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(54) **Title:** A MILKING SYSTEM AND A METHOD FOR PREVENTING DETACHMENT OF A TEAT CUP FROM A TEAT DURING A MILKING PROCESS

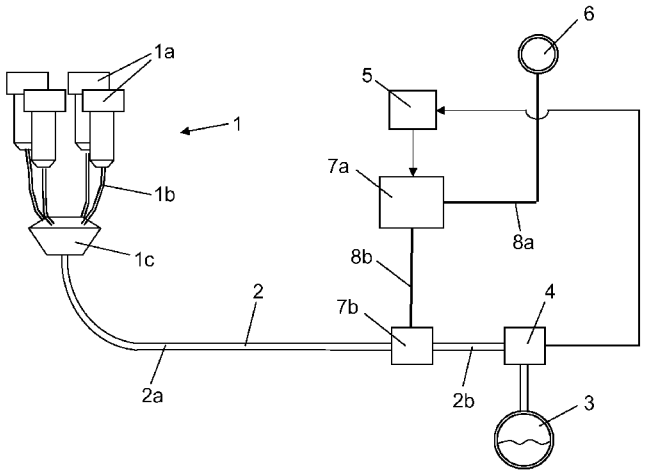


Fig 1

(57) **Abstract:** The invention relates to a milking system and a method for preventing detachment of a teat cup from a teat of an animal during a milking process. The milking system comprises a milk line (lb, lc, 2) connected to the teat cup (1 a), a vacuum system able to apply at least two different vacuum levels to the teat cup (la) and a measuring device (4) configured to measure the air flow in the milk line (1 b, 1 c, 2) during the milking process. The milking system comprises a control unit (5) configured to receive information about measured air flow values and to determine if the teat cup (la) is about to be detached from the teat by comparing the measured air flow values (q_a) with an acceptable value (q_{a1}, Aq_{a1}/At), if the measured air flow values are not acceptable, to control the vacuum system such that it applies a higher vacuum level to the teat cup (la) than the present vacuum level.

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A milking system and a method for preventing detachment of a teat cup from a teat during a milking process

THE BACKGROUND OF THE INVENTION AND PRIOR ART

The present invention relates to a milking system and a method for preventing detachment of a teat cup from a teat during a milking process, wherein the milking system comprises a milk line connected to the teat cup, a vacuum system able to apply at least two different vacuum levels to the teat cup and measuring device configured to measure the air flow in the milk line during the milking process.

During a milking process, vacuum is applied from a vacuum source to the teat cups in order to transport milk from the teat cups, via the milk line, to a storing device for milk. In order to transport the milk in the milk line, a small air flow needs to be created in the milk line. Usually, the teat cups or connected milk tubes comprise one or several small inlet openings or vents for ambient air ensuring such an air flow. A further object of the vacuum is to provide a suction force attaching the teat cups to the teats during a milking process. Such a connection between the teat cups and the teats is substantially air tight.

Undesired detachment of teat cups from the teats of an animal during a milking process is a problem. The teat cups may be detached for many reasons such as low vacuum in the teat cup, blocked air vents, restrictions in the short milk tubes, poor cluster alignment, worn milk tubes, uneven weight distribution in the cluster or be kicked off by the animals.

Thus, one reason for undesired teat cup detachment during a milking process is a low vacuum level in the teat cup. The vacuum level in the teat cups drops when the milk flow is high. Consequently, there is an increased risk for undesired detachment of teat cups during periods of the milking process

when the milk flow is high. Some individuals in a herd of milking animals are more productive than the other. For these individuals, it is an increased risk that the teat cups fall off due to high milk flow during a part of the milking process. In order to reduce this risk, it is known to use milking systems able to apply two different vacuum levels to the teat cups, one high vacuum level and a reduced vacuum level. The high vacuum level is only used when the milk flow is very high during a milking process. It is possible to use the reduced vacuum level during the whole milking process for most cows in a herd.

SUMMARY OF THE INVENTION

The object of the present invention is to decrease the risk for undesired detachment of a teat cup during a milking process of an animal.

This object is achieved with the initially mentioned milking system which comprises a control unit configured to receive information about measured air flow values and to determine if the teat cup is about to be detached from the teat by comparing the measured air flow values with an acceptable value and, if the measured air flow values deviate from the acceptable value, to control the vacuum system such that it applies a higher vacuum level to the teat cup than the present vacuum level. The acceptable value may define a range of a parameter or one or several specific characteristics which are to be fulfilled for determining if a teat cup is about to be detached from a teat or not in view of measured air flow values. If the acceptable value is not fulfilled , the higher vacuum level is applied for preventing detachment of the teat cup. If the vacuum level in a teat cup decreases for some reason, the suction force acting between the teat cup and the teat decreases. An air leakage into the teat cup may be the result and an increased air flow in the milk line. An increased air flow through the teat cup results in its turn in a further decreased vacuum. When the vacuum level in the teat

cup has decreased to a sufficient low level, the suction force between the teat cup and the teat is so low so that the teat cup falls off from the teat. Usually, this process occurs rapidly within some seconds. Consequently, the air flow in a teat cup and in a connected milk line is a very relevant parameter indicating when a teat cup is about to be detached. According to the invention, the control unit applies a higher vacuum level to the teat cup as soon as it receives information indicating that a teat cup is about to be detached. The higher vacuum level increases the suction force between the teat cup and the teat. The air leakage is reduced and the teat cup is prevented from coming loose from the teat.

According to an embodiment of the invention, the control unit is configured to compare if a measured air flow value is higher than an acceptable value in the form of a maximum allowable air flow value and, if this is the case, to control the vacuum system such that it applies a higher vacuum level to the teat cup than the present vacuum level. If the air flow in the teat cup increases to a value above a maximum allowable value, there is a great risk that teat cup is about to be detached from the teat. By applying a higher vacuum level to the teat cup, it is possible stop the increased air flow into the teat cup and prevent that the teat cup falls off.

According to an alternative embodiment of the invention, the control unit is configured to calculate a value of the air flow increase per unit time by means of measured flow values and if this calculated value is higher than an acceptable value in the form of a maximum allowable value of the air flow increase per unit time, to control the vacuum system such that it applies a higher vacuum level to the teat cup than the present vacuum level. If the air flow in a milk line suddenly increases to a high value, it is a clear indication of an air leak and that the teat cup is about to be detached from the teat. The maximum allowable value may be a predetermined value, where the risk that teat

cup is about to be detached from the teat is high. The applied higher vacuum to the teat cup may here stop the accelerating air flow into the teat cup and prevent that the teat cup falls off.

According to another preferred embodiment of the invention, the control unit is configured to continue to receive measured air flow values after a higher vacuum level has been applied to the teat cup and to determine if the teat cup is still about to be detached from the teat by means of the measured air flow values. In this case, it is possible to become aware if the applied higher vacuum to the teat cup stops air leakage into the teat cup or not. In case the air leakage into the teat cup increases further in spite of the applied higher vacuum level, a further higher vacuum level to the teat cup may be applied. In this case, more than two vacuum levels are used.

According to another preferred embodiment of the invention, the control unit is configured to determine, by means of the measured air flow values, when the teat cup no longer risks being detached from the teat. When the air flow in the milk line starts to drop or to decrease below a predetermined air flow value, the control unit may determine that the teat cup no longer is about to fall off. The control unit may be configured to control the vacuum system such that it restore the previous lower vacuum level to the teat cup when it determines that the risk is over. In this case, the milking process continues with the present applied vacuum level. Alternatively, the milking process continues with the higher vacuum level during the whole milking process.

According to another preferred embodiment of the invention, the measuring device comprises a milk meter measuring the milk flow in the milk line. Different kinds of milk meters are used in most milking system in order to control the milking process in view of the milk flow. The teat cups are, for example, detached

from the teats when the milk flow drops below a predetermined minimum value during a milking process.

According to a preferred embodiment of the invention, the milk meter also includes components for measuring the air flow in the milk line. Milk meters measuring both the milk flow and the air flow are available on the market. In this case, the measuring device does not need to comprise a separate air flow meter and a separate milk meter in the milk line.

According to a preferred embodiment of the invention, the control unit is configured to determine if the teat cup is about to be detached from the teat by means of measured air flow values and measured milk flow values. A high milk flow reduces the vacuum in the teat cup and increases the risk that the teat cup falls off. In this case, it is possible to consider both the air flow and the milk flow to determine if a teat cup is about to be detached. The invention is particularly suitable to apply in milking system already using two vacuum levels in order to prevent that teat cups fall off at high milk flow. In this case, only small changes have to be performed.

The above mentioned object is also achieved by the method defined in the claims 10-18.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention is now to be explained more closely by means of preferred embodiments, which are disclosed as examples, and with reference to the attached drawings.

Fig. 1 shows a milking system according to an embodiment of the invention,

Fig. 2 shows a graph illustrating the milk flow as a function of the time during a milking process and

Fig. 3 shows a block diagram of a method according to an embodiment of the invention.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS OF THE INVENTION

Fig. 1 shows a milking member 1 in the form of a cluster. The cluster comprises four teat cups 1a. The teat cups 1a are connected to a claw 1c by means of a respective short milk tube 1b. A milk line 2 is configured to transport milk from the claw 1c to a main milk line 3. The main milk line 3 may receives milk from a plurality of milking members 1. The main milk line 3 is connected to a vacuum source applying a high vacuum level, which may be of about 50 kPa, to the milk line 3. The milk is transported in the main milk line 3 by means of the vacuum source to a not shown milk storage device in the form of a milk tank or the like. A milk meter 4 is arranged in the milk line 2. The milk meter 4 is configured to measure the milk flow q_m in the milk line 2. The milk meter 4 is also able to measure the air flow q_a in the milk line 2.

A control unit 5 is configured to receive substantially continuously information from the milk meter 4 about the milk flow q_m and the air flow q_a in the milk conduit 2 during a milking process. The vacuum system comprises a vacuum line 6. The vacuum level in the vacuum line is a high vacuum level, which may be of about 50 kPa. Thus, the vacuum line 6 and the main milk line 3 have the same high vacuum level. A vacuum regulating valve 7a is connected to the vacuum line 6 via a first vacuum conduit 8a. A control valve 7b is arranged in the milk line 2. The control valve 7b is connected to the vacuum regulating valve 7a via a second vacuum conduit 8b. The milk line 2 comprises a first part 2a arranged upstream of the control valve 7b and a second part 2b arranged downstream of the control valve 7b with respect to the intended milk flow direction in the milk line 2. The control valve 7b has a design such it

provides the same vacuum level in the first part of the 2a of the milk line as in the second vacuum conduit 8b.

The vacuum regulating valve 7a is settable in at least two different regulating positions. The vacuum regulating valve 7a is settable in a high vacuum position in which it does not reduce the vacuum in the vacuum line 6 at all. Consequently, the high vacuum level in the vacuum line 6 is applied unchanged, via the first vacuum conduit 8a and the vacuum regulating valve 7a, to the second vacuum conduit 8b and to the control valve 7b. In this case, the control valve 7b does not reduce the vacuum level in the first part 2a of the milk line 2 in relation to the vacuum level in the second part 2b of the milk line 2 and the main milk line 3.

The vacuum regulating valve 7a is settable in at least one vacuum reducing position in relation to the high vacuum position. When the vacuum regulating valve 7a is in the vacuum reducing position, a low vacuum level, which may be about 42 kPa, in the second vacuum conduit 8b in relation to the high vacuum level of about 50 kPa. In this case, the control valve 7b reduces the vacuum level in the first part of the milk line 2a to the low vacuum level. Thereby, the vacuum level in the first part of the milk line 2a is lower than the vacuum level in the second part of the milk line 2b. The control unit 5 is able to set the vacuum regulating valve 7a in the high vacuum position and in the vacuum reducing position by means of information about measured air flow values q_a and milk flow values q_m from the milk meter 4 in the milk line 2.

During a milking process, vacuum is applied to the teat cups 1a. A first object of the vacuum in the teat cup 1a is to transport the milk from the teat cup 1, via the milk line 2, to the main milk line 3. A second object of the vacuum is to provide a substantially air tight connection between the teat cups 1a and the teats such that the teat cup 1a obtains an attachment to a teat by means of

a suction force. The vacuum level in the teat cups 1a during a milking process depends on, for example, the milk flow and air flow through the teat cup 1a. A high milk flow decreases the vacuum level in the teat cups 1a. A high air flow also decreases the vacuum level in the teat cups 1a. If the vacuum level in a teat cup 1a decreases, such as for example of an extremely high milk flow, the suction force between the teat cup 1a and the teat decreases. There is here a risk that air starts to leak into the teat cup 1a. An air leakage increases the air flow in the milk line 2 and the vacuum level in the teat cup 1a is further decreased. If the vacuum level in the teat cup 1a becomes too low, the teat cup 1a falls off from the teat. Usually, this process occurs rapidly within some seconds.

Fig. 2 shows how the air flow may vary with the time during a milking process. The teat cups 1a are attached to the teats of a cow at the time t_0. Initially, an increased air flow q_a may obtain in connection with the attachment of the teat cups 1a to the teats. When the teat cups 1a have been fixedly attached to the teats, a small relatively constant air flow q_a is sensed by the milk meter 4 in the milk line 2 during a large part of the milking process. The teat cup 1a or the short milk tubes 1b comprises one or several inlet openings for air in order to guarantee a relatively small air flow through the milk line 2 in order to ensure the transportation of milk. However, at the time t_1, the air flow q_a is suddenly increased. The air flow q_a is here increased to a higher value than a maximum allowable air flow q_{a1}. The control unit 5 determines, in view of received measured air flow values q_a from the milk meter 4, that one of the teat cups 1a is about to be detached from a teat. The control unit 5 sets the regulating valve 7a in the high vacuum position such that a higher vacuum level is applied to the teat cups 1a than the present vacuum level. The higher vacuum in the teat cups 1a results in an increased suction force between teat cups 1a and the teats. Usually, this measure reduces the air leakage into the teat cup 1a and the air flow q_a is relatively quickly decreased to the

preceding air flow level. Due to the quickly applied higher vacuum level to the teat cup 1a at the time t_1, the teat cup 1a was, in this case, prevented from being detached from the teat. The initially used vacuum level may be restored in the teat cups 1a as soon as the control unit 5 receives information indicating that air flow has been reduced to a normal flow level. During the following part of the milking process, a small relatively constant air flow q_a is sensed by the milk meter 4. The milking process is finished at the time t_2 and the teat cups are removed from the teats. A temporarily increased air flow q_a may occur when the teat cups 1a are removed from the teats.

Fig. 3 shows a block diagram illustrating a process and a method which may be performed by the use of the milking system in Fig. 1. The process starts, at 12, and a milking animal in the form of a cow enters a milking stall or the like provided with a milking member 1 of the milking system. The teat cups 1a are attached to the teats of the cow manually or by means of a milking robot. The control unit 5 receives substantially continuously information from the milk meter 4 about the milk flow q_m and the air flow q_a in the milk line 2. At 13, the control unit 5 compares measured milk flow values q_m with a maximum milk flow value q_{m1}. If the milk flow q_m is higher than a predetermined maximum milk flow value q_{m1}, the control unit 5 determines that there is a risk that the teat cups will be detached. The control unit 5 sets the vacuum reducing valve 7a in the high vacuum position such that a high vacuum level is applied to the teat cups 1a.

The process starts again at 12 and the control unit 5 receives again information of measured milk flow values q_m. At 13, the control unit 5 compares the measured milk flow values q_m with the maximum milk flow value q_{m1}. If the milk flow q_m now is lower than the predetermined maximum milk flow value $\mathbf{q_{m1}}$, the control unit 5 determines that there is no risk that the teat cups will be detached from the teats. Mostly, the control unit 5

determines, at 13, that the milk flow q_m is lower than the maximum allowable value q_{m1}. The control unit 5 sets the vacuum regulating valve 7a in the vacuum reducing position, at 15, and the control valve 7b provides a reduced vacuum level to the first part of the milk line 2a.

The milking process is continued at 16. The control unit 5 compares here measured air flow values q_a with a maximum allowable air flow q_{a1}. A too high air flow q_a in the milk line 2 indicates in air leakage into a teat cup 1a and that one of the teat cups 1a has started to detach from the teat. If the air flow q_a is lower than the maximum allowable air flow $\mathbf{q}_{a1}$, the control unity 5 determines that no teat cup 1 has started to detach from a teat. In this case, the process starts again, at 12. Alternatively or in combination, the control unit 5 may, at 16, calculate a value of the air flow increase per unit time $\Delta q_a/\Delta t$ and if this calculated value is higher than a maximum allowable such value $\Delta q_{a1}/\Delta t$, to control the vacuum system such that it applies a higher vacuum level to the teat cup 1a than the present vacuum level. The unit time Δt is, for example, less than one second.

If the control unit instead determines, at 16, that air flow q_a is higher than the maximum allowable air flow q_{a1}, at least one of the teat cups 1 seems to have started being detached from the teat. The air leakage from the surrounding to this teat cup 1a results in a sudden and rapid increase of the air flow in the milk line 2. Something has to be done in order to prevent that the teat cup 1a comes loose from the teat. The control unit 5 sets, at 17, the vacuum regulating valve 7a in the high vacuum position such that the control valve 7b applies the high vacuum level to the teat cups 1a. The suction force between the teat cups 1a and the teats increases. The air leakage between the teat cup 1a and the teat is reduced. The control unit 5 compares again, at 18, measured air flow q_a values with the maximum allowable air flow q_{a1}. If the measured air flow q_a now is lower than the maximum allowable air flow q_{a1}, the control unit 5

determines that the teat cups 1 will not come loose from the teat. The process starts again at 12.

If the air flow q_a is still higher than the maximum allowable air flow q_{a1}, the applied high vacuum has not reduced the air flow q_a to a lower value than the maximum allowable air flow value q_{a1}. The control unit 5 compares, at 19, measured milk flow q_m values with a minimum allowable milk flow q_{m1}. A too low milk flow indicates that at least one of the teat cups 1a have been detached from a teat. If the milk flow q_m is higher than the minimum allowable milk flow q_{m1}, the control unit 5 determines that the milk line 2 still receives milk from all teat cups 1a. Thus, none of the teat cups 1 have fallen off yet. The process continues, at 17, with an unchanged high vacuum. If instead the milk flow q_m is lower than the minimum allowable air flow $\mathbf{q_{m1}}$, the control unit 5 determines that one of the teat cups has been detached from a teat. In this case, it is possible to stop the milking process at 20.

The invention is not restricted to the described embodiments of the invention but may be varied freely within the scope of the claims. In the above mentioned embodiments, a milk line receives milk from four teat cups. It is of course possible to use one milk line for each teat cup and measure the air flow and the milk flow from each teat cup separately by means of a separate milk meter 4.

Claims

1. A milking system for preventing detachment of a teat cup from a teat of an animal during a milking process, wherein the milking system comprises a milk line (1b, 1c, 2) connected to the teat cup (1a), a vacuum system able to apply at least two different vacuum levels to the teat cup (1a) and a measuring device (4) configured to measure the air flow in the milk line (1b, 1c, 2) during the milking process, characterised in that the milking system comprises a control unit (5) configured to receive information about measured air flow values and to determine if the teat cup (1a) is about to be detached from the teat by comparing the measured air flow values (q_a) with an acceptable value (q_a, Δq_{a1}/At), and if the measured air flow values deviate from the acceptable value (q_a, Δq_{a1}/At), to control the vacuum system such that it applies a higher vacuum level to the teat cup (1a) than the present vacuum level.

2. A milking system according to claim 1, characterised in that the control unit (5) is configured to compare if measured air flow (q_a) values is higher than an acceptable value in the form of a maximum allowable air flow (q_{a1}) value and, if this is the case, to control the vacuum system such that it applies a higher vacuum level to the teat cup (1a) than the present vacuum level.

3. A milking system according to claim 1 or 2, characterised in that the control unit (5) is configured to calculate a value of the air flow increase per unit time (Aq_a/At) by means of measured flow values and if this calculated value (Aq_a/At) is higher than an acceptable value in the form of a maximum allowable value of the air flow increase per unit time (Aq_{a1}/At), to control the vacuum system such that it applies a higher vacuum level to the teat cup (1a) than the present vacuum level.

4. A milking system according to any one of the preceding claims, characterised in that the control unit (5) is configured to

continue to receive measured air flow values after a higher vacuum level has been applied to the teat cup (1a) and to determine if the teat cup (1a) is still about to be detached from the teat (1a) by means of the measured air flow values (q_a).

5. A milking system according to claim 4, characterised in that control unit (5) is configured to determine by means of measured air flow values (q_a) when the teat cup (1a) no longer risks being detached from the teat (1a).

6. A milking system according to claim 5, characterised in that control unit (5) is configured to control the vacuum system such that it restore the previous lower vacuum level to the teat cup (1a) when it determines that the teat cup (1a) no longer risks being detached from the teat (1a).

7. A milking system according to any one of the preceding claims, characterised in that the measuring device comprises a milk meter (4) measuring the milk flow (q_m) in the milk line (1a, 1b, 2).

8. A milking system according to claim 7, characterised in that the milk meter (4) also includes components measuring the air flow (q_m) in the milk line (1a, 1b, 2).

9. A milking system according to claim 7 or 8, characterised in that the control unit (5) is configured to determine if the teat cup (1a) is about to be detached from the teat by means of measured air flow values (q_a) and measured milk flow values (q_m).

10. A method for preventing detachment of a teat cup from a teat during a milking process performed by a milking system, wherein the milking system comprises a milk line (1b, 1c, 2) connected to the teat cup (1a), a vacuum system able to apply at least two different vacuum levels to the teat cup (1a) and a

measuring device (4) configured to measure the air flow in the milk line (1b, 1c, 2) during the milking process, characterised by the steps of receiving information about measured air flow values, determining if the teat cup (1a) is about to be detached from the teat by comparing the measured air flow values (q_a) with an acceptable value (q_a, Aq_ai/At), and, if the measured flow air values deviate from the acceptable value (q_a, Δq_{a1}/At), controlling the vacuum system such that it applies a higher vacuum level to the teat cup (1a) than the present vacuum level.

11. A method according to claim 10, characterised by that the step of comparing if a measured air flow value (q_a) is higher than an acceptable value in the form of a maximum allowable air flow value (q_{a1}), and, if this is the case, determining that the teat cup (1a) is about to be detached from the teat (1a).

12. A method according to claim 10 or 11, characterised by the step of calculating a value of the air flow increase per unit time (Aq_a/At) by means of measured flow values and if this calculated value (Aq_a/At) is higher than an acceptable value in the form of a maximum allowable value (Aq_{a1}/At), determining that the teat cup (1a) is about to be detached from the teat (1a).

13. A method according to any one of the preceding claims 10 to 12, characterised by the step of continuing to receive measured air flow values after a higher vacuum level has been applied to the teat cup (1a) and determining if the teat cup (1a) is still about to be detached from the teat (1a) by means of the measured air flow values (q_a).

14. A method according to claim 13, characterised by the step of determining by means of measured air flow values (q_a) when the teat cup (1a) no longer risks being detached from the teat (1a).

15. A method according to claim 14, characterised by the step of controlling the vacuum system such that it restore the previous

lower vacuum level to the teat cup (1a) when the teat cup (1a) no longer risks being detached from the teat (1a).

16. A method according to any one of the preceding claims 10 to 15, characterised by the step of measuring the milk flow (q_m) in the milk line (1a, 1b, 2).

17. A method according to claim 16, characterised by the step of measuring the air flow (q_m) and the milk flow (q_m) by the same meter.

18. A method according to claim 16 or 17, characterised by the step of determining if the teat cup (1a) is about to be detached from the teat by means of the measured air flow values (q_a) and measured milk flow values (q_m).

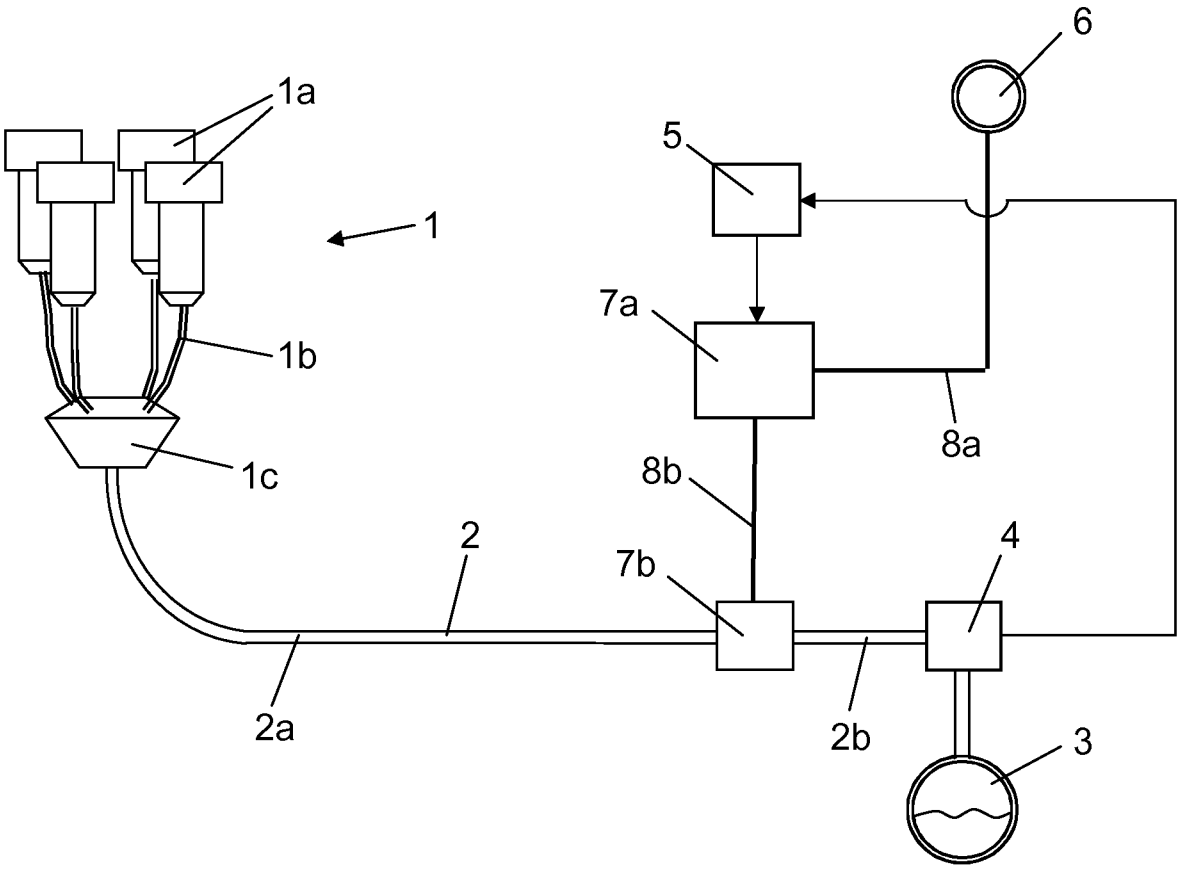


Fig 1

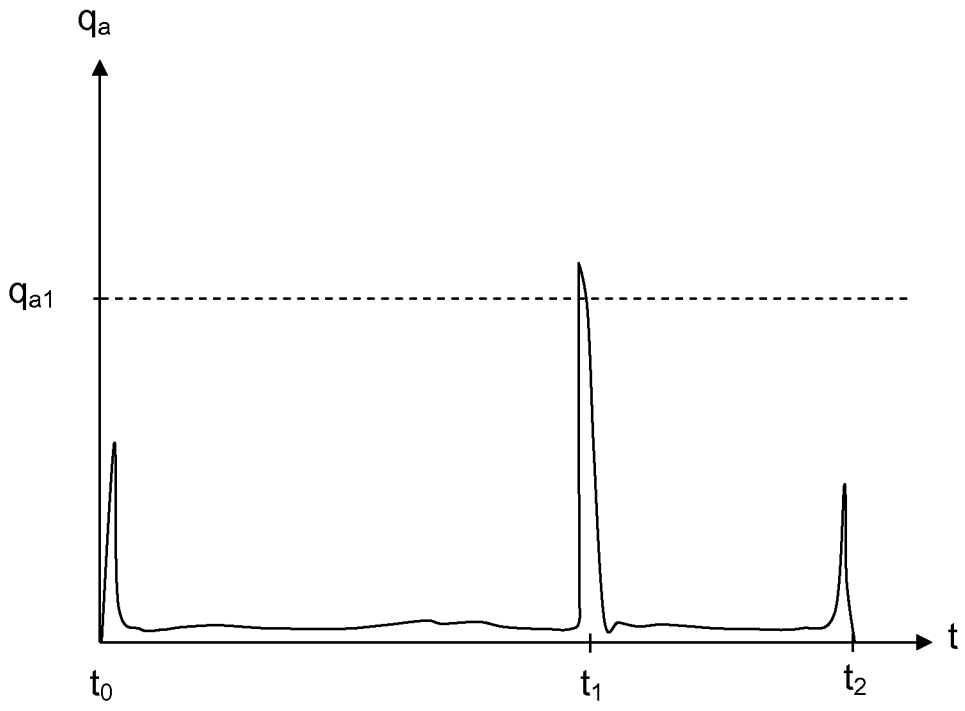


Fig 2

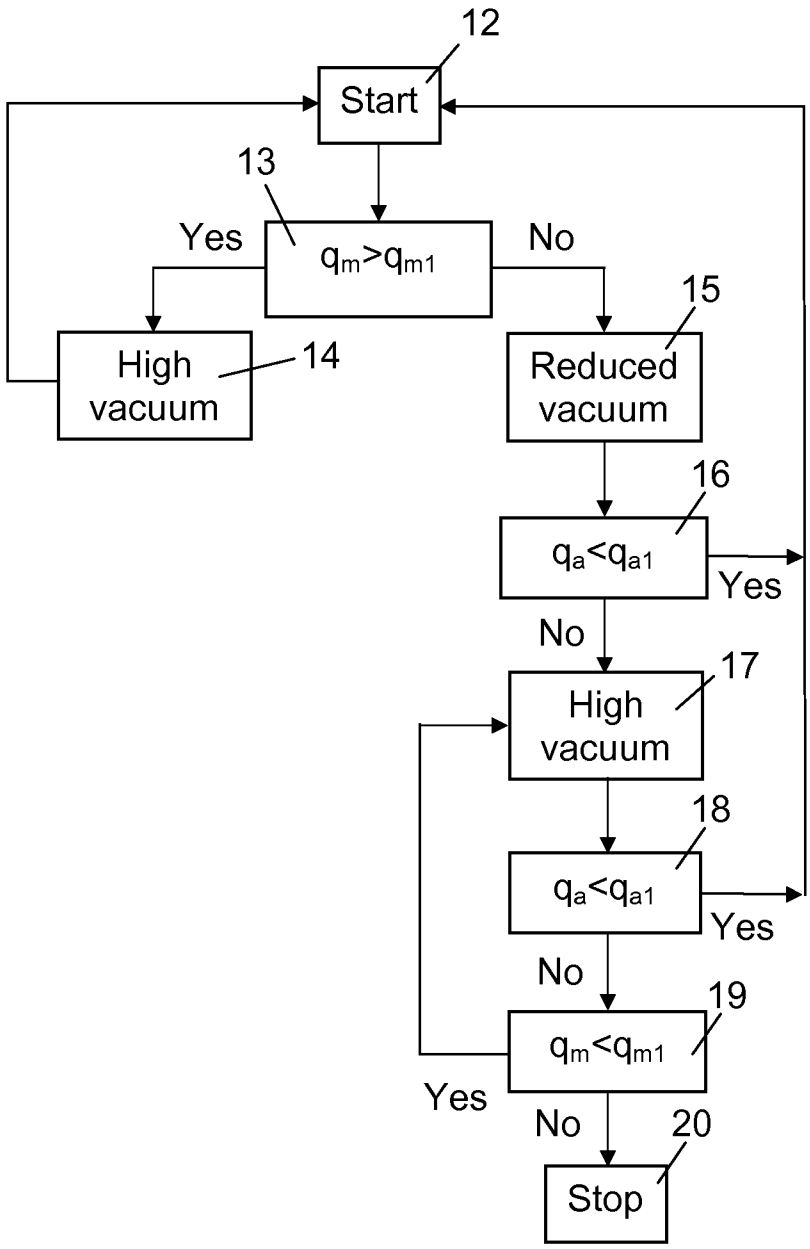

12
Start
13
Yes
$q_m > q_{m1}$
No
15
High vacuum
14
Reduced vacuum
16
$q_a < q_{a1}$
Yes
No
17
High vacuum
18
$q_a < q_{a1}$
Yes
No
19
$q_m < q_{m1}$
Yes
No
20
Stop

Fig 3

INTERNATIONAL SEARCH REPORT

International application No
PCT/SE2012/051398

A. CLASSIFICATION OF SUBJECT MATTER
INV. A01J5/007 A01J5/01
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 01/17335 Al (DELAVAL HOLDING AB [SE] ; R0E0ES ELIN [SE] ; WAEPPLING MARIA [SE]) 15 March 2001 (2001-03-15)	1-7 , 10-16
Y	page 1 - page 14; f i gures 1-4	8,9 , 17 , 18

Y	US 5 080 040 A (VAN DER LELY EDWIN [NL] ET AL) 14 January 1992 (1992-01-14) col umn 8; f i gure 2	8,9 , 17 , 18

	-/- ·	

[X] Further documents are listed in the continuation of Box C.

[X] 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

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"P" document published prior to the international filing date but later than the priority date claimed

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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
22 Apri l 2013	03/05/2013

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 , Benoi t

1

Form PCT/ISA/210 (second sheet) (April 2005)

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/SE2012/051398

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