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(54) Title: PULSATION MONITORING CLAW

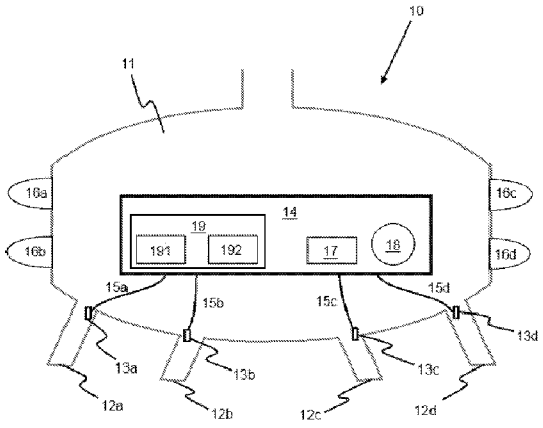

Figure 3

(57) Abstract: The invention relates to a pulsation monitoring claw (10), which comprises one milk tube (12a, 12b, 12c, 12d) provided for each milking cup (20) attached to teats of the animal to be milked and which enables measuring the intensity, frequency and duration of vacuum applied on teats during milking process. Pulsation monitoring claw (10) comprises; sensors (13a, 13b, 13c, 13d) that are placed on each mentioned milk tube (12a, 12b, 12c, 12d) and that measure applied vacuum, a central processor unit (14) that calculates the pulsation ratio for each teat by using data from the mentioned sensors (13a, 13b, 13c, 13d) and evaluates the acceptability of this value, a power supply (18) that provides the required energy for the operation of the mentioned central processor unit (14), a trigger unit (17) to trigger the central processor unit (14) in order to activate the power supply (18) when milking process starts and communication wires (15) that enable the communication between each sensor (13a, 13b, 13c, 13d) and the central processor unit (14).

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DESCRIPTION

PULSATION MONITORING CLAW

TECHNICAL FIELD

The invention is developed to be used in milking systems, wherein it relates to a pulsation monitoring claw that enables monitoring the intensity, frequency and duration of vacuum applied to animal teats during milking and warns the user if required limits are exceeded.

PRIOR ART

In milking systems, teat diseases occur in time especially in bovine animals due to high yield. These diseases of udder directly affect milk production and in most instances, milk obtained from other healthy udders can't also be used as "product" for days due to the administered antibiotic treatment. Used antibiotics are easily transmitted form the animal body to the milk. Economically utilizing the milk containing antibiotics is impossible both health-wise and from the technical aspect.

The fundamental method of fighting disease in a business is to eliminate the conditions that cause the disease. One of the main factors of disease formation in teats is the intensity, frequency and duration of the vacuum applied on the animal's udder.

In case the vacuum applied on the udder is high, it is observed that teats acquire a pale red and bluish color; the tip becomes thick and edematous; teat canal protrudes and the keratin layer of the teat canal is disrupted. Moreover, teats become highly tense and are sucked into the teat cups of the machine. Besides high vacuum level, low vacuum level also poses harmful effects to the udder. Low vacuum level results in slower milking and thus longer milking duration. Since teats will stay under the effect of vacuum for a longer time, this is not a desired situation. It is indicated that milk yield in cows decreases by 5% in milking with low vacuum levels. In both conditions, the structure in the udder that blocks microbes is disrupted and the risk of developing

mastitis is increases.

Squeeze and release cycle of teat cups is called pulsation. Pulsation ratio is shown as "X/Y" and this means vacuum is applied during "X" percent of the duration of one cycle; and the udder is in squeezing, i.e. resting stage during the remaining "Y" percent. There is a significant relationship between pulsation applied to teat and mastitis. High pulsation ratio (e.g. 70/30) might reduce milking duration due to long vacuum period (for example when vacuum is applied in 70% of a second). However, in this case an incompatibility occurs between the flow of milk from the teat and the operation of the machine especially in old cows. As a result, the udder will remain under vacuum longer than the optimum period and it will become defenseless against microbes due to the deformation of udder canals. Low pulsation ratio (e.g. 30/70) increases milking duration and longer milking duration will similarly result in longer exposure to vacuum and render the udder defenseless against bacteria.

Low or high pulsation frequency is also harmful to the udder. In case of very low pulsation frequency (less than 30 per minute), pain is felt on the teat due to insufficient blood circulation. Cows respond to pain by kicking. In case of high pulsation frequency (more than 60 per minute), teat canal is overstrained and loses its inherent power to prevent microorganisms from entering the udder.

In Figure 4, view of the milking claw applied to teats is shown. When the right cup is in squeeze position, the left cup is in release position. In squeeze position, vacuum applied to the udder and flow of milk from the udder is stopped; whereas in release position vacuum is applied to the udder in order to enable milk outflow.

Teat cups are connected to the milking claw after hoses connected to the vacuum inlet (21). Hose distance is fixed here. The rubber part placed inside the teat cup and squeezing the udder is called teat cup liner. Teat cup liner and the hose, referred to as vacuum inlet (21) constitute a single piece together. Teat cup liners are manufactured as standard.

Vacuum enabling the milking process is transmitted to the teat cup liner through milking claw and enters the chamber, in which the udder is placed, via the vacuum inlet (21). If vacuum is also provided through the pulsator inlet (22) in the meantime, internal and external pressure will be equal and thus the teat cup liner will preserve its form and milk flow will be provided by applying vacuum directly to the udder. If air with atmospheric pressure enters the pulsator inlet (22) while there is vacuum inside the internal chamber, i.e. the chamber in which the udder is placed; the pressure of the internal chamber will be negative and that of the external chamber will be positive leading to closing of the liner by contracting inwards and cessation of application of vacuum on the udder. Meanwhile, milk flow stops and udder is allowed to rest.

Pulsator is the component that enables vacuum or air entry from the pulsator inlet (22) as shown in Figure 4. It connects the pulsator inlet (22) to the vacuum pipeline and the environment atmosphere respectively according to the desired pulsation settings. Once the pulsator starts applying vacuum to the mentioned chamber, all air in this area and the hose should be evacuated by vacuum for the liner to go back to its old form. If the hose is extended or the diameter of the hose is increased, squeezing process will last longer than it's supposed to because air inside will be evacuated later; and the desired pulsation ratio will change. Therefore hose diameter and distance between the pulsator and the teat cup is important for the pulsation ratio.

In many existing applications, vacuum measurement is performed with mechanical vacuum gauges from one point (outlet of the vacuum source) on the vacuum pipeline. However, in milking parlors with many stations, vacuum passes through many different sized joints and junctions until it reaches the milking claw, i.e. the cup on the animal's udder. Therefore, the value at the outlet of the vacuum source is different than the value that reaches the animal's udder. Moreover, another major factor in mastitis disease formation is the pulsation ratio and frequency; and pulsation ratio cannot be measured in this system.

Another application in the state of art is the installation of vacuum and pulsation gauges for each milking station. These gauges are mounted on the outlet of pulsators, which exist in each station and enable the formation of pulsation; and they need a central control unit. Information and/or warnings are communicated to the

user most probably by the central control unit and herd management software is usually used for the communication of these warnings. As to herd management systems, they are much more expensive than vacuum measurement systems. Basic drawbacks of these methods are given below.

- Length of the pulse hose between the pulsator and claw changes the volume of the area to be evacuated by vacuum. Therefore, pulsation ratio at the outlet of the pulsator is not equal to the pulsation ratio at the claw. Consequently, pulsation applied to the udder is not exactly measured.

- They are hard to install since they work with a central control unit. Skilled labor is necessary for gauge units installed at each station; for connecting each unit to vacuum pipelines and for data connections to the central control unit in each measurement unit; thus, this brings a cost burden to the user.

BRIEF DESCRIPTION OF THE INVENTION

Present invention relates to a pulsation monitoring claw developed in order to eliminate the abovementioned disadvantages and bring new advantages to the relevant technical field.

Main object of the invention is to provide a pulsation monitoring claw, which measures the intensity, frequency and duration of vacuum applied to each teat of the animal during milking process and evaluates the acceptability of these parameters by a processor unit contained within itself.

Another object of the invention is to provide a monitoring claw that automatically becomes active during milking process and inactive after the milking process is finished; therefore measures the ratio, frequency and speed of pulsation during every milking process without the need to interfere by the user.

Another object of the invention is to provide a monitoring claw that can communicate with external units in a wired or wireless manner. Therefore, all performed measurements (pulsation ratio, vacuum intensity, frequency and period etc.) can be

transferred to external systems and recorded, interpreted and similar actions can be performed.

Another object of the invention is to provide a monitoring claw that can be integrated with any kind of mechanical or electronic milking system. For instance, besides being able to be used in mobile milking machines that are only made of mechanical components and that do not contain any smart components; monitoring claw will also be able to be used together with automatic milking systems and/or advanced herd management systems.

In order to realize all objectives including the abovementioned objectives and the ones that will be clearly revealed by the detailed explanation below; present invention relates to a pulsation monitoring claw, which comprises one milk tube provided for each milking cup attached to teats of the animal to be milked and which enables measuring the intensity, frequency and duration of vacuum applied on teats during milking process. The mentioned pulsation monitoring claw is characterized in that it comprises:

- sensors that are placed in each mentioned milk tube and that measure applied vacuum,
- a central processor unit that calculates the pulsation ratio for each teat by using data from the mentioned sensors and evaluates the acceptability of this value,
- a power supply that provides the required energy for the operation of the mentioned central processor unit,
- a trigger unit to trigger the central processor unit in order to activate the power supply when milking process starts,
- communication wires that enable the communication between each sensor and the central processor unit.

Another preferred embodiment of the invention comprises an external systems connection unit in order to enable wired and/or wireless communication of the central processor unit with external electronic units.

Another preferred embodiment of the invention comprises warning lights, each of which corresponds to one teat and enables warning the user by being switched on by the central processor unit when level of vacuum applied to the corresponding teat is not acceptable.

In another preferred embodiment of the invention, mentioned trigger unit is a direction sensor that activates the power supply during the milking process and inactivates it when milking process is finished by detecting the direction change occurring in the pulsation monitoring claw.

In another preferred embodiment of the invention, mentioned trigger unit is a pressure sensor that activates the power supply by detecting the negative pressure occurring in the claw during the milking process and inactivates it upon disappearing of the pressure when milking process is finished.

In another preferred embodiment of the invention, mentioned trigger unit activates and inactivates the power supply in accordance with a command received from an external unit by the unit for connecting with external systems.

In another preferred embodiment of the invention, mentioned trigger unit is an on-off button that is placed on the pulsation monitoring claw and that enables activating and inactivating of the power supply manually.

A smart power management system is provided with the trigger unit that controls the power supply within the scope of the pulsation monitoring claw of the invention. Therefore, it is ensured that the power supply is activated only during milking process and inactivated when milking process is finished. This extends the lifetime of the power supply. Thus, a compact pulsation monitoring claw that comprises sensors, decision making component, feedback component (warning lights) and power supply is provided. The need to work with herd management systems, electronic milking components and such additional systems for the measurement of vacuum values is eliminated and a pulsation monitoring claw that can be integrated with any kind of simple or complex milking system is provided.

In order to understand the present invention's structure and its advantages with additional components, it has to be evaluated together with the figures explained below.

BRIEF DESCRIPTION OF THE FIGURES

Figure 1 shows the use of pulsation monitoring claw of the invention in a stationary milking system.

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

Figure 3 is a schematic view of the pulsation monitoring system of the invention.

Figure 4 is the view of milking cups applied on teats.

REFERENCE NUMBERS

10 Milking Claw
- 11 Body
- 12 Milk tubes
- 13 Sensor
- 14 Central Processor Unit
- 15 Communication Wire
- 16 Warning Light
- 17 Trigger Unit
- 18 Power Supply
- 19 External Systems Connecting Unit
  - 191 Wireless Connection Unit
  - 192 Wired Connection Unit

20 Milking Cups
- 21 Vacuum Inlet
- 22 Pulsator Inlet

DETAILED DESCRIPTION OF THE INVENTION

In this detailed description, novelty of the invention is explained with examples only for the better understanding of the subject in a manner not to constitute any limiting effects. Accordingly, a pulsation monitoring claw (10) that is used for milking in stationary or mobile milking systems and that also comprises components to enable monitoring applied vacuum values on teats is described in the following description and drawings.

Figure 1 shows the use of pulsation monitoring claw (10) of the invention in a stationary milking system and Figure 2 shows the use of the claw in a mobile milking system. Pulsation monitoring claw (10) is generally comprised of a body (11), four milk tubes (12) provided on the mentioned body (11) and milking cups (20) connected to the mentioned milk tubes (12). Milking cups (20), provided one for each teat, are attached to teats and extracted milk is transferred to the body (11) after first passing through milk tubes (12). Milk filled in the body (11) is then transferred to the associated milk collection center.

Figure 3 is a schematic view of the pulsation monitoring claw (10) of the invention. According to this, every milk tube (12a, 12b, 12c, 12d) is provided with at least one sensor (13a, 13b, 13c, 13d) that measures the intensity, frequency and duration of vacuum applied to the associated teat. Inside the body (11), a central processor unit (14) is provided to which data measured by sensors (13a, 13b, 13c, 13d) is transferred. Communication between the central processor unit (14) and sensors (13a, 13b, 13c, 13d) is provided by communication wires (15). Central processor unit (14) analyses vacuum values measured individually for each teat and calculates the pulsation ratio considering the change of these values per second. Four warning lights (16a, 16b, 16c, 16d), each representing one udder, are placed on the body (11). Central processor unit (14) sends a command to the warning light (16a, 16b, 16c, 16d) corresponding to the teat on which pulsation ratio and/or vacuum value is not acceptable and thus warns the user by turning on the light. Required energy for the operation of the central processor unit (14) is provided by a power supply (18) placed inside the body (11). Activation and inactivation of the mentioned power supply (18)

is provided by means of a trigger unit (17). Various structures that can activate and inactivate the power supply manually or automatically can be used as trigger unit (17). In a preferred embodiment of the invention, a direction sensor is used as the trigger unit (17). Direction sensor activates the power supply (18) by detecting the motion when milking claw (10) is turned so that milking cups (20) face upwards. After a defined period, central processor unit (14) inactivates the power supply (18) and ends the measurement process. A pressure sensor can also be used as an alternative to the direction sensor. A negative pressure builds up inside the milking cup since milking process is performed by vacuum. Pressure sensor detects this change and that milking process has started and provides the activation of the power supply (18). Besides this and similar systems that enable activating and inactivating the power supply (18) automatically; power supply (18) can also be controlled manually by an on-off button placed on the pulsation monitoring claw (10).

Central processor unit (14) comprises an external systems connection unit (19) having wired connection unit (192) providing wired connection to external systems and/or a wireless connection unit (191) providing wireless connection to external systems. Central processor unit (14) can communicate and perform data transfer with external units in a wired or wireless manner by means of the external systems connection unit (19). Operation of the power supply (18) can be controlled by commands sent by an external unit by means of the external systems connection unit.

In accordance with the information given above, pulsation monitoring claw (10) of the invention operates as follows: When pulsation monitoring claw (10) is on standby with milking cups (20) facing downwards, it is turned by the user so that milking cups (20) face upwards and placed on the animal to be milked. In case a direction sensor is used as trigger unit (17), this sensor detects the vertical motion of the milking claw (10) and starts the milking process by activating the power source (18). Milk extracted by milking cups (20) is transferred to the associated milk tube (12a, 12b, 12c, 12d). Each sensor (13a, 13b, 13c, 13d) provided for each milk tube (12a, 12b, 12c, 12d) measures the value of vacuum applied to its tube and transfers measurement results to the central processor unit (14) by means of the communication wires (15). Central processor unit (14) evaluates vacuum values measured individually and calculates the pulsation ratio considering the change of

these values per second. Central processor unit warns the user by turning on warning lights (16a, 16b, 16c, 16d) belonging to the udder for which it detected unacceptable pulsation ratio and/or vacuum level. It inactivates the power supply (18) and ends the process after a certain time period.

CLAIMS

1. A pulsation monitoring claw (10), which comprises one milk tube (12a, 12b, 12c, 12d) provided for each milking cup (20) attached to teats of the animal to be milked and which enables measuring the intensity, frequency and duration of vacuum applied on teats during milking process, characterized in that it comprises:

   - sensors (13a, 13b, 13c, 13d) that are placed on each mentioned milk tube (12a, 12b, 12c, 12d) and that measure applied vacuum,
   - a central processor unit (14) that calculates the pulsation ratio for each teat by using data from the mentioned sensors (13a, 13b, 13c, 13d) and evaluates the acceptability of this value,
   - a power supply (18) that provides the required energy for the operation of the mentioned central processor unit (14),
   - a trigger unit (17) to trigger the central processor unit (14) in order to activate the power supply (18) when milking process starts,
   - communication wires (15) that enable the communication between each sensor (13a, 13b, 13c, 13d) and the central processor unit (14).

2. Pulsation monitoring claw (10) according to Claim 1, characterized in that the central processor unit (14) unit comprises an external systems connecting unit (19) in order to enable wired and/or wireless communication thereof with external electronic units.

3. Pulsation monitoring claw (10) according to Claim 1, characterized in that it comprises warning lights (16a, 16b, 16c, 16d), each of which corresponds to one udder and enables warning the user by being switched on by the central processor (14) unit when vacuum level applied to the corresponding udder is not acceptable.

4. Pulsation monitoring claw (10) according to Claim 1, characterized in that the mentioned trigger unit (17) is a direction sensor that detects the position change

of the pulsation monitoring claw (10) during milking process and activates the power supply (18).

5. Pulsation monitoring claw (10) according to Claim 1, characterized in that the mentioned trigger unit (17) is a pressure sensor that detects the negative pressure inside the claw during milking process and activates the power supply (18).

6. Pulsation monitoring claw (10) according to Claim 1, characterized in that the mentioned trigger unit (17) activates and inactivates the power supply in accordance with a command received by an external unit systems connecting unit (19) from an external unit.

7. Pulsation monitoring claw (10) according to Claim 1, characterized in that the mentioned trigger unit (17) is an on-off button that is placed on the milking claw (10) and that enables activating and inactivating the power supply (18) manually.

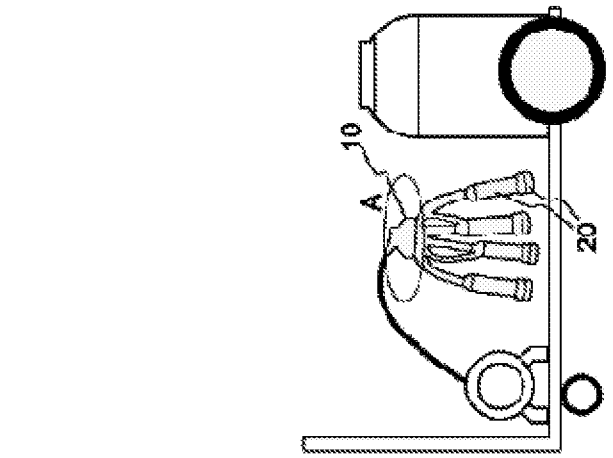
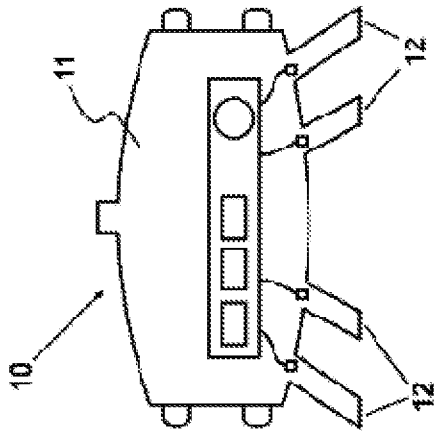


Figure 2



Detail A

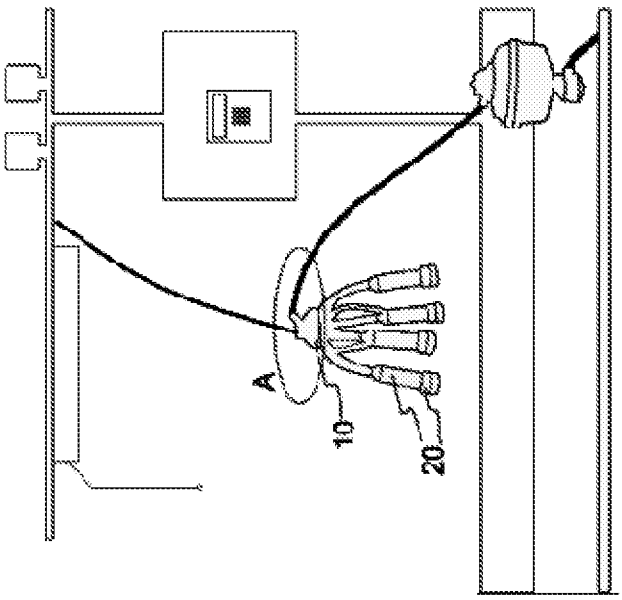


Figure 1

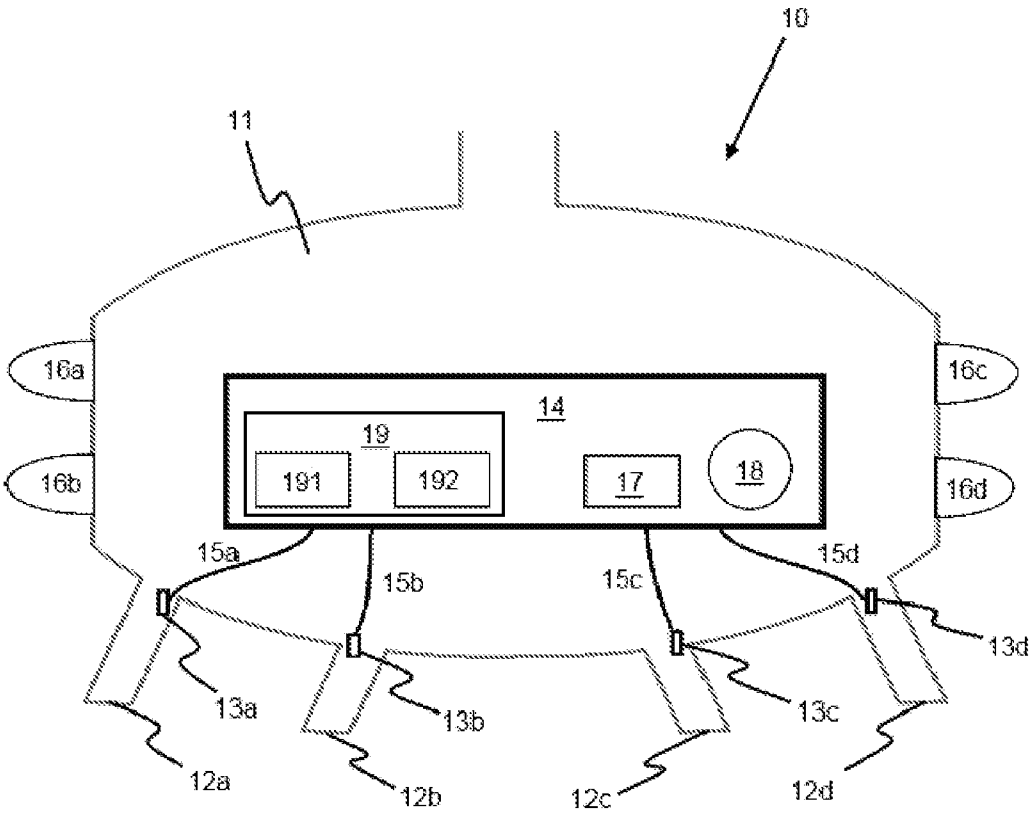

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Figure 3

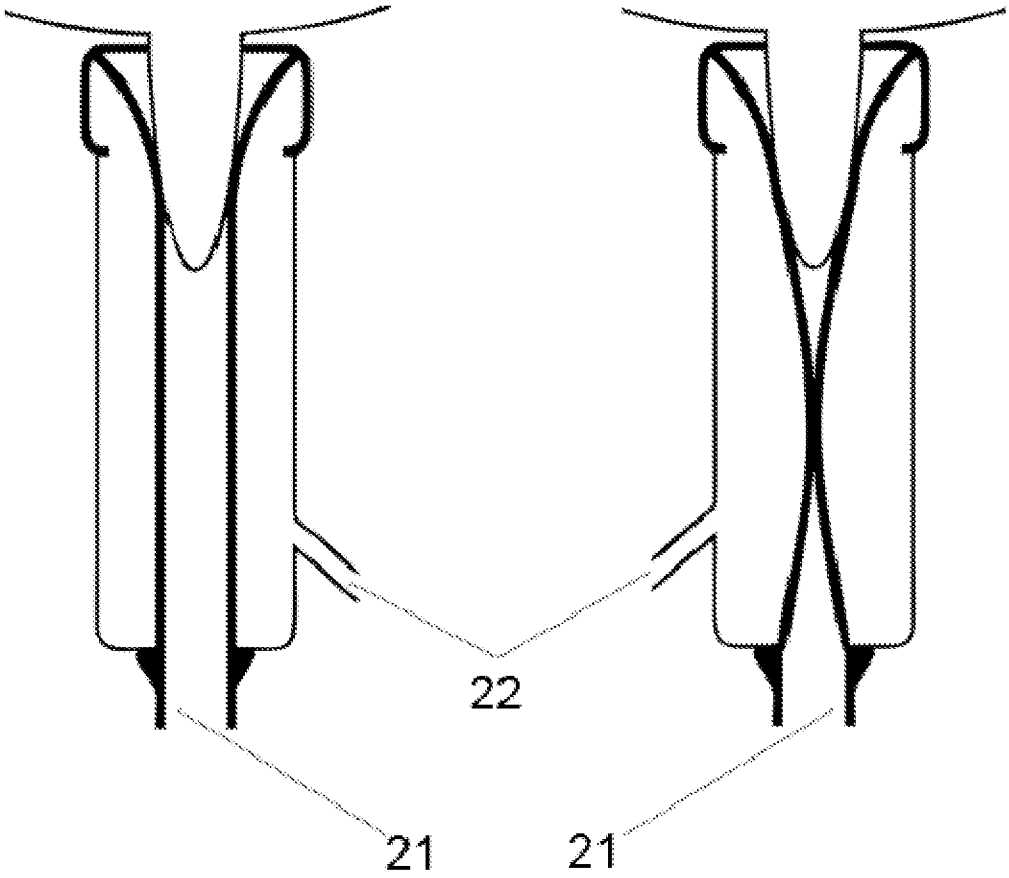

Figure 4

INTERNATIONAL SEARCH REPORT

International application No
PCT/TR2016/050059

A. CLASSIFICATION OF SUBJECT MATTER
INV. A01J5/007 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	WO 2008/069734 A1 (DELAVAL HOLDING AB [SE]; INNINGS LARS [SE]) 12 June 2008 (2008-06-12) page 13; figure 3	1-7
X	WO 2007/089185 A1 (DELAVAL HOLDING AB [SE]; SANDBERG OLA [SE]; OBERMUELLER HELMUT [SE]) 9 August 2007 (2007-08-09) page 7 - page 10; figure 1	1-7
A	US 6 378 455 B1 (POSTMA EBELE MARTEN [NL] ET AL) 30 April 2002 (2002-04-30) figure 1	1

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"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	Date of mailing of the international search report
2 June 2016	09/06/2016

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Moeremans, Benoit

1

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/TR2016/050059

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