouch 109 that will engage the top of the birthing sensor to prevent accidental premature release of the birthing sensor from the pouch 109. The flap or pouch may be constructed from a transparent material to allow sight of any graphical user interface or
15 light emitting diodes (if provided) on the birthing sensor. The band of flexible material may have a protective outer coating of rubber-like or other suitable material to prevent ingress of dirt and or moisture into the band of flexible material. The band of flexible material may be the same as that often used for equine bandages, elastane, with Velcro
® straps connected thereto.

Referring to Figures 20 to 23 inclusive, there is shown a further alternative embodiment of attachment means, indicated generally by the reference numeral 201, for use with the construction of birthing sensor 103 illustrated in Figures 16 to 19 inclusive, where like parts have been given the same reference numerals as before. The attachment means
25 201 again comprises a pouch 109 for reception of a birthing sensor 103 and a pair of straps, 205, 207. However, in the embodiment shown, the strap 205 is instead provided with a hook 209 and the strap 207 is provided with a plurality of loops 211, 213 and 215. The hook 209 and loops 211, 213, 215 may also provide a secure engagement of the birthing sensor and attachment means to the tail of an animal.

In use, the birthing sensor 103 is placed in the sewn-in pouch 109 and the opposite side of the attachment means is placed in abutment against the tail 30 of an animal (as illustrated in Figure 23). The straps 205, 207 are then led around the tail and the hook 209 is placed in one of the loops 211, 213, 215 to provide a secure engagement of the
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attachment means on the tail 30. In order to remove the birthing sensor, the hook 209 can be released from the loop 211, 213, 215 and the attachment means and birthing sensor removed from the animal's tail 30.

- 5 Again, the parts of the attachment means have not been shown to scale in the drawings 20 to 23 in order to illustrate all of the various components clearly. The straps 205, 207 are preferably of the order of 0.075 meters to 0.15 meters wide, ideally of the order of 0.10 to 0.125 meters (4 to 5 inches) wide. The straps are constructed from a relatively soft, stretchable material (such as elastane or the like) that will not cause significant
10 discomfort to the animal. Preferably, the material will be such that it will allow the tail to "breathe" and will have an outer layer or rubber or rubber-like material that will repel ingress of foreign materials such as faeces. Although three loops 211, 213, 215 are shown, more or less loops 211, 213, 215 could be provided. Indeed, more than one hook 209 could be provided if desired. It might be preferable to provide a single loop and
15 multiple hooks. Various minor modifications to the construction of the device such as these could be made without departing from the spirit of the invention.

- Instead of providing hook and eye fasteners as described with reference to Figures 16 to 19 inclusive, or indeed instead of providing a hook and loop fastener arrangement as
20 described in Figures 20 to 23, other fastener arrangements could be provided. These include, for example, a buckle and strap arrangement whereby the strap is led through the buckle and frictional forces hold the strap in position relative to the buckle. Alternatively, a pin mounted on the buckle that can protrude through a hole in the strap (i.e. similar to a belt) could be used instead to hold the attachment means and birthing
25 sensor in position. Indeed, a combination of these with hook and eye fasteners such as Velcro ® could be used to good effect. It is envisaged that padding adjacent the rear of the pouch 109 could be provided to prevent discomfort to the animal caused by the birthing sensor.

- 30 It is envisaged that various modifications could be made to the embodiment shown in the drawings without departing from the spirit of the present invention. For example, instead of providing a single channel-shaped flange than extends substantially the entire length of the casing 3 in the embodiment shown in Figures 1 to 15 inclusive, a smaller flange that extends only part of the length of the casing could be provided, a plurality of channel

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shaped flanges could be provided and indeed, one or more hooks for receiving the resiliently deformable continuous securing strap could be provided instead of a channel shaped flange. In addition to the above, padding such as a rubber insert or other resiliently deformable material could be placed on the bottom of the casing to provide a cushion layer between the casing and the tail of the cow. A non-slip coating that preferably is non-abrasive to the animal, can also be placed directly onto the bottom of the casing or onto the padding layer, if one is provided, in a location on the padding layer where it comes into contact with the animal's tail. In addition to the above, the birthing sensor may be provided with an externally visible light such as a light emitting diode (LED) that will demonstrate to a farmer or other person monitoring the animal that the sensor is in fact operational. A number of externally visible lights could be provided to indicate other aspects such as low battery power and the like.

In this specification the terms "comprise, comprises, comprised and comprising" and the terms "include, includes, included and including" are all deemed totally interchangeable and should be afforded the widest possible interpretation.

The invention is in no way limited to the embodiments hereinbefore described but may be varied in both construction and detail within the scope of the claims.

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Claims:

- (1) A birthing sensor (1) configured to be mounted on the tail of a pregnant animal, the birthing sensor comprising an elongate sealed casing (3) comprising a top (5), a bottom (7), a pair of elongate longitudinal sides (9, 11) and a pair of lateral ends (13, 15), the birthing sensor further comprising a continuous resiliently deformable securing strap (31) for engagement of the casing and securing the casing in position about a pregnant animals tail, the casing comprising a securing strap engagement means on each longitudinal side of the casing, the securing strap engagement means including a channel-shaped flange (17) extending outwardly from one of the longitudinal sides (9) for releasable engagement of the continuous securing strap (31) thereby trapping the tail of the animal intermediate the continuous securing strap (31) and the bottom (7) of the casing.
- (2) A birthing sensor (1) as claimed in claim 1 in which the securing strap engagement means comprises a second channel shaped flange (19) extending outwardly from the other of the longitudinal sides (11) for releasable engagement of the continuous securing strap (31).
- (3) A birthing sensor (1) as claimed in claim 1 or 2 in which the first and second channel-shaped flanges (17, 19) extend substantially along the entire length of the elongate sealed casing.
- (4) A birthing sensor (1) as claimed in claim 1 in which the continuous securing strap (31) is permanently mounted on the longitudinal side (11) of the casing opposite the longitudinal side (9) of the casing with the channel-shaped flange (17) extending outwardly therefrom.
- (5) A birthing sensor (1) as claimed in any preceding claim in which the bottom (7) of the casing is provided with a tail-receiving channel (21) extending longitudinally along its length.
- (6) A birthing sensor (1) as claimed in any preceding claim in which there is provided a padding layer on the bottom (7) of the casing.

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- (7) A birthing sensor (1) as claimed in any preceding claim in which there is provided a non-slip layer on the bottom (7) of the casing for contact with the tail of the pregnant animal.

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- (8) A method of securing a birthing sensor (1) as claimed in any preceding claim to the tail (30) of a pregnant animal comprising the steps of: bringing the bottom (7) of the casing (3) into engagement with the tail of the pregnant animal adjacent the base of the tail, looping the continuous resiliently deformable securing strap (31) that is secured to one longitudinal side (11) of the casing around the tail and securing it in position in the channel-shaped flange (17) extending outwardly from the other of the longitudinal sides (9) thereby trapping the tail of the animal intermediate the continuous securing strap (31) and the bottom (7) of the casing (3).

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- (9) A method of securing a birthing sensor (1) as claimed in claim 8 in which the method comprises the initial step of securing the continuous resiliently deformable securing strap (31) to the first longitudinal side (11) of the casing by securing the strap (31) in position in the channel-shaped flange (19) extending outwardly from the longitudinal side (11).

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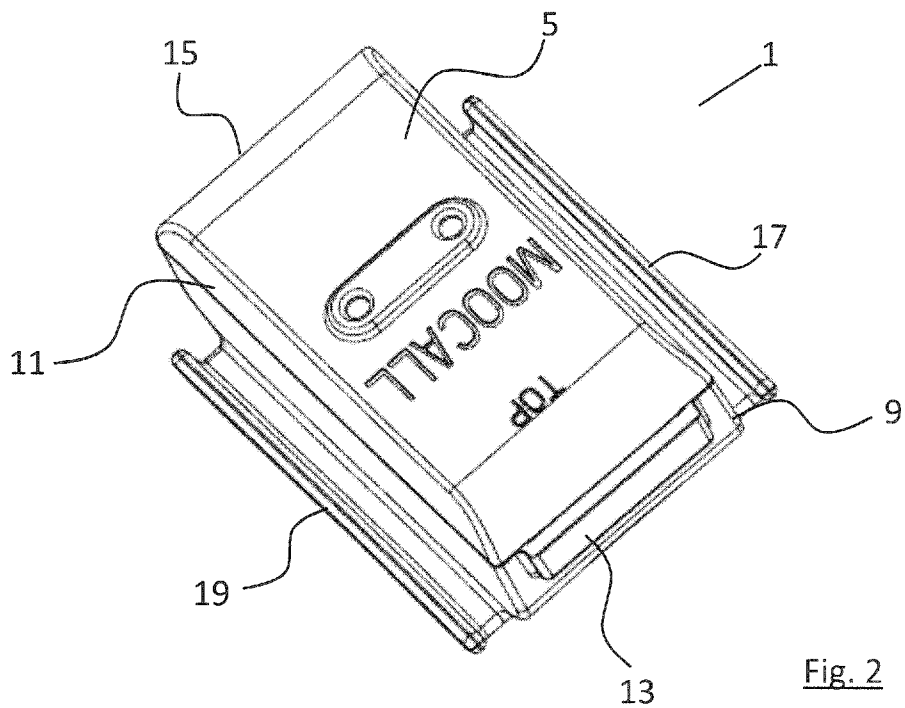
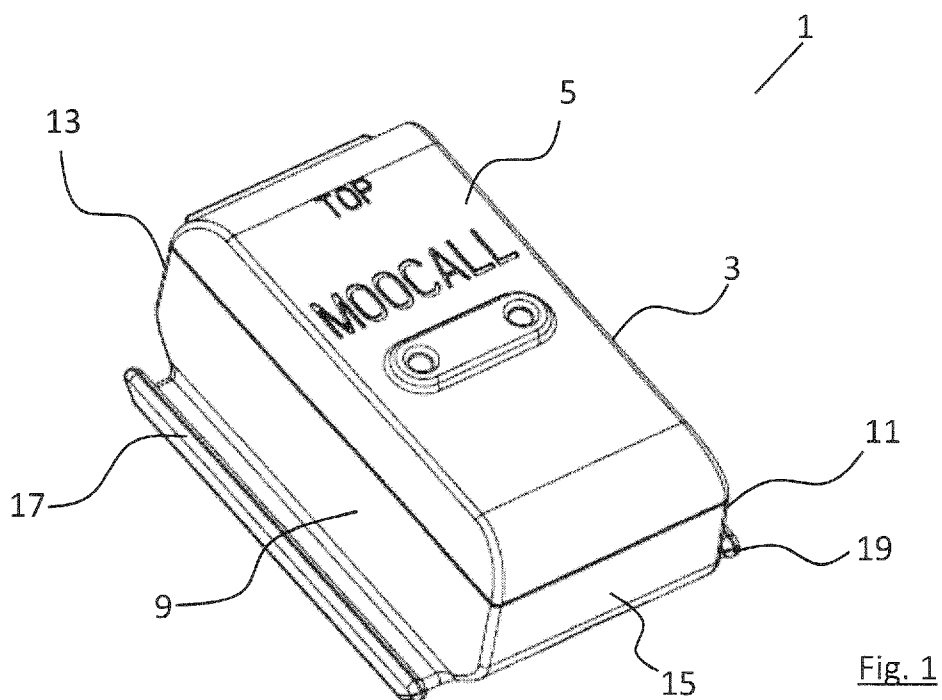
- (10) A birthing sensor (1) substantially as hereinbefore described with reference to and as illustrated by the accompanying drawings.

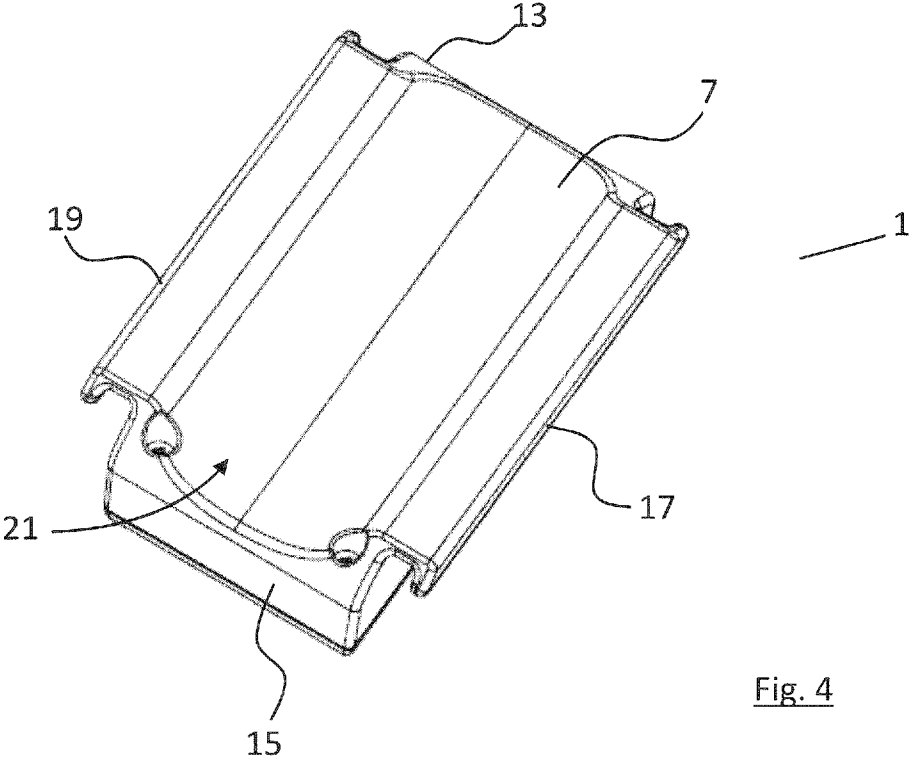
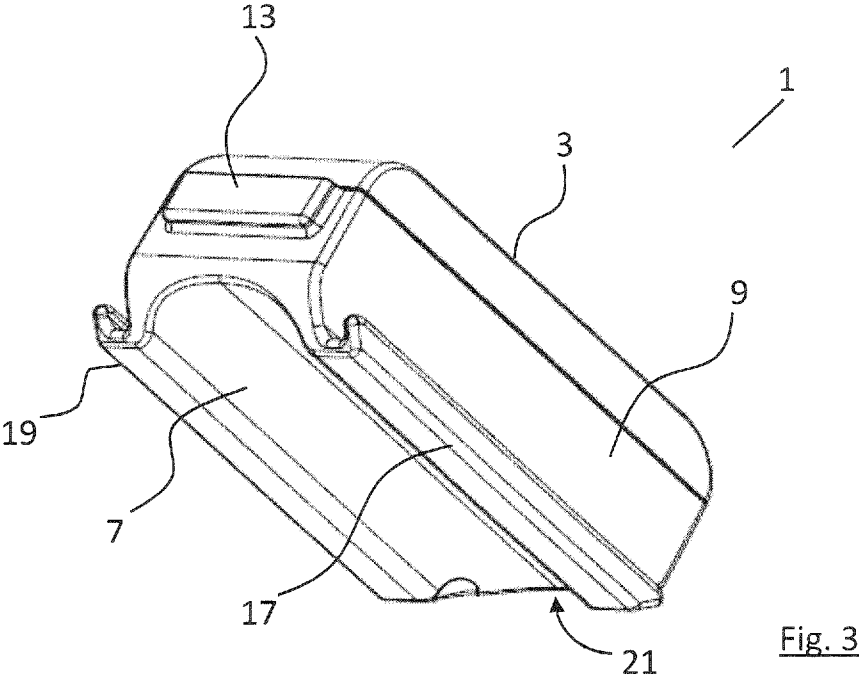
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- (11) A method of securing a birthing sensor (1) substantially as hereinbefore described with reference to and as illustrated by the accompanying drawings.

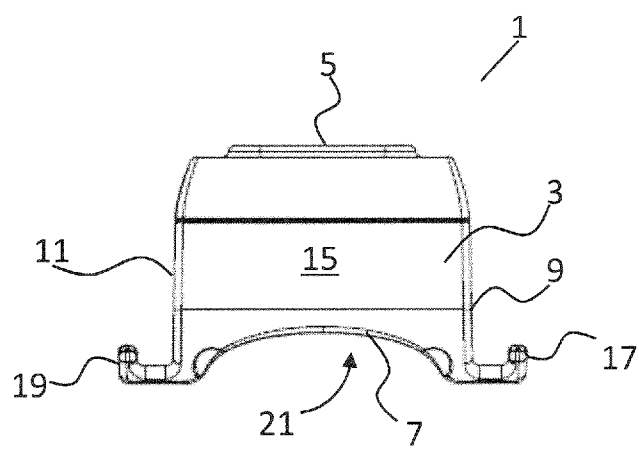
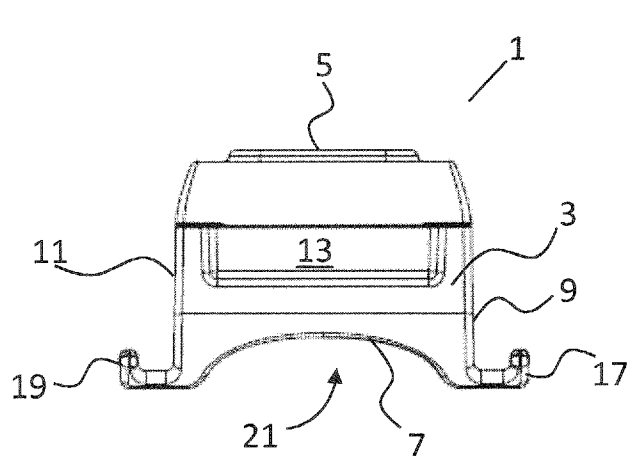
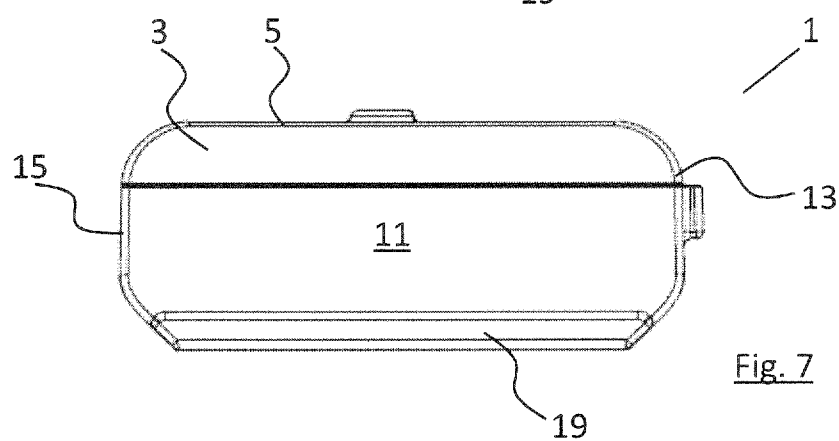
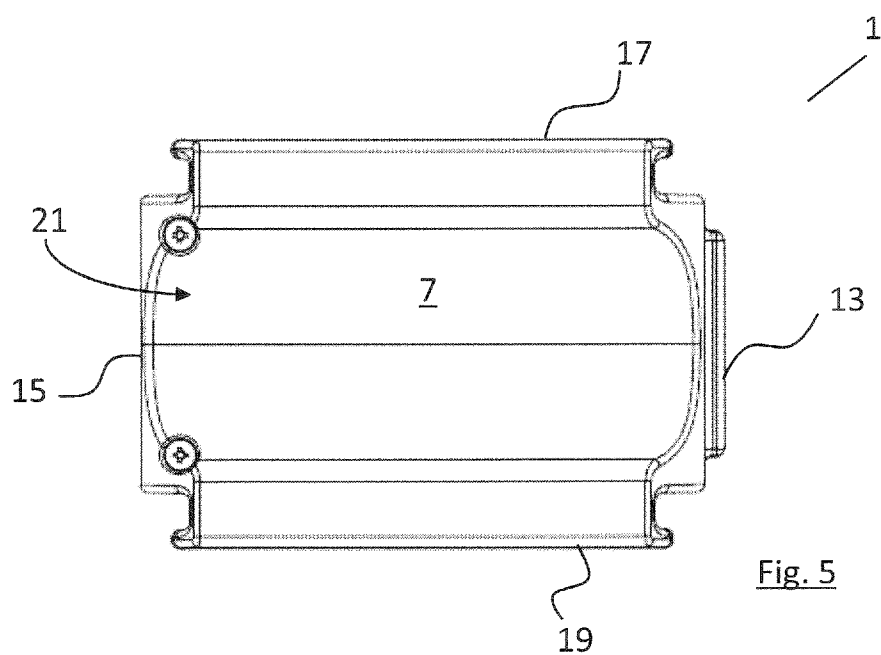
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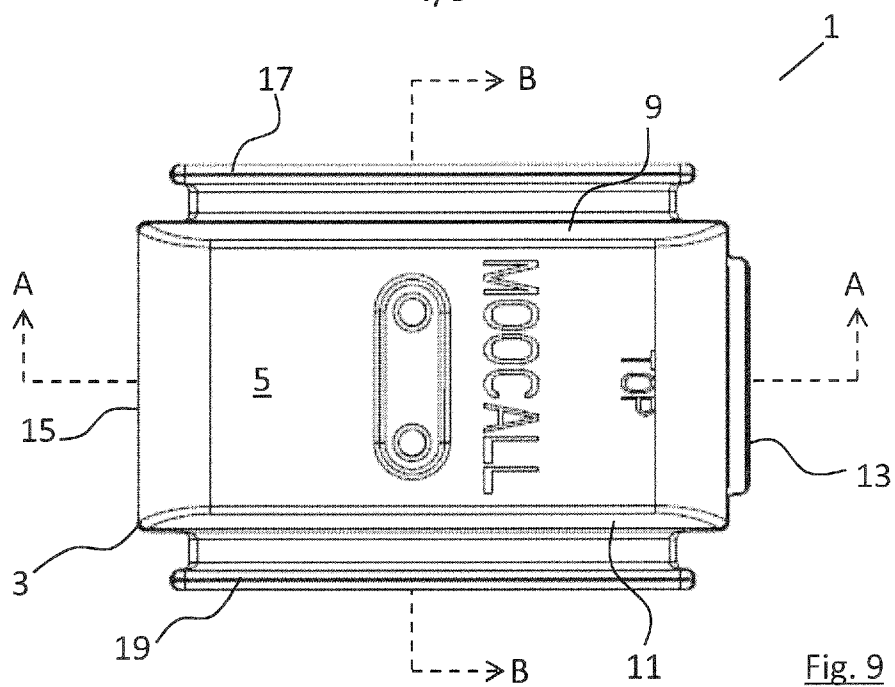


Fig. 9

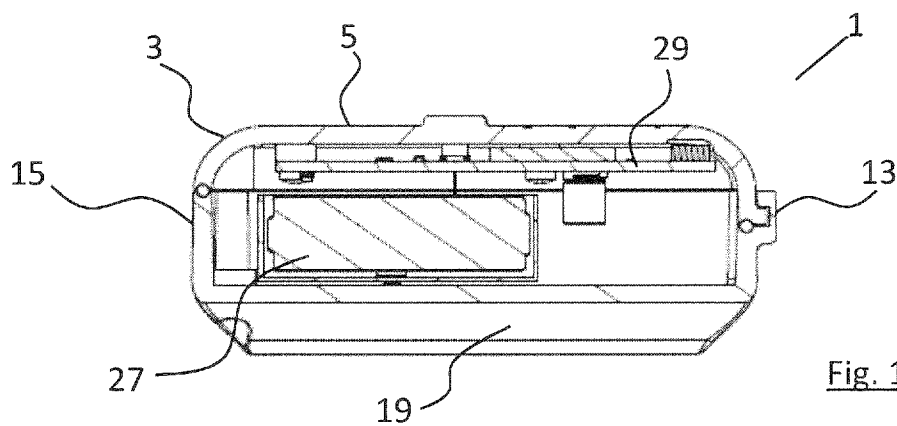


Fig. 10

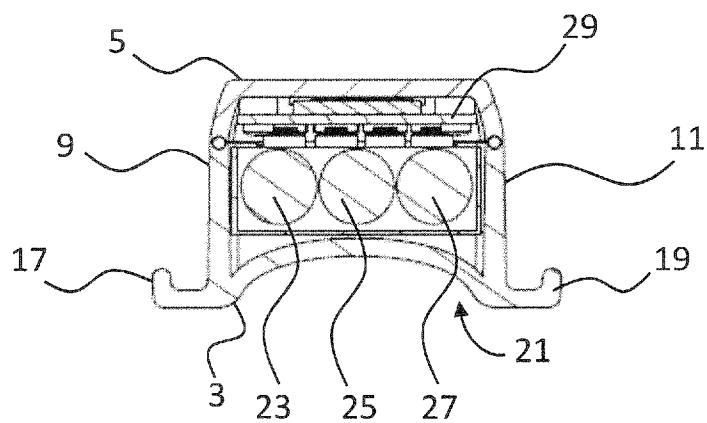


Fig. 11

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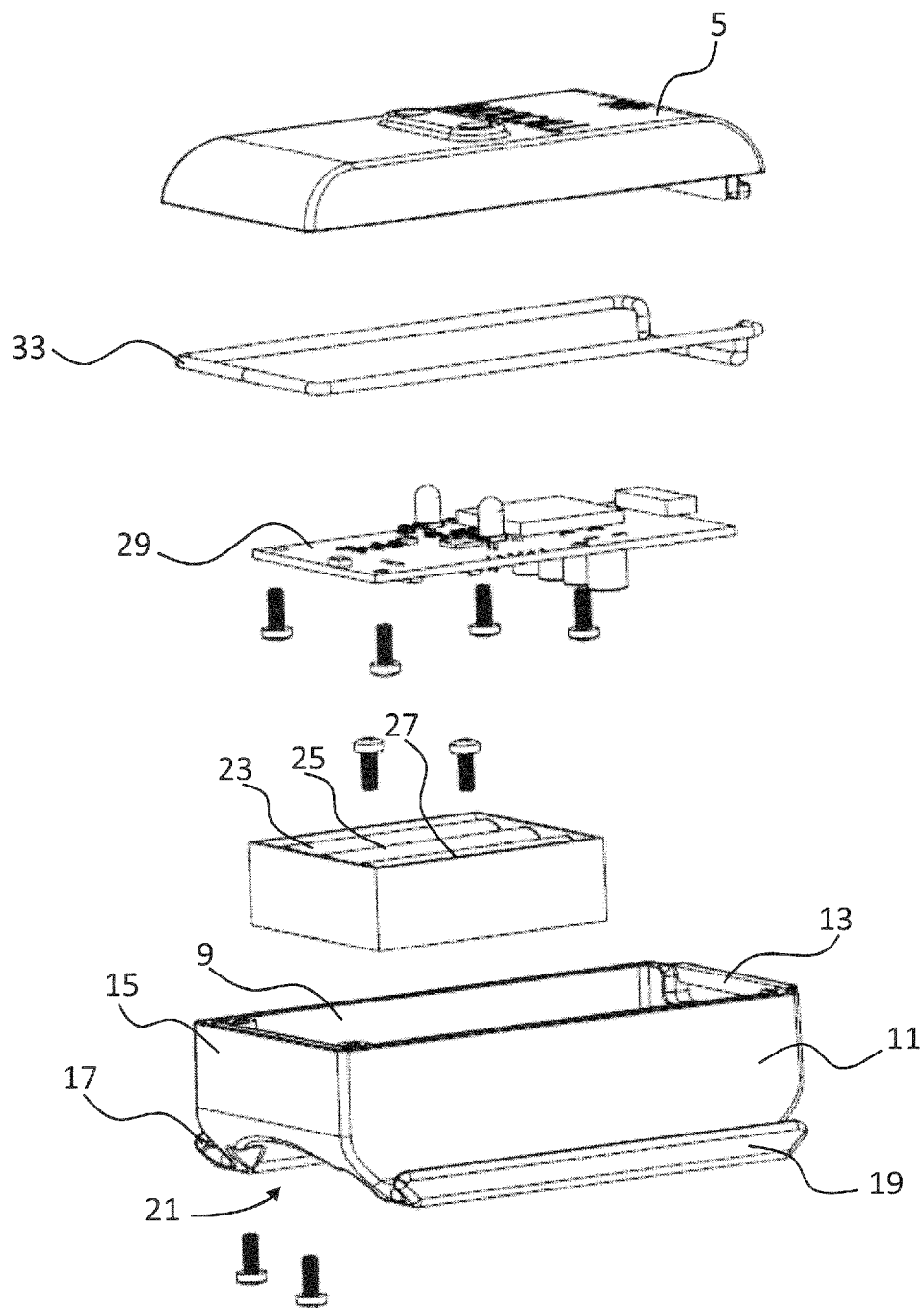
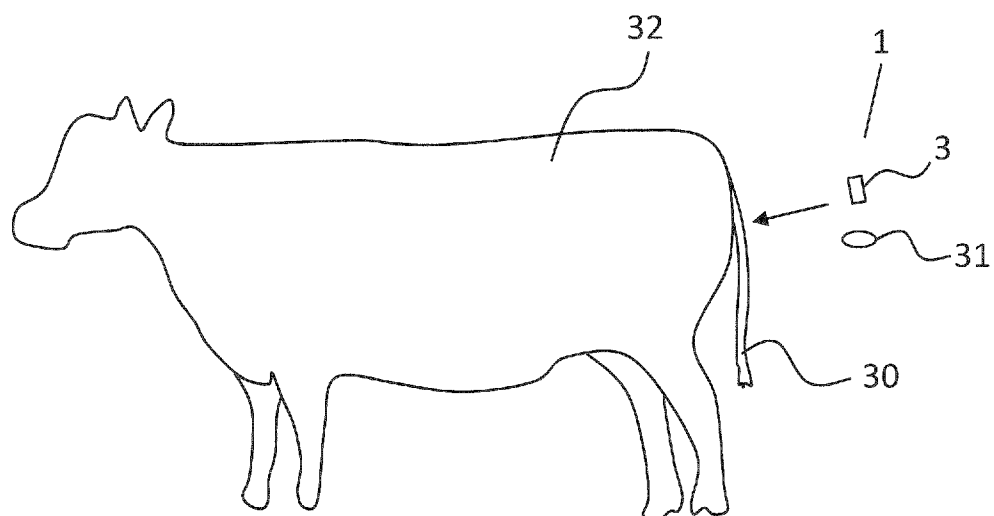
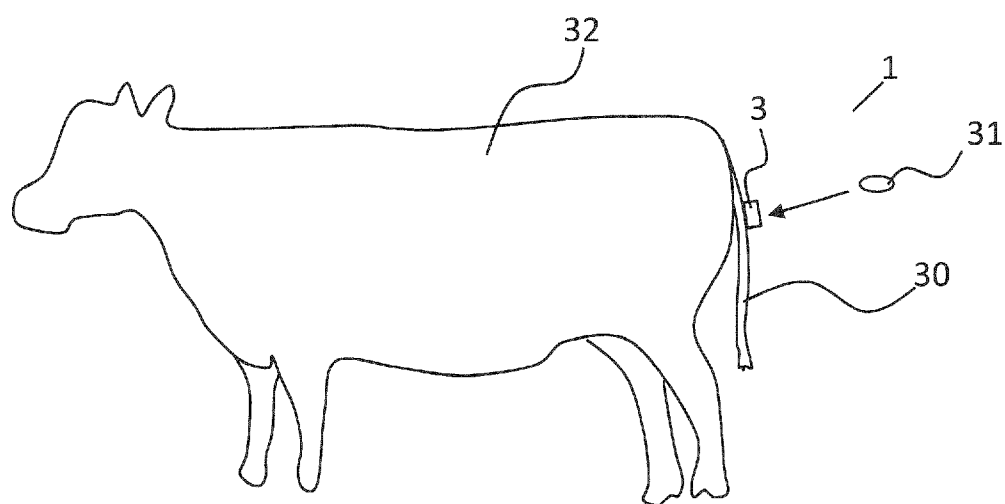
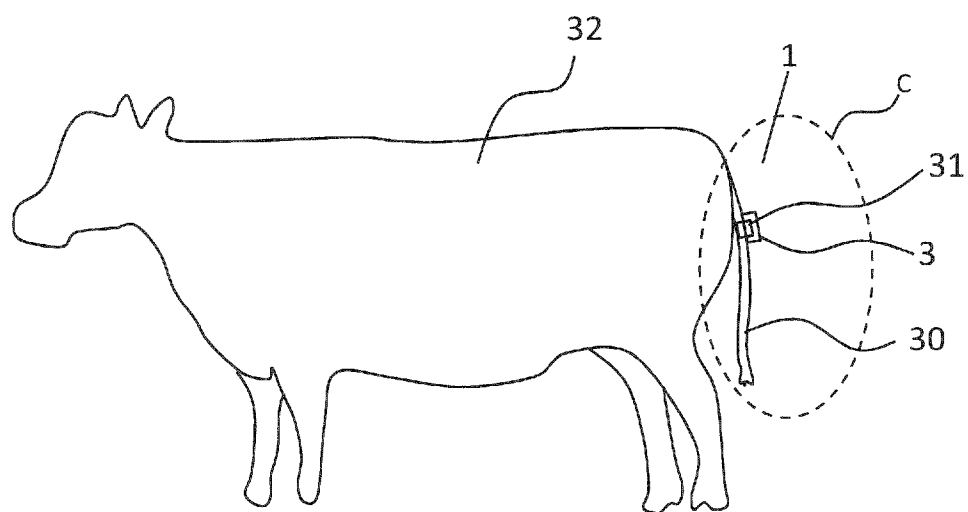


Fig. 12

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Fig. 13 (a)Fig. 13 (b)Fig. 13 (c)

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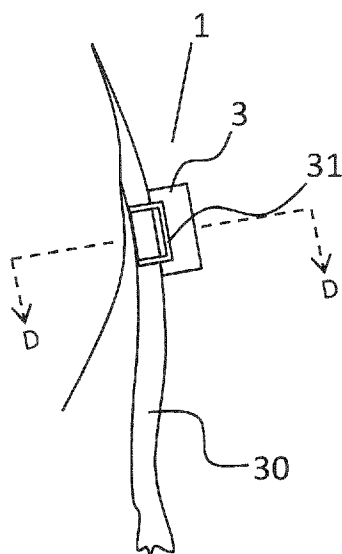


Fig. 14

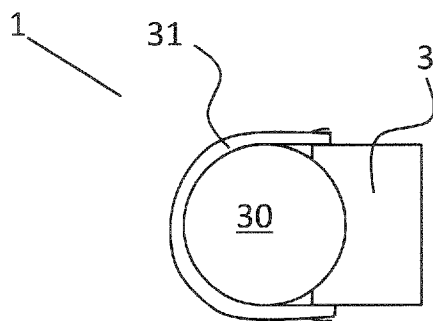
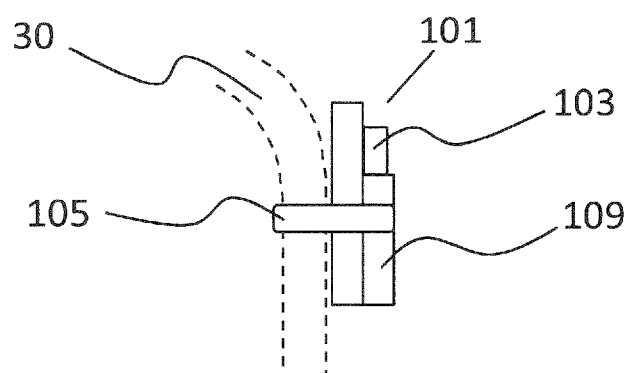
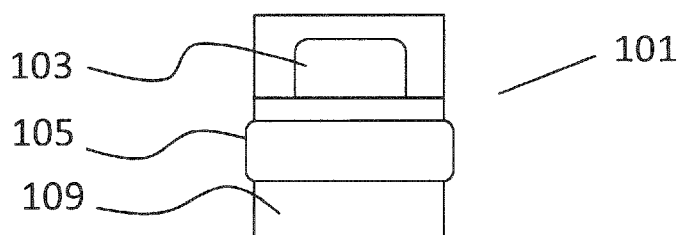
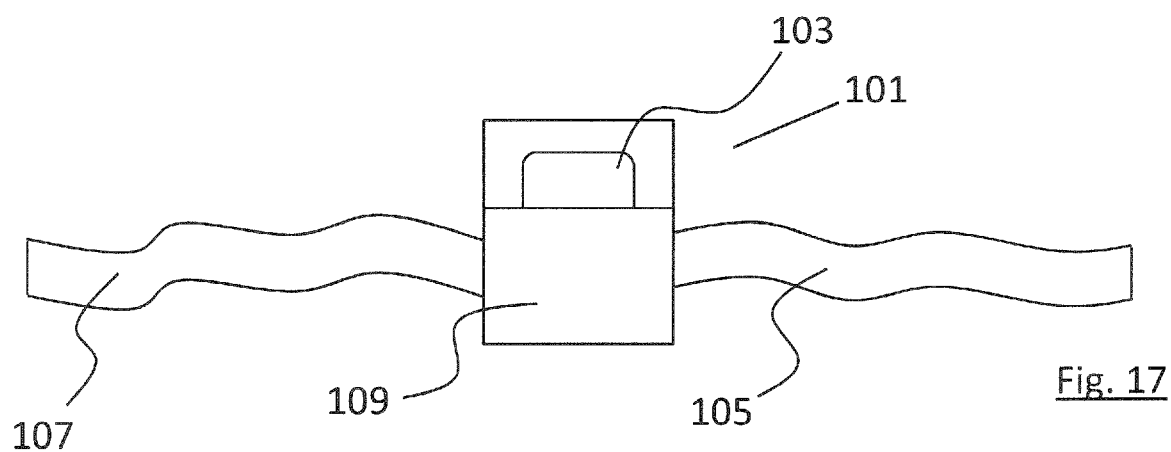
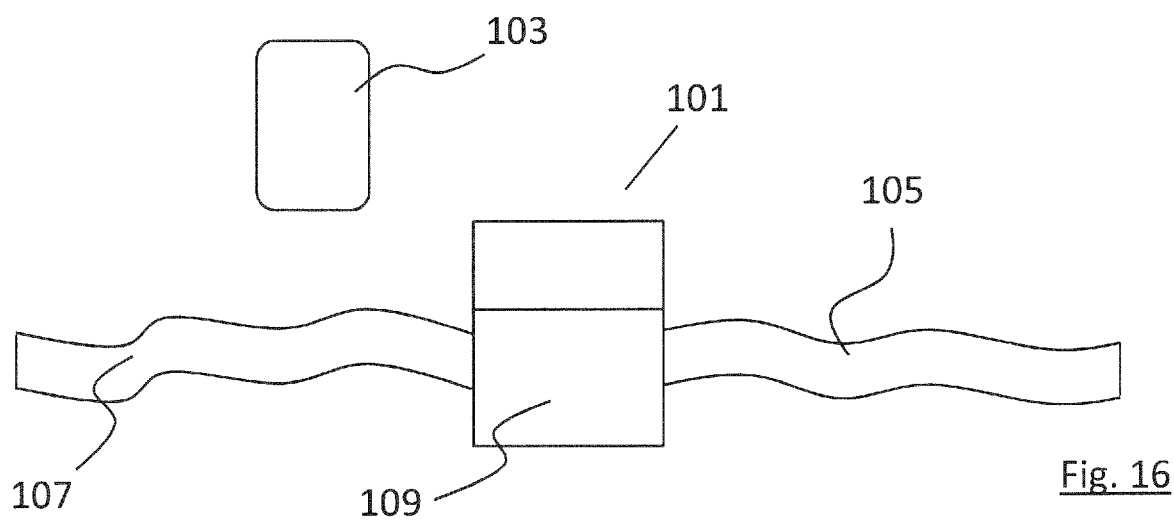


Fig. 15

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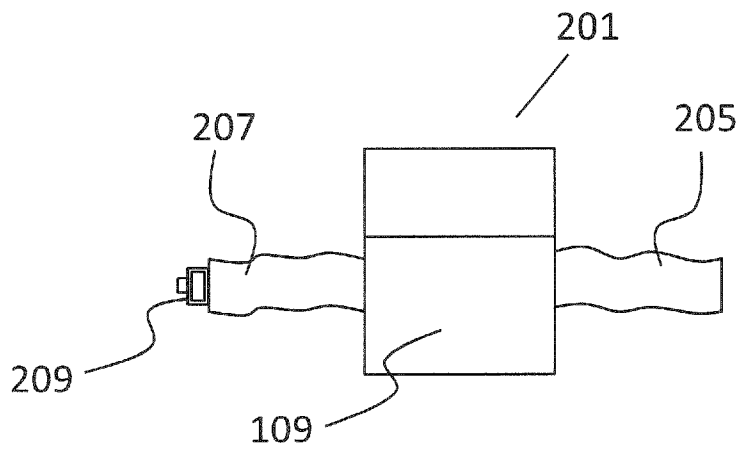


Fig. 20

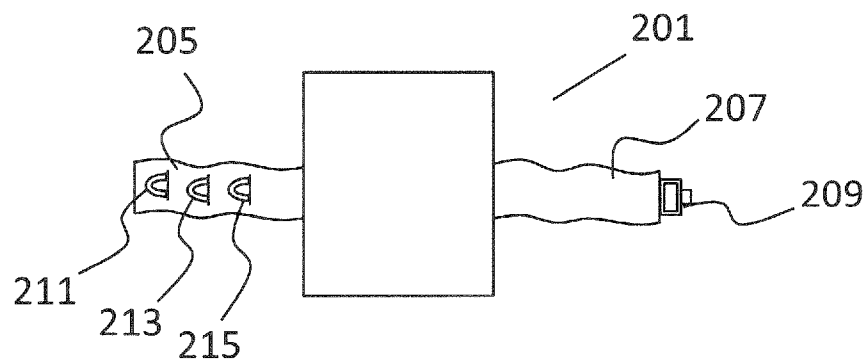


Fig. 21

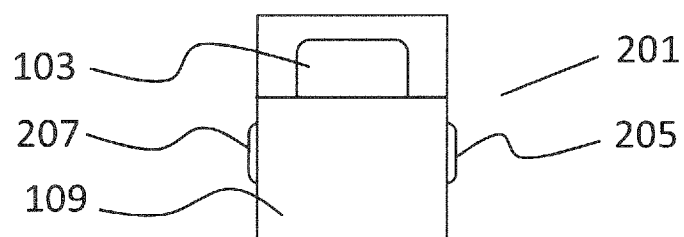


Fig. 22

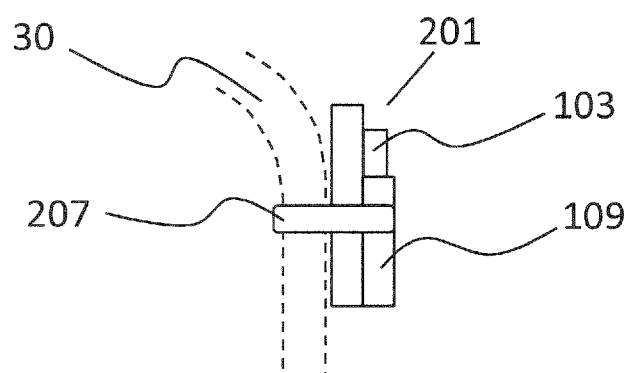


Fig. 23

INTERNATIONAL SEARCH REPORT

International application No.
PCT/EP2013/062066

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.: 10, 11
because they relate to subject matter not required to be searched by this Authority, namely:
Claims 11 and 12 are intrinsically unclear and in violation of Rule 6.2(a) PCT, since protection is sought sensor and method respectively "as hereinbefore described with reference to and as illustrated by the accompanying drawings".
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:

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 an 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

International application No
PCT/EP2013/062066

A. CLASSIFICATION OF SUBJECT MATTER
INV. A61D17/00
ADD.

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)
A61D

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)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2010/036277 A1 (AUSTIN) 11 February 2010 (2010-02-11) paragraph [0060]; figures 1,2,5 -----	1-9
X	EP 0 377 343 A1 (MENETRIER ET AL.) 11 July 1990 (1990-07-11) column 3, line 39 - column 4, line 29; figure 2 -----	1-9
X	WO 02/03881 A1 (VAN DEN BERGE) 17 January 2002 (2002-01-17) abstract; figure 3 -----	1-9
X	JP 2002 095375 A (NEW COSMOS ELECTRIC CORP) 2 April 2002 (2002-04-02) figures 1,4 -----	1-9



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents :

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"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

18 November 2013

Date of mailing of the international search report

25/11/2013

Name and mailing address of the ISA/

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Authorized officer

Raybould, Bruce

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/EP2013/062066

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JP 2002095375 A	02-04-2002	NONE	