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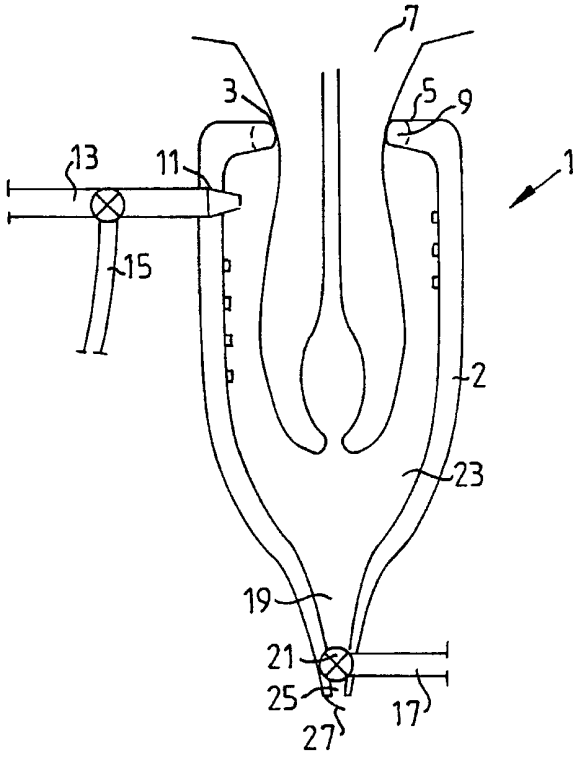
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[Continued on next page]

(54) Title: METHOD FOR CLEANING TEATS OF AN ANIMAL



(57) Abstract: The present invention relates to a method for cleaning teats of an animal with a teat cleaning device (1) having a teat cup (2) for accommodating a teat (7) during a cleaning process. The cleaning device (1) also comprises cleaning means arranged for cleaning said teat by a cleaning fluid flow ejected from a nozzle (11) and by vacuum-supplying means (17) providing said teat cup (2) with an under-pressure during the cleaning process. The method includes determining said animal's ability to accept being exposed to a default cleaning process and adapting said cleaning process in dependence of said ability.

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Published:

— *With international search report.*

— *With amended claims.*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

Method for cleaning teats of an animal

TECHNICAL FIELD OF THE INVENTION

The present invention relates to a method for cleaning a teat of an animal with a teat cleaning device having teat receiving means for accommodating a teat during a cleaning process and cleaning means arranged for cleaning said teat.

The invention also relates to an apparatus for carrying out the method.

Finally, the invention also relates to an automated milking system comprising the apparatus.

BACKGROUND OF THE INVENTION

When dairy animals are to be milked it is necessary to first clean the teats of the animal to avoid dirt present on the teats contaminating the collected milk.

Teat cleaning may nowadays be performed automatically, utilising robot systems performing teat cleaning and other animal related processes, such as milking, with no or little human intervention.

These robot systems and their associated features, such as milking- and cleaning means, may be regarded as unpleasant to sensitive animals being exposed to, particularly if the animal has no or little experience of what the animal related process implies.

Other animals may suffer from an increased sensibility due to a malady or an injury in the udder or in a teat, thereby experiencing discomfort during a cleaning process, if no consideration is taken to this disability.

Accordingly, when an animal is exposed to a cleaning process, where no consideration is taken to its demands of comfort or its ability to accept the cleaning process, it may has difficulties to accustom to the cleaning process and may therefor react with e.g. insecurity or anxiety. Thus, if no special actions are taken for solving these problems, the animal may experience discomfort or dissatisfaction during the cleaning process. Further problems to accomplish the intended cleaning process may also arise, e.g. the animal may get scared when it is exposed to the process, and hence refusing to accomplish it, or starts mooing thereby worrying other animals, or even worse starts kicking, and thereby increasing the risks for damages, both to itself but also by damaging equipment close at hand.

Consequently, it is of general interest to avoid these kinds of situations, where the above mentioned problems may arise. Instead the animal should accept the cleaning process, feel confident with it, and carry it through on a voluntary basis. It is also desirable that the animal is given a possibility to accustom to the cleaning process without force of any kind with respect to the needs of the animal.

A method for cleaning a teat with a teat cleaning device is disclosed in SE 9704515-7, in which a teat is cleaned by being inserted into a teat cup and sprayed by high speed cleaning fluid ejected from a nozzle. However, no respect is taken if the animal, being exposed to the cleaning process, suffers from discomfort.

OBJECT OF THE INVENTION

The object of the present invention is to cause animals, such as cows, to accept and accustom to a cleaning process without suffering from discomfort, particularly when the animals is unfamiliar with what the cleaning process implies.

SUMMARY OF THE INVENTION

This object is obtained by a method, as initially defined, which is characterised by the steps of:

- determining said animal's ability to accept being exposed to a default cleaning process; and

- adapting said cleaning process in dependence of said ability.

By said method, is achieved a possibility to adapt the cleaning intensity on the basis of the needs of an individual animal to be cleaned.

Preferably, said adapted cleaning process is less intensive than said default cleaning process. Consequently, the animal may more easily accept the cleaning process.

Suitably, said adapted cleaning process includes cleaning the teat by means of a cleaning fluid flow which is less intensive than a default cleaning fluid flow. In this way a more gentle rinsing is realized.

Suitably, said adapted cleaning process includes cleaning the teat by means of vacuum-supplying means providing said teat receiving means with an under-pressure which is less intensive than a default under-pressure. Hereby a more gentle cleaning action is achieved.

The adapted cleaning process may also include cleaning the teat by means of rotating brushes having a speed of rotation which is less intensive than a default speed of rotation. In this way a gentle mechanical cleaning of the teat is realized.

Preferably, said adapted cleaning process is applied for a predetermined number of coming subsequent cleaning processes before a default cleaning process is taken into practise. In this way an animal with no or little experience of a cleaning process may more easily accustom to the cleaning process.

Suitably, said adapted cleaning process is successively intensified, in subsequent cleaning processes, until a cleaning intensity corresponding to said default cleaning process is achieved. Hereby is realised a transitory stage between an adapted cleaning process and a default cleaning process which the animal more easily will accept and accustom to.

According to another aspect of the invention there is provided an apparatus for cleaning said teat, characterised by:
- means for determining said animal's ability to accept being exposed to a default cleaning process; and
- means for adapting said cleaning process in dependence of said ability.

DRAWING SUMMARY

Preferred embodiments of the present invention will now be described with reference to the appended drawings in which:

fig. 1 is a cross-sectional view of a first embodiment of a cleaning device, where a method according to the invention may be implemented;

fig. 2 is a cross-sectional view of a second embodiment of a cleaning device, where a method according to the invention may be implemented; and

fig. 3 illustrates schematically a flowchart of a method according to the present invention.

DETAILED DESCRIPTION

Figures 1 and 2 show two embodiments of a device intended for cleaning and pre-milking an animal, where the method according to the present invention may be implemented. The invention is not limited to the use of these devices, but is also conceivable to adopt to other devices featured in a similar manner. Consequently, the devices themselves do not depict any inventive features, but serve just as an example in which the inventive method may be adopted.

Referring to figure 1, a first embodiment of a teat cleaning and pre-milking device 1 is shown, comprising a teat receiving means in the shape of an approximately cylindrical teatcup 2 with a teat receiving opening 3 in its upper end surface 5. Teatcup is intended to be placed under the udder of an animal to be milked with opening 3 below a teat 7 which is to be cleaned. Teatcup 2 is then raised so that teat 7 enters through opening 3. Opening 3 has sealing means 9 in the shape of a resilient sealing collar 9 which is in substantially airtight sealing contact with the udder when teat 7 is fully inserted into teatcup 2. Teatcup 1 has cleaning means 11 in the form of at least one approximately tangential inlet nozzle 11 near to the upper surface 5. A cleaning fluid supplying means 13 in the form of a hose 13 is connected to a cleaning fluid supply (not shown). A vacuum supplying means 17 in the form of a non-collapsible pipe 17, connected to a vacuum supply (not shown), is connected to an outlet opening 19 in the base of teatcup 1 via a valve means 21.

A teat is cleaned by being inserted into teatcup 2 and sprayed by high speed cleaning fluid ejected from nozzle 11. The impact of the fluid on a circular inner wall 23 of the teatcup 2 produces vortices which clean the teat due to their turbulent motion. This turbulent motion, and consequential cleaning effect, can be increased and adjusted, for example, by pulsating and/or varying the intensity of the fluid flow, injecting air into the fluid flow and applying a vacuum to the teatcup. The cleaning

fluid leaves the teat cup 2 via outlet opening 19 which has an outlet 25 with a non-return valve 27 which permits the cleaning water to drain away either to a sewage system or to a storage system for possible examination and recycling. Preferably the draining of the cleaning fluid from the teat cup 2 is assisted by a vacuum (not shown) applied to the outlet 25. Using a vacuum causes the teat to expand which cracks and loosens any dried-on matter on the teat. This makes it easier to remove the dried-on matter during the cleaning process.

Referring to figure 2, a second embodiment of a teat cleaning and pre-milking device 30 is shown, comprising a teat receiving means in the shape of a box-like holder 32 with a teat receiving opening 34 in its upper end surface 36. Holder 32 is intended to be placed under the udder of an animal to be milked with opening 34 below a teat 38 which is about to be cleaned. Holder 32 is then raised so that teat 38 enters the holder through opening 34. Opening 34 has sealing means 40 in the shape of a resilient sealing rubber or plastic collar 40 which is in contact with the udder when teat 38 is fully inserted into holder 32. Holder 32 contains a plurality of cleaning means 42 shown here as elongated cylindrical brushes 44 with bristles 46. Holder 32 also contains cleaning fluid supplying means 48 in the form of a hose 48 connected to a cleaning fluid supply (not shown), and vacuum supplying means 52 in the form of a non-collapsible pipe 52 connected to a vacuum supply (not shown). Vacuum supplying pipe 52 is connected to an outlet opening 54 in the base of holder 32 via a valve means 56. Brushes 44 are each orientated with their longitudinal axis substantially perpendicular to the plane of upper surface 36 and are arranged in a circle with a central space 58 able to receive a teat. Brushes 44 are rotatably mounted on holder 32 and can be rotated by driving means 60.

A teat 38 is cleaned by first being fully inserted into holder 32 and then being brushed by rotating brushes 44 preferably while cleaning fluid is supplied through cleaning supplying means 48. Cleaning fluid can be supplied as a pulsating stream to improve the cleaning effect. The cleaning fluid leaves the holder via outlet open-

ing 54 which has an outlet 62 with a non-return valve 64 which permits the cleaning water to drain away either to a sewage system or to a storage system for possible examination and recycling. Preferably the draining of the cleaning fluid is assisted by a vacuum (not shown) applied to the outlet 62.

Now referring to figure 3, showing a schematic flowchart of a method according to the invention. Before a cleaning process can commence the method according to the invention requires that an animal is identified. The reason for the identification is to reveal information concerning the ability of the animal to accept being exposed to a normal or default cleaning process, for enabling an adaptation of the cleaning intensity to an individual animal, and for achieving an improved cleaning process.

It should be noted that the expression cleaning process refers to an occurrence, performed before every milking process, for cleaning the teat of an animal. The expression default cleaning process refers to a cleaning process having a cleaning intensity generally applied, and the expression adapted cleaning process refers to a cleaning process having a cleaning intensity departing from the cleaning intensity of a default cleaning process and which is adapted with respect to the animal to be cleaned.

The identification may be accomplished in any known manner, both manual and automatic identification are conceivable. This matter is not restricted by the method according to the invention, the main thing is that any for the purpose interesting and relevant animal related information is revealed. Clearly, the identification may be as simple as a recognition by a farmer, who is familiar with the animal and also is conscious of the habits and manners of the animal to be cleaned, or it can be performed automatically by means of any suitable prior art solutions, e.g. a transponder connected to an animal and a transponder reader attached to a surrounding stall.

This animal related information may be stored in a controlling unit (not shown), connected to the identifying means and controlling the cleaning process, but a separate storage means (not shown) is also conceivable.

Information revealed during this identification step may be the number of times the animal has been subjected to a cleaning process and applied cleaning intensities during these earlier cleaning processes, state of health of the animal, occurred problems during earlier cleaning processes, i.e. all relevant matter and parameters that may affect the ability of the animal to accept the cleaning process.

The revealed information is interpreted and treated by the controlling unit, which by means of pre-recorded algorithms and/or programs deals with the information in a suitable manner. The information revealed may also be displayed on a screen, and work as a base of decision for a farmer to take suitable further manual measures (not shown).

With knowledge of this animal related information the controlling unit or the farmer can adapt cleaning settings, defining the cleaning intensity, on the basis of the revealed information, and determine whether default cleaning settings D, defining a default cleaning intensity of the cleaning process, should apply, or if adapted cleaning settings E, defining an adapted cleaning intensity of the cleaning process, should apply instead.

If the animal is considered as having ability to accept a normal cleaning intensity, the default cleaning settings D can apply, and the cleaning process may commence and will be performed as earlier described. These default cleaning settings D refer to e.g. the intensity D1 of the cleaning fluid flow and the amount of applied vacuum D2 to the teat cup. These default cleaning settings D may differ between different animal breeds, and they are basically empirically derived and acquired by experience, which during practice has shown a sufficiently satisfactory cleaning effect.

However, if the animal is considered as not having ability to accept a normal cleaning intensity, i.e. the animal has not been subjected to this kind of cleaning process before, or it has, but does not feel comfortable with the cleaning process yet, or the animal suffers from e.g. an infection in the udder, causing the teats to feel sore, a default cleaning intensity can not apply. Accordingly, the default cleaning settings D, defining the default cleaning action, have to be rejected and instead adapted cleaning settings E, defining an adapted cleaning intensity should apply.

The adapted cleaning settings E refer, just like the default cleaning settings D to e.g. the intensity E1 of the cleaning fluid flow and the amount of applied vacuum E2 to the teat cup. These adapted cleaning settings E may also differ between different animal breeds but may also be animal dependent, thereby varying between different individuals of animals.

The settings E may be empirically derived and acquired by experience, which during practice has shown that some animals with less ability to accept a default cleaning intensity, using default cleaning settings D, instead accept an individually adapted cleaning intensity using settings E. It is also conceivable that the adapted cleaning settings E are determined in terms of percentage of the default cleaning settings, e.g. E = D·25 %, E = D·50 % or E = D·75 % etc.

However, it is important mentioning the fact that at least a minimum under-pressure and intensity of the cleaning fluid flow is applied, i.e. providing the teat cup with enough under-pressure for retaining against the udder and for providing a minimum sufficient cleaning action of the teat.

The adaptation in accordance with the inventive method is proceeded by applying an individually adapted intensity E1 of the cleaning fluid flow into the teat cup 2, which is less than the default intensity D1 of the cleaning fluid flow, when the

cleaning process commences. Without any further actions, and if provided under-pressure in the teat cup corresponds to the default setting D2, this would imply an increased under-pressure in the teat cup, since the intensity of the cleaning fluid flow has decreased. Accordingly, the provided under-pressure is adapted to E2, which is less than D2, for balancing the increase in under-pressure. Advantageously, there is a dependency between the intensity of the cleaning fluid flow and the provided under-pressure so that the balancing is achieved automatically when an adaptation is made.

If the teat receiving means comprises cleaning means in the shape of rotating brushes 44 arranged for cleaning the teats during the cleaning process, the animal may experience discomfort if a normal default speed D3 of rotation of the rotating brushes applies, if the animal has a less ability to accept the cleaning process. Consequently, the speed of rotation of the rotating brushes has to be altered from the default speed D3 of rotation to the adapted speed E3 of rotation, where E3 is less than D3, in accordance with the inventive method.

The actions, discussed above, could affect the cleaning result negatively, but it is conceivable and perhaps also a requirement to extend the time the cleaning is in progress. The time the cleaning is in progress may be determined for example by experiment, but also by means of detecting means (not shown) detecting, e.g. presence of dirt in the cleaning fluid.

When the cleaning process is considered as complete the settings D or E of the present cleaning process may be stored in the storage means or said controlling means which contains the other animal related information. It is important that this storage means is updated continuously, so that a desired and relevant cleaning action is achieved next time this information is revealed.

It is important to accentuate the fact that for animals, considered as not yet experienced, the above mentioned adapted cleaning settings E are just thought to be used during a transitory stage or an accustoming period, not permanently and as soon as the animals are considered as experienced, the default cleaning settings D mentioned above will apply in coming cleaning processes.

To this end, adapted cleaning settings E could apply for a predetermined number of subsequent cleaning processes, e.g. the first five or ten times the animal is subjected to the cleaning process. After theses five to ten times the animal could possibly be considered as fully accustomed, and default settings D could apply in future subsequent cleaning processes.

The cleaning intensity could also be incrementally intensified in subsequent cleaning processes until the default cleaning intensity is achieved, where the size of the incremental increase may vary between animal individuals.

It is also conceivable that, during a cleaning process, increase the cleaning intensity for example, linearly increasing the cleaning intensity from zero, at the beginning of the cleaning process, to a suitable cleaning intensity, e.g. $E = D \cdot 75\ \%$, at the completion of the cleaning process. Accordingly, an enhanced acceptance of the cleaning process may be achieved.

CLAIMS

1. Method for cleaning a teat of an animal with a teat cleaning device (1; 30) having teat receiving means (2; 32) for accommodating a teat during a cleaning process and cleaning means (11; 42) arranged for cleaning said teat, **characterised** by the steps of:
   - determining said animal's ability to accept being exposed to a default cleaning process; and
   - adapting said cleaning process in dependence of said ability.

2. Method according to claim 1, **characterised** in that said adapted cleaning process is less intensive than said default cleaning process.

3. Method according to claim 2, **characterised** by cleaning the teat by means of a cleaning fluid flow which is less intensive than a default cleaning fluid flow.

4. Method according to claim 3, **characterised** by cleaning the teat by means of vacuum-supplying means (17) providing said teat receiving means (2) with an under-pressure which is less intensive than a default under-pressure.

5. Method according to claim 2-4, **characterised** by cleaning the teat by means of rotating brushes (42) having a speed of rotation which is less intensive than a default speed of rotation.

6. Method according to any of the previous claims, **characterised** by applying said adapted cleaning process for a predetermined number of subsequent cleaning processes.

7. Method according to claim 6, **characterised** by successively intensifying said cleaning intensity, in subsequent cleaning processes, until a cleaning intensity

corresponding to said default cleaning process is achieved.

8. Apparatus for cleaning a teat of an animal with a teat cleaning device (1; 30) having teat receiving means (2; 32) for accommodating a teat during a cleaning process and cleaning means (11; 42) arranged for cleaning said teat, **characterised** by:

- means for determining said animal's ability to accept being exposed to a default cleaning process; and
- means for adapting said cleaning process in dependence of said ability.

9. Automated milking system comprising an apparatus according to claim 8.

AMENDED CLAIMS

[received by the International Bureau on 10 November 2000 (10.11.00);
original claims 1 – 9 replaced by new claims 1 – 7 (2 pages)]

1. Method in an automatic milking system for cleaning a teat of an animal with a teat cleaning device (1; 30) having teat receiving means (2; 32) for accommodating a teat during a cleaning process and cleaning means (11; 42) arranged for cleaning said teat, **characterised** by the steps of:
   - determining said animal's ability to accept being exposed to a default cleaning process;
   - adapting said cleaning process in dependence of said ability, and
   - applying said adapted cleaning process for a number of subsequent cleaning processes.

2. Method according to claim 1, **characterised** in that said adapted cleaning process is less intensive than said default cleaning process.

3. Method according to claim 2, **characterised** by cleaning the teat by means of a cleaning fluid flow which is less intensive than a default cleaning fluid flow.

4. Method according to claim 3, **characterised** by cleaning the teat by means of vacuum-supplying means (17) providing said teat receiving means (2) with an under-pressure which is less intensive than a default under-pressure.

5. Method according to claim 2-4, **characterised** by cleaning the teat by means of rotating brushes (42) having a speed of rotation which is less intensive than a default speed of rotation.

6. Method according to any of the previous claims, **characterised** by successively intensifying said cleaning intensity, in subsequent cleaning processes, until a cleaning intensity corresponding to said default cleaning process is achieved.

7. Apparatus in an automatic milking system for cleaning a teat of an animal with a teat cleaning device (1; 30) having teat receiving means (2; 32) for accommodating a teat during a cleaning process and cleaning means (11; 42) arranged for cleaning said teat, **characterised** by:

- means for determining said animal's ability to accept being exposed to a default cleaning process; and

- means for adapting said cleaning process in dependence of said ability, and for applying said adapted cleaning process for a number of subsequent cleaning processes.

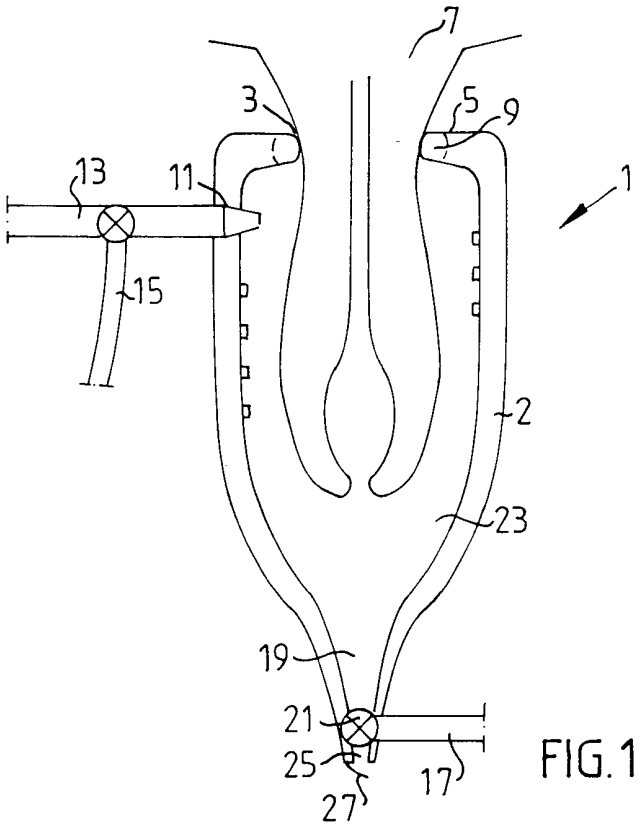

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FIG.1

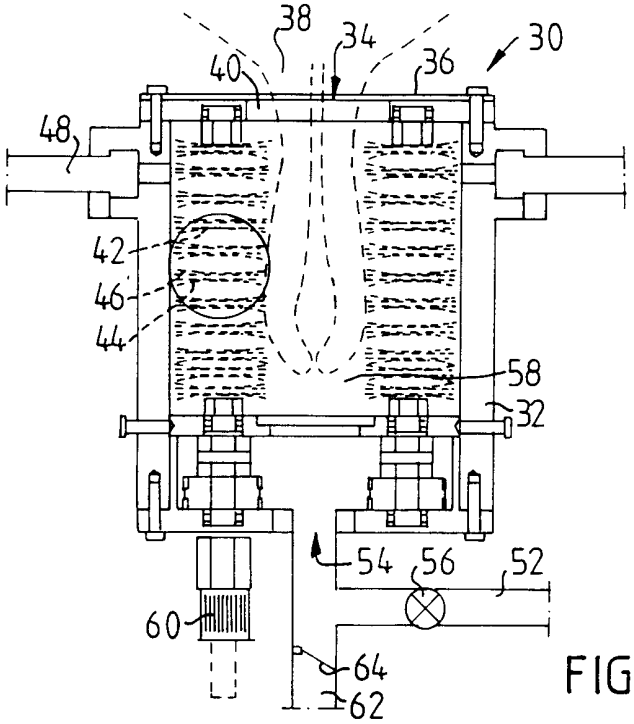

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FIG. 2

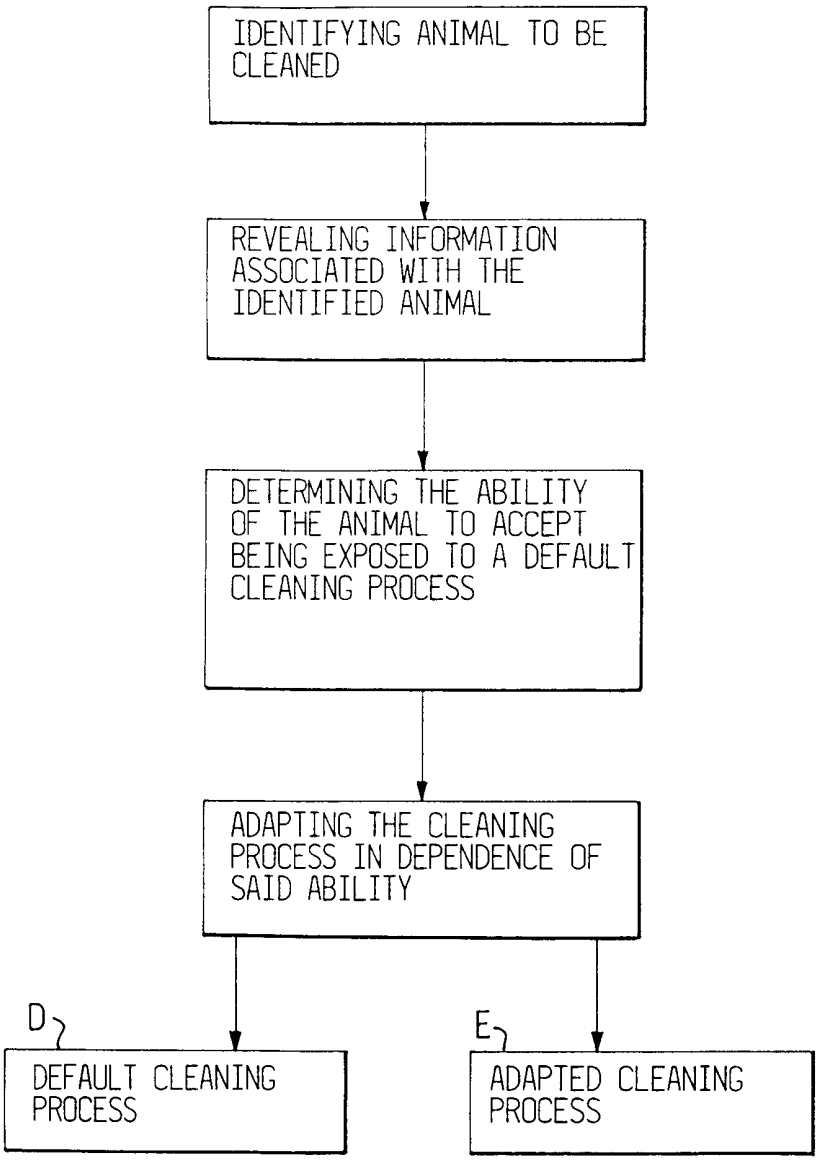

IDENTIFYING ANIMAL TO BE CLEANED
REVEALING INFORMATION ASSOCIATED WITH THE IDENTIFIED ANIMAL
DETERMINING THE ABILITY OF THE ANIMAL TO ACCEPT BEING EXPOSED TO A DEFAULT CLEANING PROCESS
ADAPTING THE CLEANING PROCESS IN DEPENDENCE OF SAID ABILITY
D
DEFAULT CLEANING PROCESS
E
ADAPTED CLEANING PROCESS

FIG.3

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE 00/01205

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: A01J 7/04 // A01J 5/017
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)

IPC7: A01J

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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A		
A		
A		

[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
"E" erlier document 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
25 Sept 2000	28 -09- 2000
Name and mailing address of the ISA Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. +46 8 666 02 86	Authorized officer Magnus Thorén/js Telephone No. +46 8 782 25 00

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE 00/01205

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.
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