



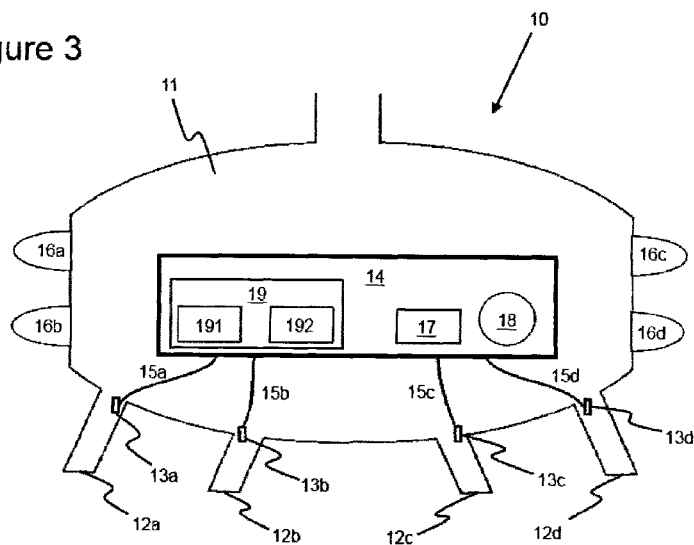
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(54) **Title:** MASTITIS WARNING CLAW**Figure 3**

(57) **Abstract:** The present invention relates to a milking claw (10) which enables to detect mastitis disease during a milking process, comprising a milk duct (12a, 12b, 12c, 12d) provided for each milking cluster (20) fitted to the nipples of the animal to be milked, sensors (13a, 13b, 13c, 13d) that are placed on said milk ducts (12a, 12b, 12c, 12d) and measure the electrical conductivity of the milk. The milking claw (10) comprises a central process unit (14) which controls if there is mastitis disease in the udder by assessing the data coming from said sensors (13a, 13b, 13c, 13d); a power source (18) which provides the energy required to operate said central process unit (14); a triggering member (17) which activates the power source (18) during milking process and deactivates it when the milking process ends.

MASTITIS WARNING CLAW

DESCRIPTION

5 TECHNICAL FIELD

The present invention relates to a leading warning claw which is developed to be used in milking systems and enables to detect the mastitis disease in nipples of animals and to warn the users.

10 BACKGROUND OF THE INVENTION

The most important of the factors affecting dairy farming is udder health. The most common disease faced in establishments is mastitis. Mastitis is the reaction that the lactating tissue shows against the infections occurring in one or more lobes of the udder.

15 Mastitis disease directly affects the quality of milk. Somatic cells pass to the milk and break the quality of the milk and decrease its amount. Somatic cells are composed of white blood cells passing from blood to the milk and a small amount of epithelium. White blood cells exist for struggling with the microorganisms in the udder tissue. Therefore, the more microorganisms the udder is exposed to, the more the number of white blood cells are. So,
20 the high amount of somatic cells in the milk may be the most important indicator of mastitis disease.

The most common method applied for treating the mastitis disease is use of antibiotics. However, antibiotics are transmitted to milk from the body of the animal easily. Utilizing the
25 *milk with antibiotics is impossible in terms of health and technique. Therefore, it is very important to diagnose the disease in early stages and to take necessary precautions. Somatic cells emerging at the start of the disease and transmitted to the milk change the conductivity of the milk. In this respect, the method of measuring the conductivity of the milk and taking decisions after evaluating the deviations occurring in the measured values in*
30 *order to control the existence of the disease is used.*

In the state of the art, used method is combining the milk taken from each nipple of the udder at a certain point and then transferring the values sensed from the milk by sensors to the external decision units, in order to detect mastitis disease. Generally, mastitis occurs in only
35 one udder. As the milk coming from the three healthy udders and one diseased udder is combined in this method, the intensity of disease indications in the milk decreases. This delays the detection of the disease.

There are systems that measure the electrical conductivity of the milk coming from four udders separately and make a decision. For instance, in the Patent Application No. US4793285 (A), conductivity of the milk coming from four nipples is measured separately and the measurement results are transferred to an external unit to be evaluated. Information
5 about the measurement results are done by monitors connected to this external unit and warning members.

The Patent No. US6378455 B1 comprises sensors to make a further measurement from each nipple and a data processing unit wherein the data taken from the sensors are
10 explained and transferred to an external component. Said external component assesses the coming data and gives the final decision on whether a disease is present.

In the patents mentioned above and in other similar systems, the main reason to locate the decision unit far from the measurement point is the requirement of power source. Power
15 source to be used in the milking claw should be light in weight to be used in a small area and to provide ergonomics and animal comfort. However, by providing these conditions, the life of power sources used in the current milking claws is less than twenty days. In that case, the user prefers to use external power sources and milking claws working by integration with the external decision units. This causes the milking systems to become large and complex
20 structures.

Consequently, the abovementioned disadvantages made it obligatory to develop a configuration which includes all the elements that measure the conductivity of the milk, produces a result by analyzing the measured values and provide a feedback about the
25 results.

BRIEF DESCRIPTION OF THE INVENTION

The present invention relates to a milking claw with a mastitis detector developed to remove the abovementioned disadvantages and to bring new advantages to the related technical
30 field.

The main object of the invention is to provide a milking claw which comprises the process unit that makes a process to locate the mastitis disease for every nipple of the milked animal separately during milking process and enables to detect the existence of the disease.
35

Another object of the invention is to remove misleading effect of the environmental conditions that affect the milk while detecting mastitis disease.

Still another object of the invention is to provide a milking claw which gets activated automatically during milking process and deactivated when the milking process ends, and makes mastitis measurement in every milking process by making the system independent from the initiative of the user.

5

A further object of the invention is to provide a milking claw which can communicate with cables or wirelessly with the external units.

Another object of the invention is to provide a milking claw which can be used in integration
10 with every kind of mechanical or electrical milking system.

In order to fulfil the objects that are mentioned above and going to be explained below, to detect mastitis disease in the milked animal during milking process, the present invention relates to a milking claw comprising:

- 15
- a milk duct provided for each milking cluster fitted to the nipples of the animal to be milked,
 - sensors that are placed on each of said milk ducts and measure the electrical conductivity of the milk;

said milking claw being characterized by comprising

- 20
- a central process unit which controls if there is mastitis disease in the udders by assessing the data coming from said sensors,
 - a power source which provides the energy required to operate said central process unit,
 - a triggering member which activates the power source during milking process and
25 deactivates it when the milking process ends.

In a preferred embodiment, the invention includes communication cables which provide the communication between each sensor unit and central process unit.

30 In another preferred embodiment, the invention includes an external unit connection unit which enables the central process unit to communicate with the external electronic units with cables and/or wirelessly.

In another preferred embodiment, the invention includes warning lights each of which
35 represents one udder and which are turned on by the central process unit when mastitis disease is detected on the represented udder and enable to warn the user.

In another preferred embodiment of the invention, said triggering member is a direction sensor which detects the direction change occurring in the milking claw during milking process and activates the power source, and deactivates it when the milking process ends.

5 In another preferred embodiment of the invention, said triggering member is a pressure sensor which activates the power source by sensing the negative pressure occurring in the claw during milking and deactivates it when the pressure diminishes when the milking process ends.

10 In another preferred embodiment of the invention, said triggering member activates and deactivates the power source in line with the command coming to the external connection unit from an external unit.

In another embodiment of the invention said triggering member is an on-off button which is
15 placed on the milking claw and enables to activate and deactivate the power source manually.

The milking claw of the invention provides a smart power management system by a triggering member controlling the power source. Thus, it is enabled to activate the power source only during milking process and deactivate it when the milking process ends. This
20 makes the life of the power source longer. By that way, a compact milking claw is provided, including sensors, decision making component, feedback component (warning lights) and power source elements all. The necessity to work with additional systems to detect mastitis is removed and a milking claw which can work in integration with all kinds of milking systems being simple or complex is provided.

25

The method for detecting mastitis, carried out by the milking claw of the invention with the mentioned elements, includes the process steps of:

- The triggering member activating the power source,
- Measuring the electrical conductivity of the milk coming from each udder by the
30 sensor placed in the related milk duct,
- Transferring the measurement results to the central process unit,
- The central process unit
 - controlling whether the mastitis disease is present in all 4 udders by comparing the electrical conductivity of the milk coming from every
35 udder with the acceptable limit value

- in case of detecting the absence of mastitis disease in all of the udders, calculating the average of conductivity values coming from each milked udder
- comparing the electrical conductivity value coming from each udder with the calculated average value
- deciding on the existence of mastitis in an udder if the electrical conductivity value of the milk coming from any udder is above the average value
- stopping the measurement process by deactivating the power source.

Another preferred process step of the invention is that the central process unit determines the level of the mastitis disease in line with the difference between the conductivity value of the milk coming from an udder and the average conductivity value of the milk.

In mastitis detection method, separate evaluation is made for the milk taken from the four udders and it is detected on which udder the mastitis is. Contrary to the existing methods, instead of making a comparison only with specific limit values in making a decision, a different limit value is determined for every animal. For example, the electrical conductivity of the milk of a dairy animal drinking water from a source with high lime and a dairy animal drinking water from a source with a low lime will be different. In the existing methods, the limit values used in measurement for these two animals are same. In this case, there is the risk of detecting mastitis disease in one animal late or detecting the mastitis disease in the other even though it does not exist. However, in the method of the invention, the conductivity value of the milk coming from each udder of the animal is compared to the average milk conductivity value taken from that animal. Thus, negative effects of environmental conditions on detecting mastitis are prevented.

In order to describe the embodiment and the advantages of the present invention with additional members, it should be assessed with the figures described below.

BRIEF DESCRIPTION OF THE FIGURES

Figure 1 shows use of the milking claw of the invention in a fixed milking system.

Figure 2 shows use of the milking claw of the invention in a mobile milking system.

Figure 3 is the schematic view of the milking claw of the invention.

REFERENCE NUMBERS

- 10 Milking Claw
 - 11 Body
 - 12 Milk Ducts
 - 5 13 Sensor
 - 14 Central Process Unit
 - 15 Communication Cable
 - 16 Warning Light
 - 17 Triggering Member
 - 10 18 Power source
 - 19 External Unit Connection Unit
 - 191 Wireless External Unit Connection Unit
 - 192 Cabled External Unit Connection Unit
- 20 Milking Clusters

15

DETAILED DESCRIPTION OF THE INVENTION

In this detailed description, the novelty of the invention is described with the examples that will have no limiting effect only for better understanding of the subject. In accordance with this, the description and figures below disclose a milking claw (10) which is used for milking in fixed or mobile milking systems and includes the elements that enable to detect mastitis disease in animals.

Figure 1 shows use of the milking claw (10) of the invention in a fixed milking system and Figure 2 shows use of the milking claw of the invention in a mobile milking system. The milking claw (10) generally comprises a body (11), four milk ducts (12) provided on said body (11) and milking clusters (20) connected to said milk ducts (12). Milking clusters (20) provided separately for each nipple are connected to the nipples and the milk firstly passes through the milk ducts (12) and is transferred into the body (11). The milk filling into the body (11) is transferred to the related milk collection center from here.

30

Figure 3 is a schematic view of the milking claw (10) of the invention. According to this, there is at least one sensor (13a, 13b, 13c, 13d) measuring the electrical conductivity of the milk coming from the corresponding nipple in each milk duct (12a, 12b, 12c, 12d). A central process unit (14) is provided in the body (11), where the data measured by the sensors (13a, 13b, 13c, 13d) are transferred. The communication between the central process unit (14) and the sensors (13a, 13b, 13c, 13d) is enabled by the communication cables (15). Central process unit (14) determines if there is mastitis disease in any udder and on which stage it is,

35

in accordance with the data transferred thereto. There is one warning light (16a, 16b, 16c, 16d) located on the body (11) to represent each udder. Central process unit (14) sends a command to the warning light (16a, 16b, 16c, 16d) corresponding to the udder detected with the disease and turns it on, thus informs the user about the existence of mastitis disease.

5 The energy required for the central process unit (14) to operate is provided by a power source (18) located in the body (11). Activation and deactivation of said power source (18) is enabled by a triggering member (17). Various structures can be used as a triggering member (17) to activate and deactivate the power source manually or automatically. In the preferred embodiment of the invention, direction sensor is used as triggering member (17). Direction

10 sensor activates the power source (18) when the milking clusters (20) of milking claw (10) are turned upwards by detecting this movement. When the milking process ends and the milking clusters (20) are turned reverse downwards, the direction sensor deactivates the power source (18) and ends the operation of the system. A pressure sensor can be used as an alternative for the direction sensor. As milking process is performed by vacuum, a

15 negative pressure is formed in the milking cluster. The pressure sensor senses this change and understands that the milking process has started and enables to activate the power source (18). When the milking process ends, pressure effect is removed and the power source (18) is deactivated in line with this change. In addition to these and similar systems which can automatically activate and deactivate the power source, manual control of the

20 power source (18) is also enabled by means of an on-off button which is to be located on the milking claw (10).

In the central process unit (14), there is an external unit connection unit (19) including a cabled external unit connection unit (192) and/or a wireless external unit connection unit

25 (191). By means of these units (19) central process unit (14) communicates with the external units with cables or wirelessly and make data transfer. The operation of the power source (18) is controlled by the commands sent from an external unit by means of the external unit connection unit (19).

30 In line with the information given above, the milking claw (10) of the invention works in this way: While the milking clusters (20) are in idle mode facing downwards, the milking claw (10) is fitted to the animal to be milked such that the milking clusters (20) face upwards, by the user. In the case that a direction sensor is used as triggering member (17), this sensor senses the vertical movement of the milking claw (10) and activates the power source (18)

35 and milking process begins. The milk milked by milking clusters (20) is transferred to the corresponding milk duct (12a, 12b, 12c, 12d). A sensor (13a, 13b, 13c, 13d) provided on each milk duct (12a, 12b, 12c, 12d) measures the electrical conductivity of the milk coming to

the duct (12a, 12b, 12c, 12d) where it is available and transfers the measurement results to the central process unit (14) by the communication cables (15). Central process unit (14) compares the conductivity values of the milk coming from four nipples with the acceptable limit values. Thus, first it is observed whether the disease is present in all of the udders.

5 Acceptable limit values are the values that are used universally and determined with academic studies. These values are used directly or by being determined in line with the environmental factors of the measurement. After it is detected that the disease is not present in all of the udders, the electrical value of the milk coming from each udder is calculated and the electrical conductivity value of the milk coming from each udder is compared with the

10 average value. It is decided that the milked udder with a higher conductivity value than the average value has mastitis disease. The level of the disease is determined by the change between the conductivity value of the milk coming from the corresponding udder and the average value. Central process unit (14) turns on the warning light (16a, 16b, 16c, 16d) representing the udder with the disease and warns the user. After a certain time, it

15 deactivates the power source (18) and ends the process.

CLAIMS

1. A milking claw (10) which enables to detect mastitis disease during a milking process,
comprising
 - 5 - a milk duct (12a, 12b, 12c, 12d) provided for each milking cluster (20) fitted to the nipples of the animal to be milked,
 - sensors (13a, 13b, 13c, 13d) that are placed on each of said milk ducts (12a, 12b, 12c, 12d) and measure the electrical conductivity of the milk;**characterized in that** the milking claw (10) comprises
 - 10 - a central process unit (14) which controls if there is mastitis disease in the udders by using the data coming from said sensors (13a, 13b, 13c, 13d),
 - a power source (18) which provides the energy required to operate said central process unit (14),
 - a triggering member (17) which activates the power source (18) during milking
15 process and deactivates it when the milking process ends.
2. The milking claw (10) according to Claim 1, characterized by comprising communication
cables (15) providing communication between each sensor (13a, 13b, 13c, 13d) and the
central process unit (14).
20
3. The milking claw (10) according to Claim 1, characterized by comprising an external unit
connection unit (19) which enables the central process unit (14) to communicate with the
external electronic units with cables and/or wirelessly.
- 25 4. The milking claw (10) according to Claim 1, characterized by comprising warning lights
(16a, 16b, 16c, 16d) each of which represents one udder and which are turned on by the
central process unit (14) when mastitis disease is detected on the represented udder and
enable to warn the user.
- 30 5. The milking claw (10) according to Claim 1, characterized in that said triggering member
(17) is a direction sensor which detects the direction change occurring in the milking claw
(10) during milking process and activates the power source (18), and deactivates it when
the milking process ends.
- 35 6. The milking claw (10) according to Claim 1, characterized in that said triggering member
(17) is a pressure sensor which activates the power source (18) by sensing the negative
pressure occurring in the claw during the milking process and deactivates it when the
pressure diminishes when the milking process ends.

7. The milking claw (10) according to Claim 1, characterized in that said triggering member (17) activates and deactivates the power source in line with the command coming to the external connection unit (19) from an external unit.
- 5 8. The milking claw (10) according to Claim 1, characterized in that said triggering member (17) is an on-off button which is placed on the milking claw (10) and enables to activate and deactivate the power source (18) manually.
- 10 9. The method for detecting mastitis disease by the milking claw (10) according to any one of the Claims 1 to 8, characterized by comprising the process steps of
- The triggering member (17) activating the power source (18),
 - Measuring the electrical conductivity of the milk coming from each udder by the sensor (13a, 13b, 13c, 13d) placed in the related milk duct (12a, 12b, 12c, 12d),
 - 15 - Transferring the measurement results to the central process unit (14),
 - The central process unit (14)
 - controlling whether the mastitis disease is present in all 4 udders by comparing the electrical conductivity of the milk coming from every udder with the acceptable limit value
 - 20 ▪ in case of detecting the absence of mastitis disease in all of the udders, calculating the average of conductivity values coming from each milked udder
 - comparing the electrical conductivity value coming from each udder with the calculated average value
 - 25 ▪ deciding on the existence of mastitis in an udder if the electrical conductivity value of the milk coming from that udder is above the average value
 - stopping the measurement process by deactivating the power source.
- 30 10. The method for detecting mastitis disease according to Claim 9, characterized in that the central process unit (14) turns on the warning light (16a, 16b, 16c, 16d) representing the udder with the disease and warns the user.
- 35 11. The method for detecting mastitis disease according to Claim 9, characterized in that the central process unit (14) determines the level of the mastitis disease in line with the difference between the conductivity value of the milk coming from an udder and the average conductivity value of the milk.

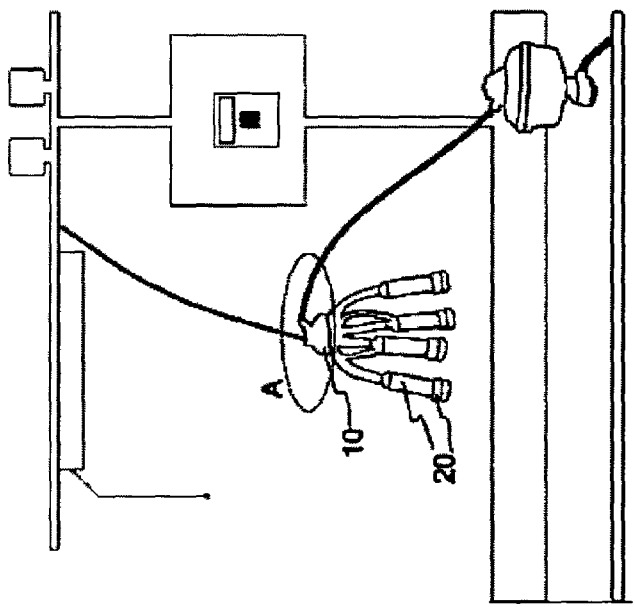
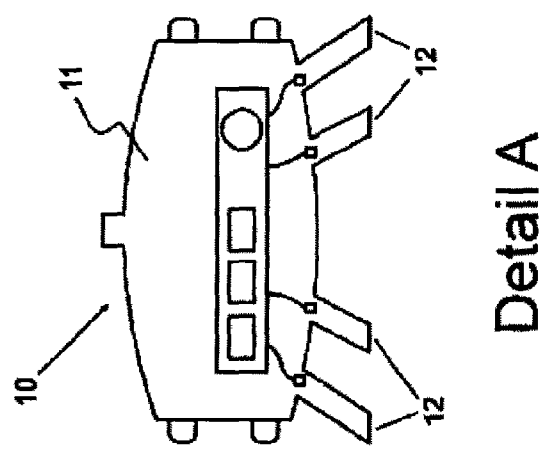


Figure 1



Detail A

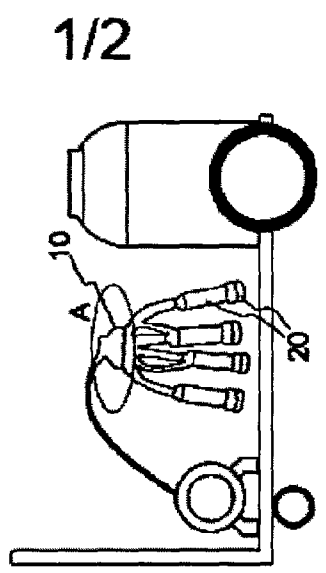


Figure 2

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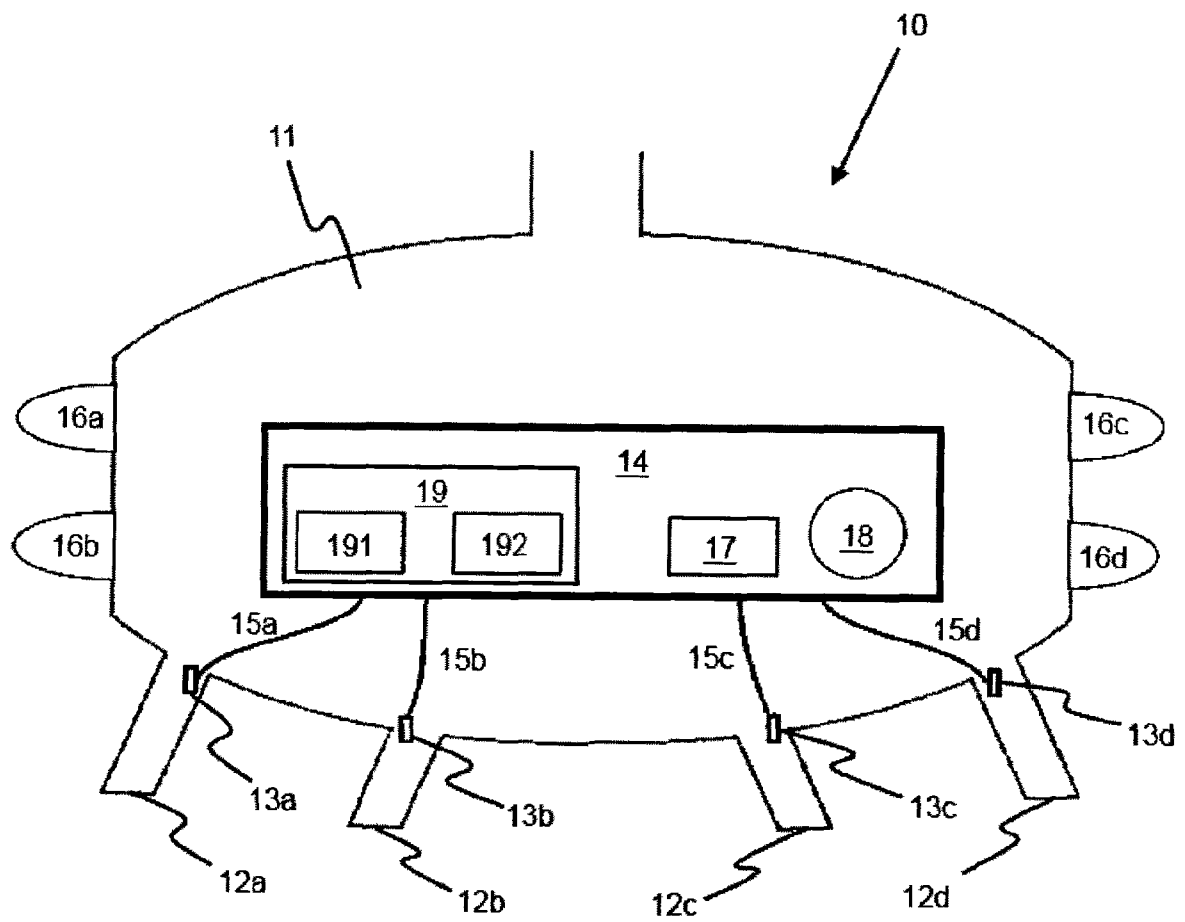


Figure 3

INTERNATIONAL SEARCH REPORT

International application No
PCT/TR2015/000242

A. CLASSIFICATION OF SUBJECT MATTER
INV. A01J5/013 A01J5/04
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)
A01J

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 6 378 455 B1 (POSTMA EBELE MARTEN [NL] ET AL) 30 April 2002 (2002-04-30) cited in the application column 2 - column 5; figure 1 -----	1-11
A	EP 0 137 367 A2 (EISAI CO LTD [JP]) 17 April 1985 (1985-04-17) page 6 - page 14; figures 4,5 -----	1-11
A	US 4 793 285 A (MARSHALL BARRY R [GB]) 27 December 1988 (1988-12-27) cited in the application the whole document -----	1-11



Further documents are listed in the continuation of Box C.



See patent family annex.

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"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

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"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

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/TR2015/000242

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