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(71) Applicant: **Panasonic Corporation**
Osaka 571-8501 (JP)

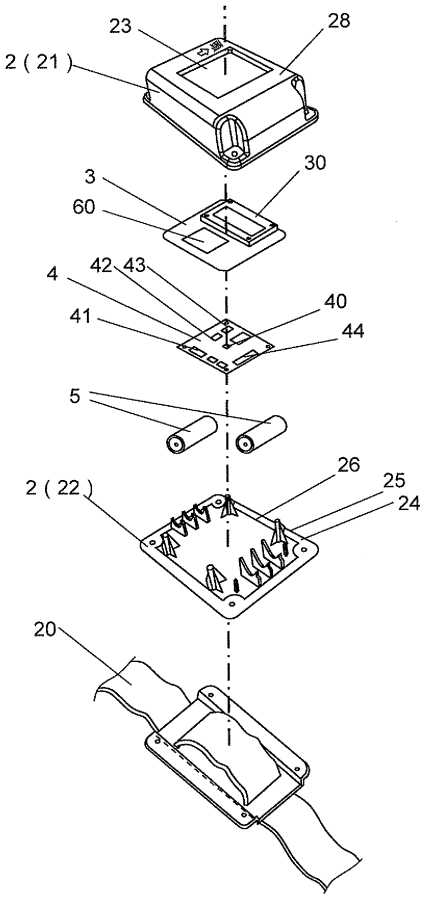
(72) Inventors:
- **NORITAKE, Keisuke**
  Osaka 540-6207 (JP)
- **MIZUTANI, Yoshiki**
  Osaka 540-6207 (JP)

(74) Representative: **Schwabe - Sandmair - Marx**
Patentanwälte
Stuntzstraße 16
81677 München (DE)

(54) ESTRUS DETECTION DEVICE AND ESTRUS DETECTION SYSTEM

(57) An estrus detection device is composed of a resin case (2) and a belt (20) to be attached to a livestock animal. The case (2) contains a triaxial acceleration sensor (40) as an activity sensor for detecting the motion of the animal; a signal processing unit (41) for converting the output of the triaxial acceleration sensor (40) to the amount of activity; a temporary storage unit (42) for storing the output of the signal processing unit (41) as the present amount of activity; a storage unit (43) for storing, as the past amount of activity for a past predetermined time period, the amount of activity stored so far in the temporary storage unit (42); an estrus determination unit (44) for determining whether the animal is in estrus or not based on the past amount of activity and the present amount of activity; and a display part (30) for showing that the animal in in estrus when the estrus determination unit (44) has determined that the animal in in estrus.

FIG. 3



EP 2 599 384 A1

Description

TECHNICAL FIELD

[0001] The present invention relates to a device for detecting estrus in livestock, especially cows.

BACKGROUND ART

[0002] To achieve profitable production of calves, it is important to detect estrus in cows, and particularly, to find out when cows come into estrus. Some devices for detecting estrus include a pedometer (see Patent Literature 1).

[0003] Such a pedometer is attached to a target cow. The detection device divides each day into a plurality of time periods, and extracts the number of her steps counted by the pedometer for each time period. The detection device then compares the counted steps with the number of her steps corresponding to the same time period in the past "n" days, thereby determining whether the cow is in estrus or not from the comparison result.

[0004] This estrus detection device will now be described in detail with reference to Fig. 9. The device includes counting device 101 and a least one pedometer 102. Counting device 101 includes computer 103 and communication device 104. Pedometer 102 is secured to a cow's body, for example, around a cow's neck or leg with a belt or something. Pedometer 102 includes a step counting unit, a communication unit, and a control unit.

[0005] In this configuration, when a cow equipped with pedometer 102 walks, the step counting unit counts the number of her steps, and transmits it to the control unit. The control unit accumulates the number of her steps up to a predetermined time, and transmits the accumulated value to the communication unit together with a signal for identifying individual cows. The communication unit receives the accumulated value and the signal, and transmits them to communication device 104. After the communication unit transmits the value and the signal to communication device 104, the control unit resets the accumulated value.

[0006] Computer 103 stores the data of the number of her past steps in the form of, for example, D_1, D_2, D_3, D_4 ..... Computer 103 compares the number of her most recent steps received from communication device 104 with the data of the number of her past steps. When the comparison indicates that the number of her most recent steps is larger than the data of her past steps, computer 103 determines that the cow is in estrus.

[0007] However, such a conventional detection device for detecting estrus in cows involves a large-scale system with counting device 101, thereby requiring expensive equipment.

Citation List

Patent Literature

[0008]

Patent Literature 1: Japanese Patent Unexamined Publication No. 2008-92878

SUMMARY OF THE INVENTION

[0009] The present invention is directed to provide a simple device for detecting estrus in livestock.

[0010] The estrus detection device of the present invention includes a case to be attached to a livestock animal; an activity sensor contained in the case, the activity sensor detecting a motion of the livestock animal; a signal processing unit contained in the case, the signal processing unit converting the output of the activity sensor to the amount of activity; a temporary storage unit contained in the case, the temporary storage unit storing the output of the signal processing unit as the present amount of activity; a storage unit contained in the case, the storage unit storing, as a past amount of activity for a predetermined past time period, the amount of activity stored so far in the temporary storage unit; an estrus determination unit contained in the case, the estrus determination unit determining whether the livestock animal is in estrus or not based on the past amount of activity and the present amount of activity; and a display part contained in the case, the display part showing that the livestock animal is in estrus when the estrus determination unit has determined that the livestock animal is in estrus.

[0011] The estrus detection device is attached to livestock such as cows that are close to estrus. Whether they are in estrus or not can be detected only by this estrus detection device, without a large-scale system.

[0012] The estrus detection device can be initialized using the characteristics of a triaxial acceleration sensor. Furthermore, the estrus detection device can be operated without opening the case, thereby being hermetically sealed.

BRIEF DESCRIPTION OF DRAWINGS

[0013]

Fig. 1A is an external front view of an estrus detection device according to a first exemplary embodiment of the present invention.

Fig. 1B is an external side view of the estrus detection device according to the first exemplary embodiment of the present invention.

Fig. 2 shows the estrus detection device according to the first exemplary embodiment of the present invention when the device is attached to a livestock animal.

Fig. 3 is an exploded perspective view of the estrus detection device according to the first exemplary embodiment of the present invention.

Fig. 4 is a conceptual front view of an essential part of the estrus detection device according to the first exemplary embodiment of the present invention.

Fig. 5 is a conceptual side view of the essential part of the estrus detection device according to the first exemplary embodiment of the present invention.

Fig. 6 is a block diagram of the estrus detection device according to the first exemplary embodiment of the present invention.

Fig. 7 is a flowchart showing the operation of the estrus detection device according to the first exemplary embodiment of the present invention.

Fig. 8 is a block diagram of an estrus detection system according to a second exemplary embodiment of the present invention.

Fig. 9 is a schematic diagram of a conventional estrus detection device.

DESCRIPTION OF EMBODIMENTS

[0014] Embodiments of the present invention will now be described with reference to the drawings.

FIRST EXEMPLARY EMBODIMENT

[0015] Figs. 1A and 1B are external views of an estrus detection device according to the first exemplary embodiment. Estrus detection device 1 has case 2 and belt 20 under it. As shown in Fig. 2, case 2 with belt 20 is attached around the neck of a cow as livestock. Estrus detection device 1 can be attached to other livestock such as pigs and cows.

[0016] The inner structure of case 2 will now be described with reference to Figs. 3 to 6.

[0017] Case 2 contains display board 3, control board 4, and power supply 5. Display board 3 includes display part 30. Control board 4 includes triaxial acceleration sensor 40 as an activity sensor, signal processing unit 41, temporary storage unit 42, storage unit 43, and estrus determination unit 44.

[0018] The activity sensor, which detects the motion of a livestock animal, can be one of various kinds of acceleration sensors. Among them, triaxial acceleration sensor 40 can detect the magnitude and direction of the motion of the livestock animal three dimensionally with high precision. Triaxial acceleration sensor 40 is located at the center of gravity of case 2. In Figs. 3 and 5, the center of gravity is shown by a chain line.

[0019] Signal processing unit 41 converts the output of triaxial acceleration sensor 40 as the activity sensor to the amount of activity. Temporary storage unit 42 stores the output of signal processing unit 41 as the present amount of activity. Storage unit 43 stores, as the past amount of activity for a past predetermined time period, the amount of activity stored so far in temporary storage unit 42. Estrus determination unit 44 determines whether the livestock animal is in estrus or not based on the past amount of activity and the present amount of activity.

[0020] The components of each of signal processing unit 41, temporary storage unit 42, storage unit 43, and estrus determination unit 44 are mounted on control board 4. Alternatively, these units 41, 42, 43, and 44 can be composed of a microcomputer.

[0021] Display part 30 shows that the livestock animal is in estrus when estrus determination unit 44 determines that the livestock animal equipped with estrus detection device 1 is in estrus.

[0022] Display part 30 also shows the time elapsed since the animal was determined to be in estrus.

[0023] Power supply 5 supplies electric power to the components mounted on display board 3 and control board 4.

[0024] Case 2 includes cover 21 and base 22.

[0025] Cover 21 has window 23 disposed to face display part 30. Cover 21 is made of a resin such as polycarbonate or polyethylene terephthalate, which are excellent in workability, impact resistance, and heat resistance.

[0026] Base 22 includes board 24, outer rib 25, and inner rib 26. Outer rib 25 is formed on the outer periphery of a surface of one side of board 24. Inner rib 26 is formed along the inside of outer rib 25 on a surface of the same one side

of board 24. As shown in Fig. 4, some parts of inner rib 26 may not be formed along outer rib 25 due to structural reasons of base 22. Inner rib 26 is taller than outer rib 25.

[0027] Between outer rib 25 and inner rib 26 is provided packing 27, which is used to seal case 2. The packing is made of foam mainly composed of ethylene-propylene-diene rubber (EPDM), which is excellent in weather resistance and heat resistance.

[0028] Cover 21 has projection 28, which is formed around window 23 in such a manner as to project in the direction opposite to display part 30. Projection 28 is formed on the entire surface of cover 21 in Fig. 3, but may alternatively be formed at only a part of the periphery of window 23.

[0029] The operation of estrus detection device 1 having the above-described configuration will now be described with reference to Fig. 6. The motion of a cow equipped with estrus detection device 1 is detected by triaxial acceleration sensor 40, which outputs an electrical signal indicating the magnitude and direction of the motion. The electrical signal detected by triaxial acceleration sensor 40 is converted to the amount of activity by signal processing unit 41. The amount of activity is transmitted from signal processing unit 41 to temporary storage unit 42. The amount of activity is stored for a fixed period of time as the present amount of activity in temporary storage unit 42. After the fixed period of time has passed, a new electrical signal detected by triaxial acceleration sensor 40 is transmitted as a new amount of activity to temporary storage unit 42 via signal processing unit 41. The amount of activity stored so far in temporary storage unit 42 is transmitted to storage unit 43, and is stored in storage unit 43 for the predetermined time period as the past amount of activity.

[0030] The present amount of activity is transmitted from temporary storage unit 42 to estrus determination unit 44, whereas the past amount of activity stored for the predetermined time period is transmitted from storage unit 43 to estrus determination unit 44.

[0031] Estrus determination unit 44 compares the present amount of activity with the past amount of activity, and determines whether the livestock animal is in estrus or not based on the comparison result. More specifically, upon receiving a new amount of activity from signal processing unit 41, temporary storage unit 42 transmits the present amount of activity stored so far therein to storage unit 43. Storage unit 43 stores the received present amount of activity as a past amount of activity. Estrus determination unit 44 calculates the average value of the past amount of activity, and compares it with the present amount of activity. Estrus determination unit 44 has a predetermined threshold to determine the comparison result. When the present amount of activity exceeds the threshold of the average value of the past amount of activity, estrus determination unit 44 determines that the cow is in estrus.

[0032] Determining that the cow is in estrus, estrus determination unit 44 transmits the result to display part 30. Display part 30 shows that the cow is in estrus. The display is, for example, a liquid crystal display (LCD in Fig. 6) or a light-emitting diode (LED). With this display, estrus detection device 1 in the present exemplary embodiment informs the manager of the livestock animal that she is in estrus.

[0033] Estrus determination unit 44 measures the time elapsed since the cow was determined to be in estrus, and transmits the measured time to display part 30. Display part 30 displays the present amount of activity in the form of numerical values.

[0034] When a predetermined duration has passed, estrus determination unit 44 determines that the cow went out of estrus. In the present exemplary embodiment, estrus determination unit 44 determines that estrus is over when 24 hours have passed since a cow was determined to be estrus.

[0035] Estrus determination unit 44 transmits the determination result to display part 30. Display part 30 ends to show that the cow is in estrus.

[0036] In general cows have an estrous cycle of about 21 days. Hence, when used for cows, estrus detection device 1 has only to store data for 30 days for the past amount of activity.

[0037] After being detected to be estrus by estrus detection device 1 of the present exemplary embodiment, the cow is made pregnant by natural mating or artificial insemination.

[0038] After the cow is pregnant, there is no need to detect her estrus, so that estrus detection device 1 is initialized and is attached to a different cow.

[0039] Estrus detection device 1 according to the present exemplary embodiment, which includes triaxial acceleration sensor 40, is initialized using the characteristics of triaxial acceleration sensor 40. More specifically, if a rotation is applied to estrus detection device 1 for a specified time period, triaxial acceleration sensor 40 transmits to signal processing unit 41 an electrical signal indicating that the rotation is applied in a specific direction. Upon receiving this electrical signal, signal processing unit 41 transmits a signal for erasing the past amount of activity. Upon receiving this signal via temporary storage unit 42, storage unit 43 erases the past amount of activity. This process is referred to as a reset.

[0040] The above described operation will now be described with reference to the flowchart of Fig. 7.

[0041] Triaxial acceleration sensor 40 detects the motion of a cow (S1). Signal processing unit 41 converts the magnitude and direction of the detected motion of the cow to the amount of activity, and then determines whether a rotation is applied or not (S2). When the rotation is determined to be applied, estrus detection device 1 is initialized by a reset (S3). When the rotation is determined not to be applied, temporary storage unit 42 stores the detected amount of activity

as the present amount of activity (S4, S5). The present amount of activity is updated, for example, every hour, which is the fixed period of time above-mentioned. Every time a new amount of activity is updated, the present amount of activity stored so far is transmitted to storage unit 43. Storage unit 43 stores this present amount of activity as a past amount of activity. In the present exemplary embodiment, the predetermined time period is 72 hours. This means that the past amount of activity is stored for 72 hours after the initialization of estrus detection device 1. Estrus determination unit 44 determines whether 72 hours have passed after the initialization (S6). If the elapsed time is less than 72 hours, the processes of S4 and S5 are performed again. When the elapsed time exceeds 72 hours, estrus determination unit 44 determines whether the cow is in estrus or not based on the present amount of activity and the past amount of activity (S7). When estrus determination unit 44 determines that the cow is in estrus, estrus determination unit 44 starts to measure the elapsed time (S8). Upon being informed from estrus determination unit 44 that the cow is in estrus, display part 30 shows this information. In this case, display part 30 also shows the elapsed time after the determination of estrus (S9). Estrus determination unit 44 determines whether 24 hours, which is the predetermined duration above-mentioned, have passed since the cow was determined to be estrus (S10). If the elapsed time is less than 24 hours, display part 30 continues to show that the cow in in estrus. When the elapsed time exceeds 24 hours, estrus determination unit 44 transmits a signal requesting display part 30 to end to show that the cow in in estrus.

[0042] As apparent from the above description, estrus detection device 1 according to the present exemplary embodiment can be attached only to cows that are close to estrus. This allows the detection of estrus in livestock without using a large-scale system.

[0043] If a cow detected to be in estrus get pregnant, estrus detection device 1 is initialized to be used for detecting whether another cow is in estrus. This eliminates the need to prepare estrus detection device 1 for every cow, thereby reducing the initial cost.

[0044] Showing the time elapsed since the animal was determined to be in estrus allows the manager to determine the best time for insemination.

[0045] Triaxial acceleration sensor 40 as the activity sensor is located at the center of gravity of case 2. Estrus detection device 1 with belt 20 is attached around the neck of a cow. Conventional pedometer 102, which is attached to a cow' leg, can be accidentally stepped on by her another leg or another cow's leg. In contrast, estrus detection device 1, which is attached to the neck of a cow, is less susceptible to external disturbances, thereby being prevented from breakdown.

[0046] Furthermore, estrus detection device 1 is located on the center line of the body of a cow, thereby making the detection more accurate.

[0047] Case 2 includes cover 21 and base 22. Base 22 includes outer rib 25 formed on the outer periphery of one side of board 24, and inner rib 26 formed along the inside of outer rib 25 on the same side of board 24. Inner rib 26 is taller than outer rib 25. This configuration can protect case 2 from penetration of water. Providing packing 27 between inner rib 26 and outer rib 25 can further improve waterproofness of estrus detection device 1.

[0048] Cover 21 has projection 28 formed around window 23 in such a manner as to project in the direction opposite to display part 30. Projection 28 which encloses cover 21 is spaced apart from window 23 by a predetermined distance, thereby preventing window 23 from coming into contact with external elements.

[0049] Estrus detection device 1 can be initialized by applying a rotation, without opening case 2 or providing a switch for initialization. This configuration ensures the waterproofness of estrus detection device 1, allowing it to be washed while it is on a cow.

SECOND EXEMPLARY EMBODIMENT

[0050] Fig. 8 is a block diagram of an estrus detection system. In Fig. 8, the same components as in the first exemplary embodiment are denoted by the same reference numerals and the description thereof is omitted.

[0051] The estrus detection system includes estrus detection device 81, communication device 82, and notification device 83. Estrus detection device 81 according to the present exemplary embodiment differs from estrus detection device 1 of the first exemplary embodiment in including first transmission unit 60. Estrus determination unit 44 transmits the information that the cow is in estrus to first transmission unit 60. First transmission unit 60 transmits a first estrus signal indicating that the cow is in estrus to first reception unit 61 of communication device 82.

[0052] First reception unit 61 receives the first estrus signal and transmits it to second transmission unit 62 via calculation unit 65. Second transmission unit 62 transmits a second estrus signal to second reception unit 63 of notification device 83, thereby informing that the first estrus signal has been transmitted.

[0053] Second reception unit 63 transmits the received second estrus signal to notification unit 64 via calculation unit 66. Notification unit 64 notifies that the cow equipped with estrus detection device 81 according to the present exemplary embodiment is in estrus.

[0054] Communication device 82 and notification device 83 may be formed as an integral component. Alternatively, it is possible to provide two or more communication devices 82. Notification unit 64 may be composed of a warning light or a display. Communication device 82 and notification device 83 may be wired or wireless.

[0055] This configuration eliminates the need to check all of estrus detection devices 81 attached to the cows. Instead, it is possible to identify cows that are in estrus according to the notification of notification device 83. This simplifies the procedure for determining estrus in cows.

INDUSTRIAL APPLICABILITY

[0056] The above-described estrus detection device is applicable not only to cows but also to other livestock such as pigs and horses which can be determined whether they are in estrus or not by their amount of activity.

REFERENCE MARKS IN THE DRAWINGS

[0057]

1	estrus detection device
2	case
3	display board
4	control board
5	power supply
20	belt
21	cover
22	base
23	window
24	board
25	outer rib
26	inner rib
27	packing
28	projection
30	display part
40	triaxial acceleration sensor (activity sensor)
41	signal processing unit
42	temporary storage unit
43	storage unit
44	estrus determination unit
60	first transmission unit
61	first reception unit
62	second transmission unit
63	second reception unit
64	notification unit
81	estrus detection device
82	communication device
83	notification device

Claims

1. An estrus detection device to be attached to a livestock animal, comprising:

a case to be attached to a livestock animal;
an activity sensor contained in the case, the activity sensor detecting a motion of the livestock animal;
a signal processing unit contained in the case, the signal processing unit converting an output of the activity sensor to an amount of activity;
a temporary storage unit contained in the case, the temporary storage unit storing an output of the signal processing unit as a present amount of activity;
a storage unit contained in the case, the storage unit storing, as a past amount of activity for a past predetermined time period, the amount of activity stored so far in the temporary storage unit;

an estrus determination unit contained in the case, the estrus determination unit determining whether the livestock animal is in estrus or not based on the past amount of activity and the present amount of activity; and
a display part contained in the case, the display part showing that the livestock animal is in estrus when the estrus determination unit determines that the livestock animal is in estrus.

2. The estrus detection device of claim 1, wherein
when the estrus determination unit determines that the livestock animal is in estrus, the display part shows a time elapsed since the livestock animal was determined to be in estrus.

3. The estrus detection device of claim 1 or 2, wherein
the activity sensor is a triaxial acceleration sensor.

4. The estrus detection device of claim 3, wherein
the triaxial acceleration sensor is located at a center of gravity of the case.

5. The estrus detection device of claim 1, wherein
the case includes a cover and a base,
the cover has a window disposed at a position facing the display part; and
the base includes;
a board;
an outer rib formed on an outer periphery of a surface of one side of the board;
an inner rib formed along the outer rib inside the outer rib on the surface of the one side of the board, the inner rib being taller than the outer rib.

6. The estrus detection device of claim 5, wherein
the cover has a projection formed around the window, the projection projecting in a direction opposite to the display part.

7. The estrus detection device of claim 3, wherein
when the triaxial acceleration sensor detects a rotation continued for a specified time period, the signal processing unit erases the past amount of activity stored in the storage unit.

8. An estrus detection system comprising an estrus detection device to be attached to a livestock animal, a communication device, and a notification device, wherein
the estrus detection device comprises:

a case to be attached to a livestock animal;
an activity sensor contained in the case, the activity sensor detecting a motion of the livestock animal;
a signal processing unit contained in the case, the signal processing unit converting an output of the activity sensor to an amount of activity;
a temporary storage unit contained in the case, the temporary storage unit storing an output of the signal processing unit as a present amount of activity;
a storage unit contained in the case, the storage unit storing, as a past amount of activity for a predetermined past time period, the amount of activity stored so far in the temporary storage unit;
an estrus determination unit contained in the case, the estrus determination unit determining whether the livestock animal is in estrus or not based on the past amount of activity and the present amount of activity;
a display part contained in the case, the display part showing that the livestock animal is in estrus when the estrus determination unit determines that the livestock animal is in estrus; and
a first transmission unit contained in the case, the first transmission unit transmitting a first estrus signal indicating that the livestock animal is in estrus,

the communication device comprises:

a first reception unit for receiving the first estrus signal from the first transmission unit; and
a second transmission unit for transmitting a second estrus signal to the notification device when the first reception unit has received the first estrus signal, and

the notification device comprises:

a second reception unit for receiving the second estrus signal from the second transmission unit; and
a notification unit for notifying that the livestock animal is in estrus when the second reception unit has received the second estrus signal.

9. The estrus detection system of claim 8, wherein
when the estrus determination unit determines that when the livestock animal is in estrus, the first estrus signal includes a time elapsed since the livestock animal is determined to be in estrus.

10. The estrus detection system of claim 8 or 9, wherein
the activity sensor is a triaxial acceleration sensor.

11. The estrus detection system of claim 10, wherein
the triaxial acceleration sensor is located at a center of gravity of the case.

12. The estrus detection system of claim 8, wherein
the case includes a cover and a base,
the cover has a window disposed on a position facing the display part; and
the base includes,
a board,
an outer rib formed on an outer periphery of a surface of one side of the board, and
an inner rib formed along the outer rib inside the outer rib on the surface of the one side of the board, the inner rib being taller than the outer rib.

13. The estrus detection system of claim 12, wherein
the cover has a projection formed around the window, the projection projecting in a direction opposite to the display part.

14. The estrus detection system of claim 10, wherein
when the triaxial acceleration sensor detects a rotation continued for a specified time period, the signal processing unit erases the past amount of activity stored in the storage unit.

FIG. 1A

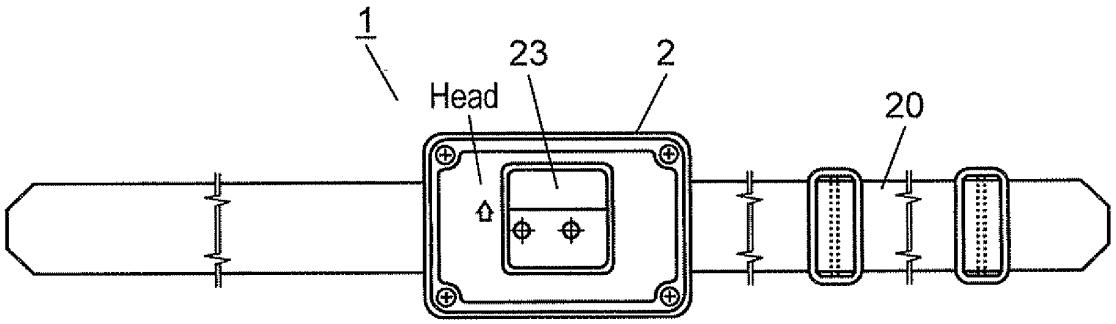


FIG. 1B

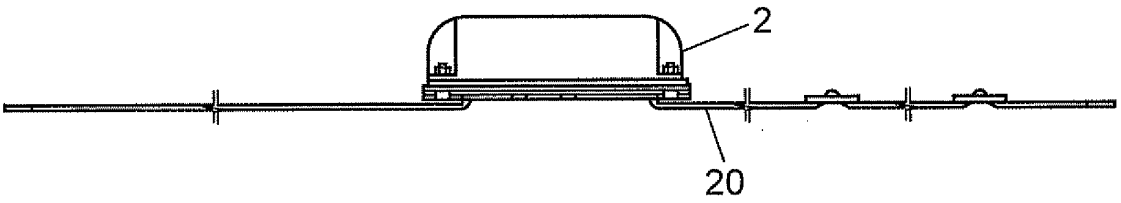


FIG. 2

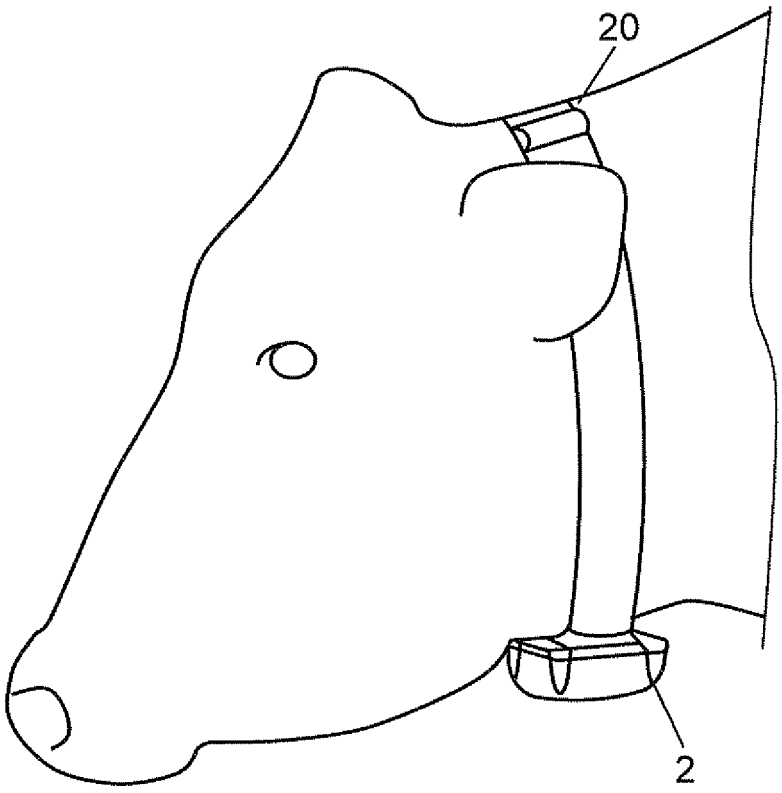


FIG. 3

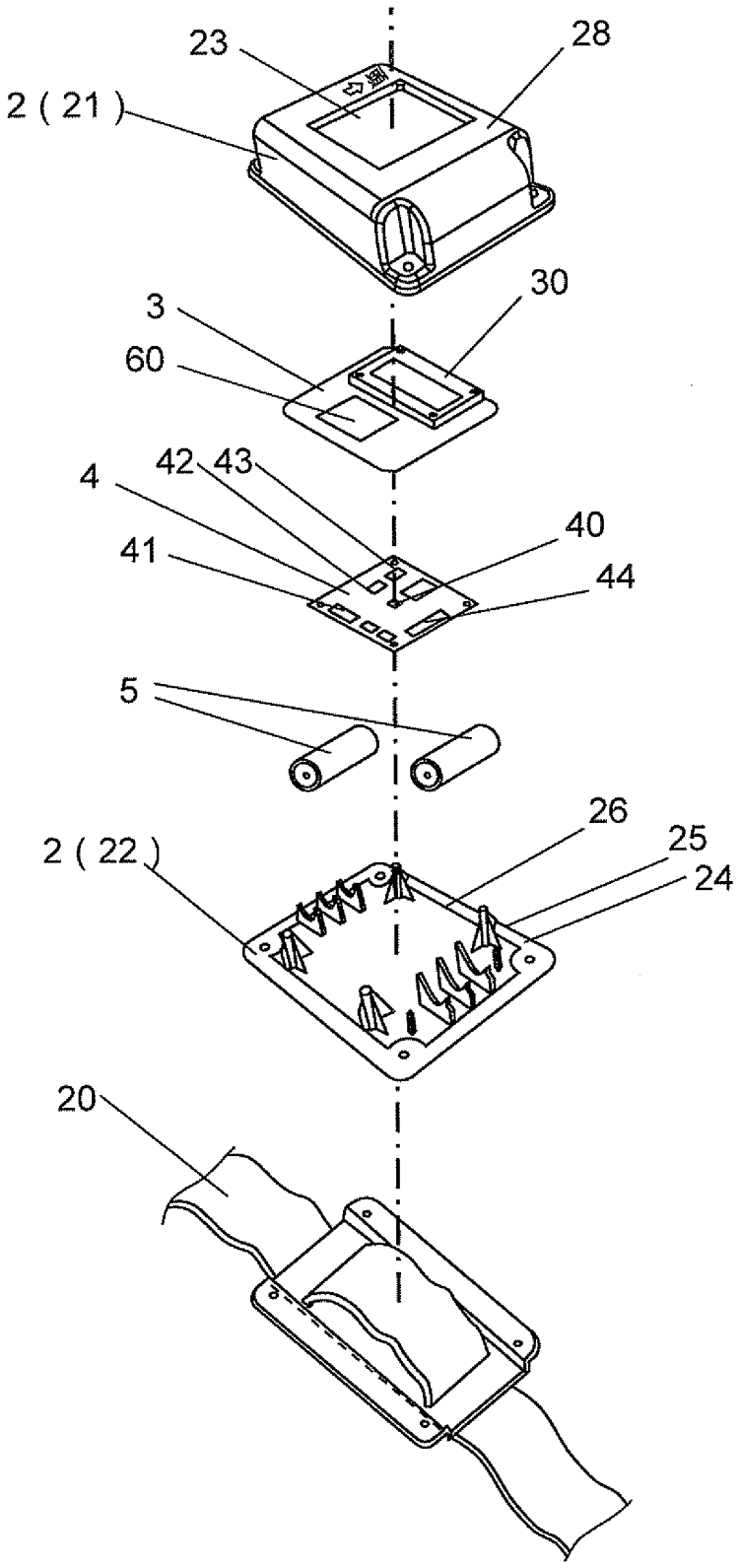


FIG. 4

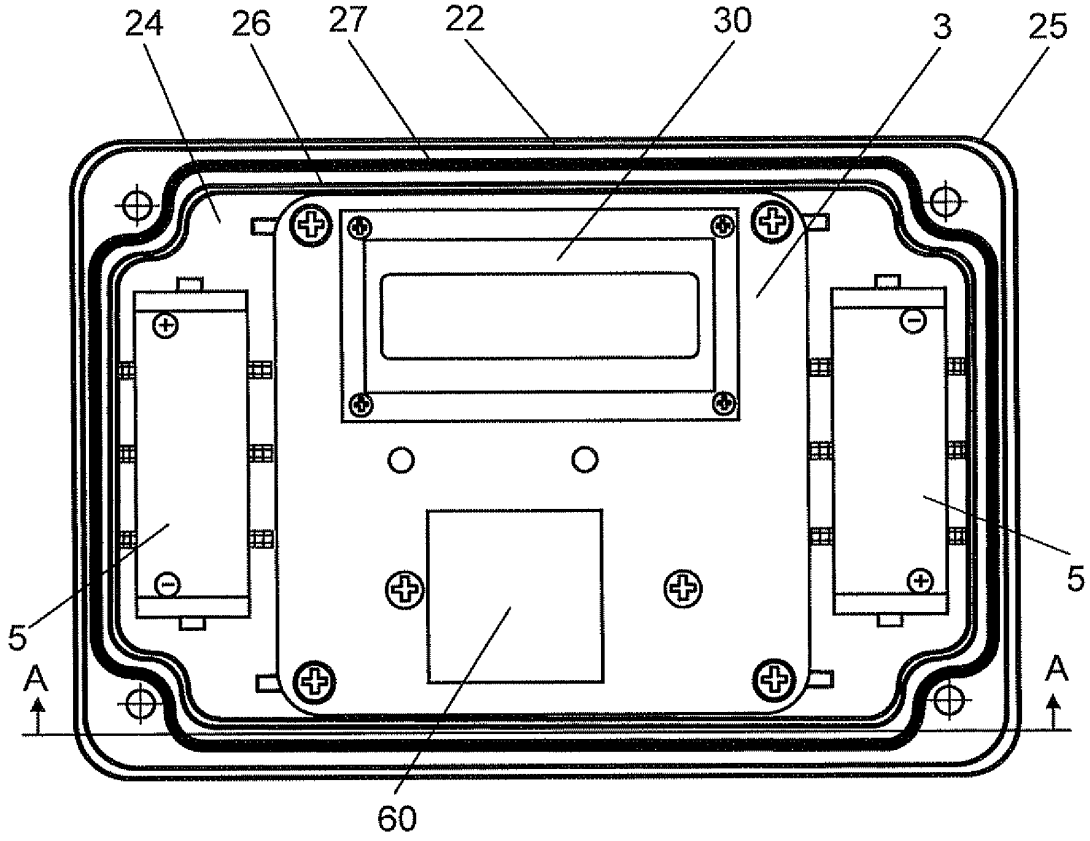


FIG. 5

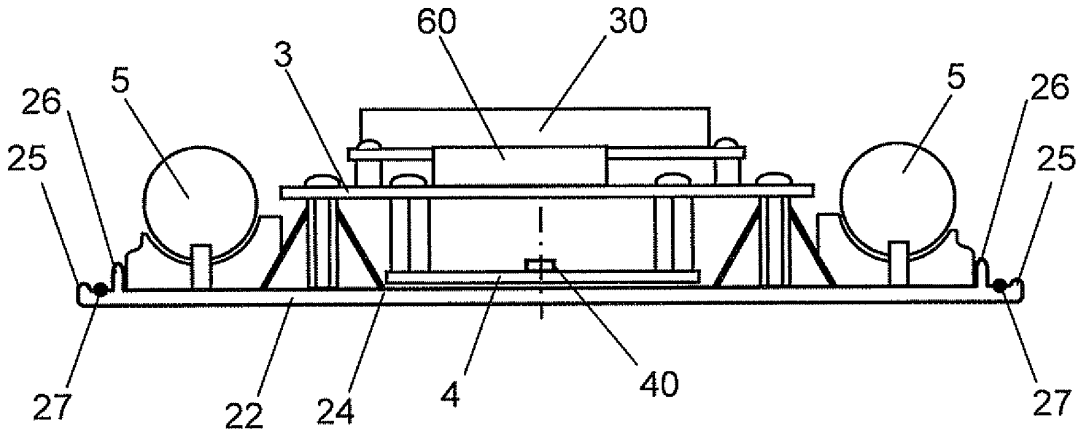


FIG. 6

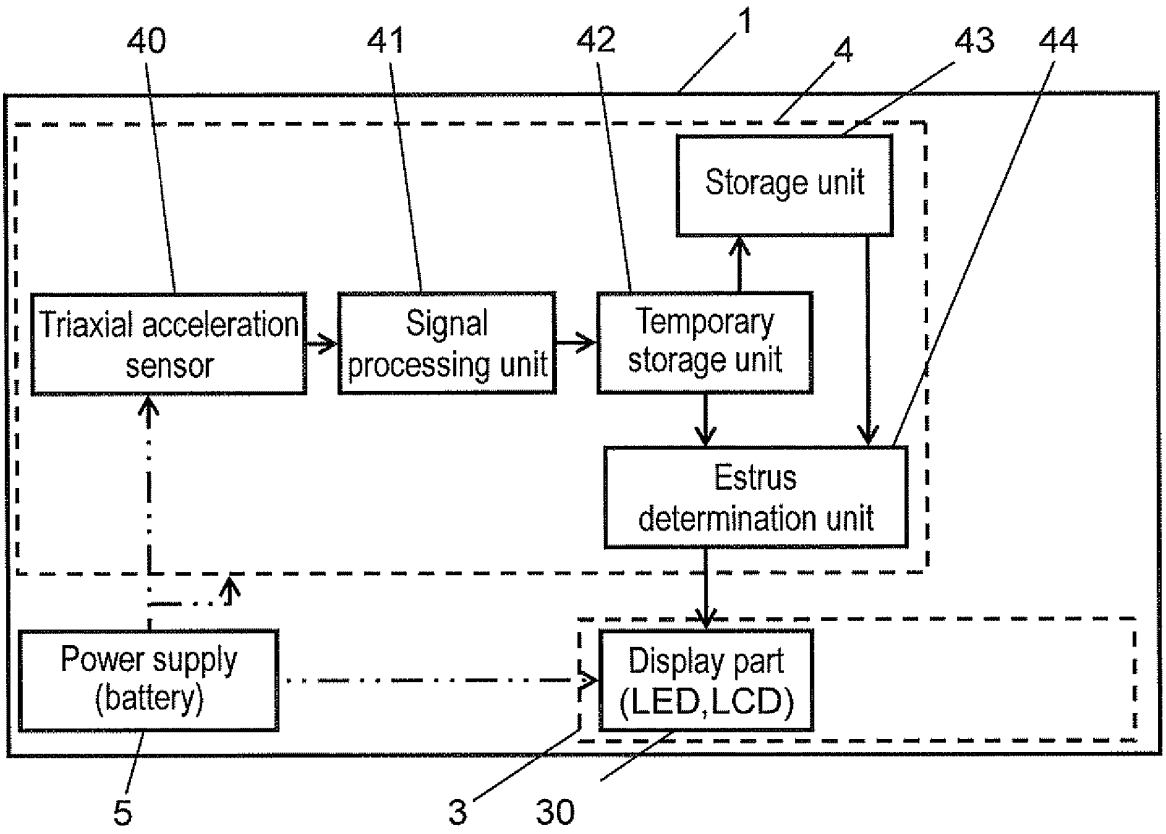

40
41
42
1
4
43
44
Storage unit
Triaxial acceleration sensor
Signal processing unit
Temporary storage unit
Estrus determination unit
Power supply (battery)
Display part (LED,LCD)
5
3
30

FIG. 7

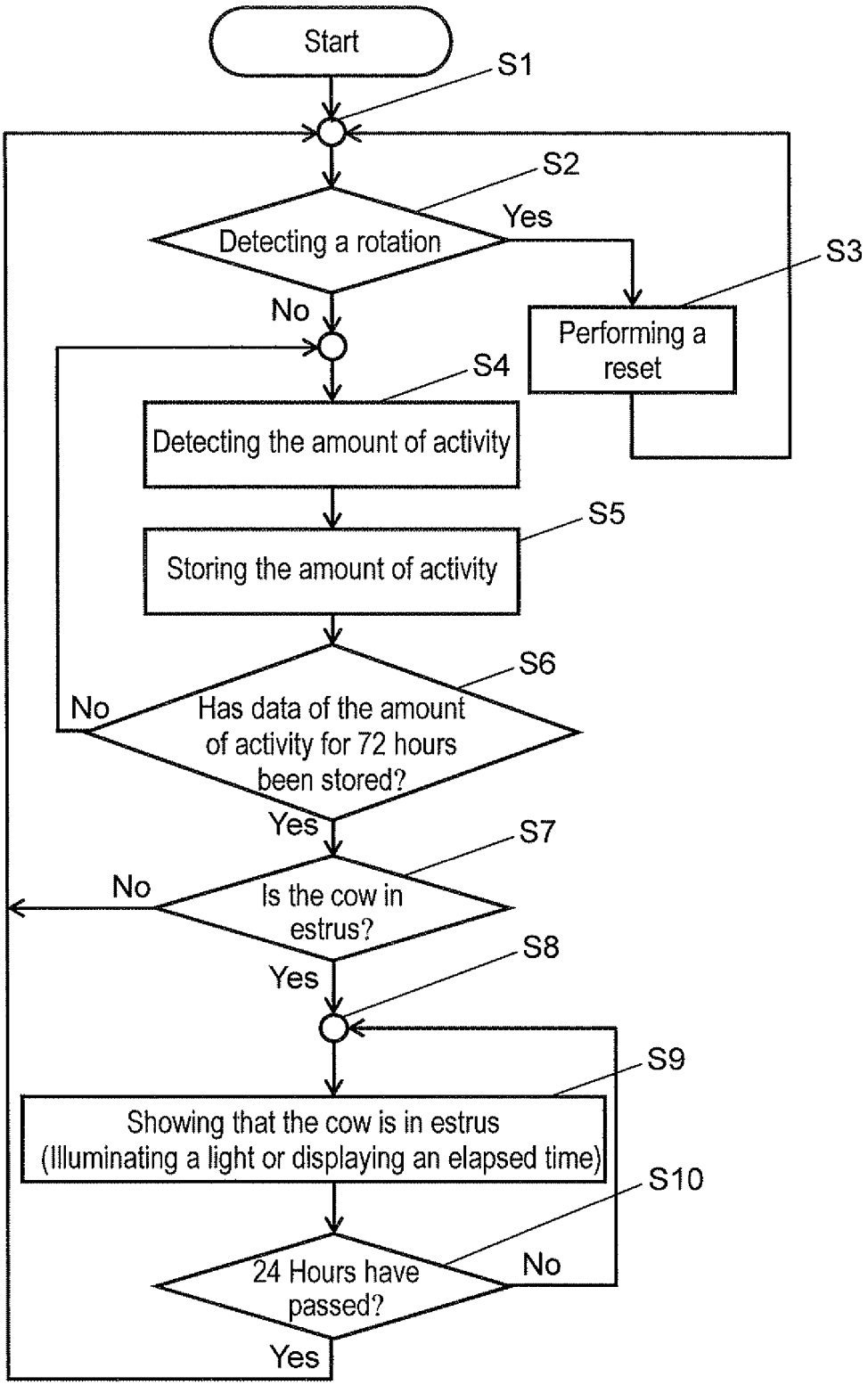

Start
S1
S2
Detecting a rotation
Yes
S3
Performing a reset
No
S4
Detecting the amount of activity
S5
Storing the amount of activity
S6
No
Has data of the amount of activity for 72 hours been stored?
Yes
S7
No
Is the cow in estrus?
Yes
S8
S9
Showing that the cow is in estrus (Illuminating a light or displaying an elapsed time)
S10
24 Hours have passed?
No
Yes

FIG. 8

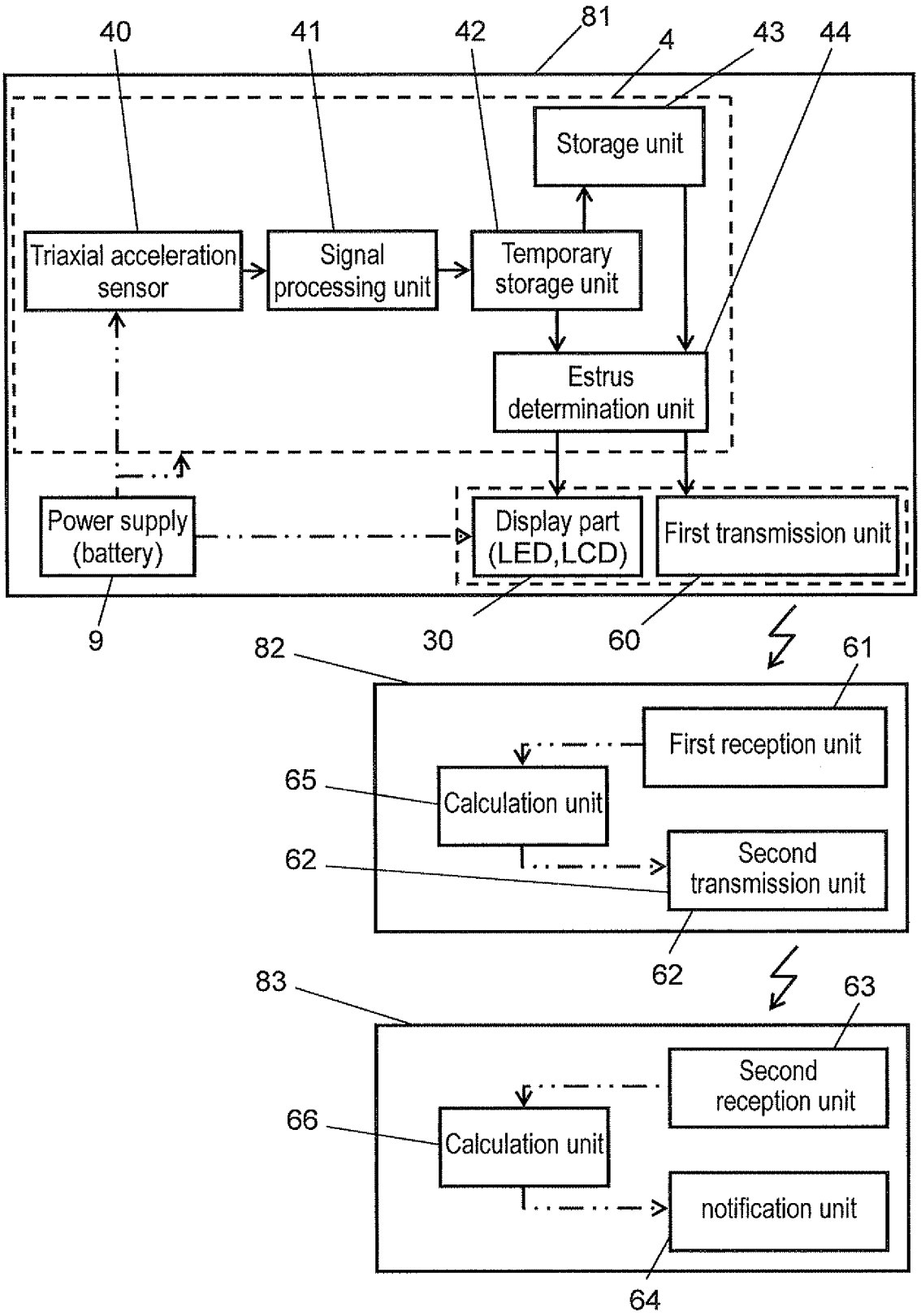
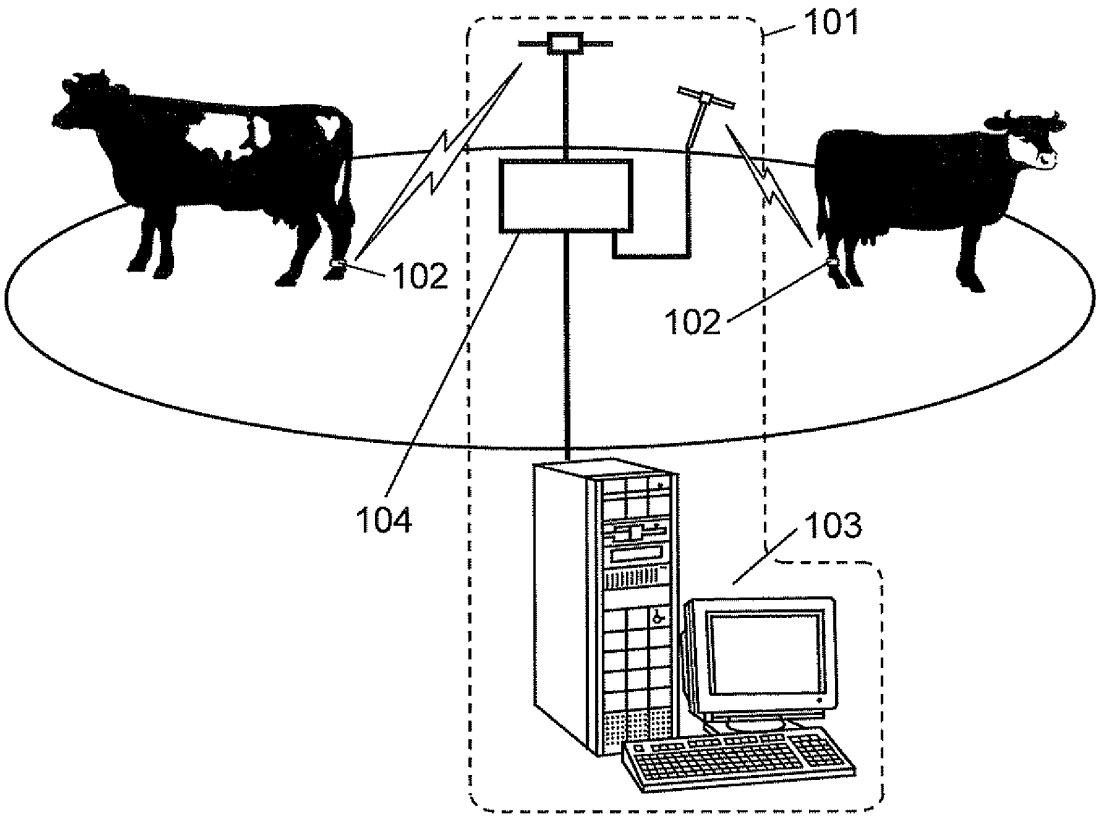

40
41
42
81
4
43
44
Storage unit
Triaxial acceleration sensor
Signal processing unit
Temporary storage unit
Estrus determination unit
Power supply (battery)
Display part (LED,LCD)
First transmission unit
9
30
60
82
61
First reception unit
65
Calculation unit
62
Second transmission unit
62
83
63
Second reception unit
66
Calculation unit
notification unit
64

FIG. 9



INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2011/004138

A. CLASSIFICATION OF SUBJECT MATTER
A01K67/02(2006.01)i

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)
A01K67/02

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Jitsuyo Shinan Koho 1922-1996 Jitsuyo Shinan Toroku Koho 1996-2011
Kokai Jitsuyo Shinan Koho 1971-2011 Toroku Jitsuyo Shinan Koho 1994-2011

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
CA/BIOSIS/MEDLINE/WPIDS(STN), JSTPlus/JMEDPlus/JST7580(JDreamII), CiNii

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP 2008-092878 A (Comtec Co., Ltd.), 24 April 2008 (24.04.2008), claims (Family: none)	1-14
Y	JP 2007-075043 A (Wacom-IT Co., Ltd.), 29 March 2007 (29.03.2007), claims; fig. 1 to 5 (Family: none)	1-14
A	Toshio WATANABE et al., "Estrus Detection in Dairy Cattle Using an Acceleration Sensor", IEICE Technical Report, 09 July 2009 (09.07.2009), vol.109(131), pages 135 to 139	1-14

☒ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:
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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
03 August, 2011 (03.08.11)	16 August, 2011 (16.08.11)
Name and mailing address of the ISA/ Japanese Patent Office Facsimile No.	Authorized officer Telephone No.

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2011/004138

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	Naoyuki OKAZAKI et al., "3 Jiku Hoko Sensor ni yoru Kuroge Washu Mesu Ushi no Hatsujo Kenchi no Kokoromi", 2009 Nendo Dai 111 Kai The Japanese Society Zootechnical Science Annual Meeting abstracts, 28 September 2009 (28.09. 2009), page 99, IX28-04	1-14

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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2008092878 A **[0008]**