

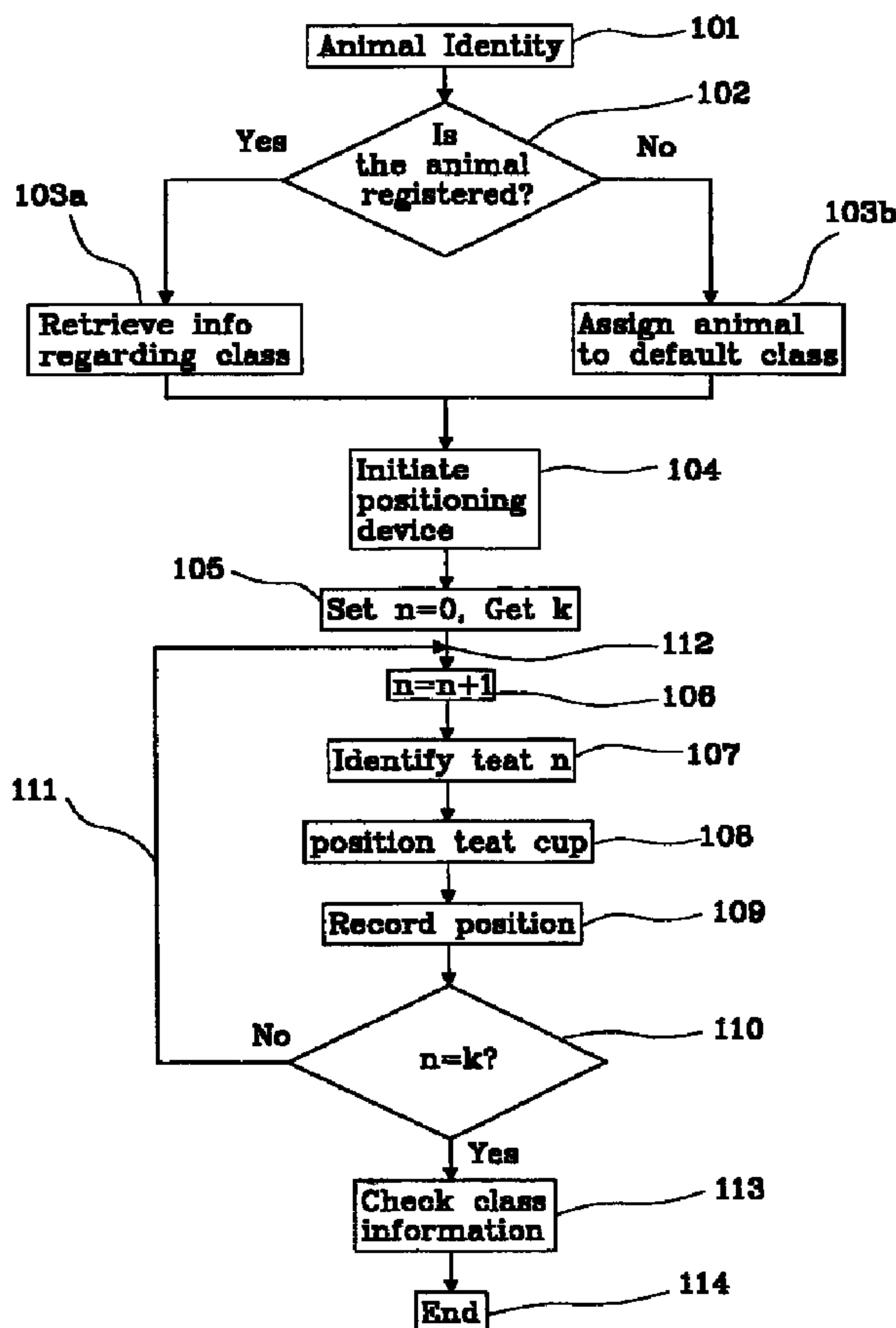


(86) Date de dépôt PCT/PCT Filing Date: 2000/01/13  
 (87) Date publication PCT/PCT Publication Date: 2000/07/20  
 (45) Date de délivrance/Issue Date: 2009/05/12  
 (85) Entrée phase nationale/National Entry: 2001/06/26  
 (86) N° demande PCT/PCT Application No.: SE 2000/000049  
 (87) N° publication PCT/PCT Publication No.: 2000/041559  
 (30) Priorité/Priority: 1999/01/15 (SE9900110-9)

(51) Cl.Int./Int.Cl. *A01J 5/017* (2006.01)  
 (72) Inventeur/Inventor:  
 NILSSON, MATS, SE  
 (73) Propriétaire/Owner:  
 DELAVAL HOLDING AB, SE  
 (74) Agent: BORDEN LADNER GERVAIS LLP

(54) Titre : PROCÉDE ET DISPOSITIF DE MISE EN PLACE DE GOBELETS DE TRAYEUSE SUR UN ANIMAL EN LACTATION

(54) Title: METHOD AND DEVICE FOR POSITIONING TEAT CUPS ON A MILKING ANIMAL



(57) Abrégé/Abstract:

The present invention relates to a method for positioning animal related means, e.g. teat cups, of a milking animal, more specifically to a method to initialise an automatic positioning device to utilise a sequence of movements associated with said animal. The

(57) **Abrégé(suite)/Abstract(continued):**

sequence of positioning movements is associated with a class to which the animal belongs among a plurality number of classes corresponding to the identity of said animal. The animal is beforehand assigned to a class based on its individual position of each teat. The different sequence of movements, adapted for different shapes of udders on the animal, may speed up the process for positioning the teat cups and thereby increase the through-put of animals in the system. The present invention also relates to a control device.

**PCT**WORLD INTELLECTUAL PROPERTY ORGANIZATION  
International Bureau

## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

<b>(51) International Patent Classification <sup>7</sup> :</b>  <b>A01J 5/017</b>	<b>A1</b>	<b>(11) International Publication Number:</b> <b>WO 00/41559</b>  <b>(43) International Publication Date:</b> 20 July 2000 (20.07.00)
<b>(21) International Application Number:</b> PCT/SE00/00049 <b>(22) International Filing Date:</b> 13 January 2000 (13.01.00)  <b>(30) Priority Data:</b> 9900110-9                      15 January 1999 (15.01.99)                      SE  <b>(71) Applicant (for all designated States except US):</b> ALFA LAVAL AGRI AB [SE/SE]; P.O. Box 39, S-147 21 Tumba (SE).  <b>(72) Inventor; and</b> <b>(75) Inventor/Applicant (for US only):</b> NILSSON, Mats [SE/SE]; Scheelevägen 27, S-147 31 Tumba (SE).  <b>(74) Agent:</b> EHRNER & DELMAR PATENTBYRÅ AB; Box 103 16, Gumshornsgatan 7, S-100 55 Stockholm (SE).		<b>(81) Designated States:</b> AE, AL, AM, AT, AT (Utility model), AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CR, CU, CZ, CZ (Utility model), DE, DE (Utility model), DK, DK (Utility model), DM, EE, EE (Utility model), ES, FI, FI (Utility model), GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KR (Utility model), KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SK (Utility model), SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).  <b>Published</b> <i>With international search report.</i> <i>Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.</i>
<b>(54) Title:</b> METHOD AND DEVICE FOR POSITIONING TEAT CUPS ON A MILKING ANIMAL		
<b>(57) Abstract</b>  <p>The present invention relates to a method for positioning animal related means, e.g. teat cups, of a milking animal, more specifically to a method to initialise an automatic positioning device to utilise a sequence of movements associated with said animal. The sequence of positioning movements is associated with a class to which the animal belongs among a plurality number of classes corresponding to the identity of said animal. The animal is beforehand assigned to a class based on its individual position of each teat. The different sequence of movements, adapted for different shapes of udders on the animal, may speed up the process for positioning the teat cups and thereby increase the through-put of animals in the system. The present invention also relates to a control device.</p>		

**METHOD AND DEVICE FOR POSITIONING TEAT CUPS ON A MILKING  
ANIMAL**

**Technical field**

The present invention relates to a method for positioning  
5 animal related means, e.g. teat cups, relative to a defined  
part of an animal, e.g. a milking animal, more specifically to  
a method to initialise an automatic positioning device to  
utilise a sequence of movements associated with said animal.  
The present invention also relates to a control device.

10 **Description of related art**

Present automatic milking systems comprise an automatic  
positioning device, such as a robot arm with identifying  
means. The positioning device normally utilises a  
predetermined sequence of movements to locate and identify  
15 teats on an udder of a milking animal. The udder of a milking  
animal, such as a cow, may have different shapes and the teats  
on the udder may be positioned differently. In spite of these  
variations a single sequence of movements is normally used,  
which results in that the teats on some animals can not be  
20 found within a predetermined time limit. Such animals may then  
have to be rejected since they cannot be milked using this  
system.

Furthermore, a shift in position of the teats occurs over  
time, in particular in the case of a young animal, in which  
25 the size of the udder increases with growth, which in turn  
gives rise to greater distances between teats. If substantial  
changes arise, the animal may be rejected by the system.

In case of an adult animal it has been found that fluctuating milk yield occurs per visit to the milking robot. Due to the fact that the milk yield varies with the teat position per milking animal vary through greater or lesser tension of the udder, affected by the fluctuating quantity of the milk present therein.

Furthermore, during the period between two calvings the yield increases during the first months and decreases again thereafter. This will also lead to a change in the distances between the teats.

In WO 96/20587 a method is disclosed for regularly checking the position of the teats for positioning teat cups on milking animals addressing the problem related to teats that are not in the same position on a subsequent visit. Readjustments of the position is necessary, which is recorded as a new position for the next visit. The positioning of the teat cups on to the teats is initially done manually to get an initial position of the teats. During the checking only the adjustments from the initial position is stored.

This way of introducing a new animal to an automatic milking system is time consuming, especially if the milking system is introduced to a stock of animals.

#### **Summary of the invention**

The object with the present invention is to provide a method and a control device for positioning teat cups on a milking animal which overcomes the prior art problems.

The object is achieved by a method for positioning at least one animal related means relative to at least one defined part of an animal, said animal occupying a defined space provided

with an automatic positioning device, said method comprising the steps of:

- obtaining an identity of said animal,
- determining a class to which the animal belongs among a plurality of classes corresponding to the identity of said animal, the animal being beforehand assigned to a class based on its individual position of each defined part,
- initialising said automatic positioning device to utilise a sequence of positioning movements associated with the class, and
- positioning said animal related means using said sequence of movements,

whereby the process for positioning the animal related means is adapted for varying positions of each defined parts of said animal.

The specific problem with introducing a new animal to the above mentioned system is solved by initializing the automatic position device to use a basic sequence of movements.

The object is also achieved by a control device for positioning animal related means relative to defined parts of an animal. The control device compares the established locations of the defined animal parts with a predetermined range of locations for the class, and updates the class if necessary.

An advantage with the present invention is that animals with unusually shaped udders, having teats positioned in an undesired way, may still be allowed in the automatic milking

3A

system instead of being discarded from the system. An discarded animal must either be sold or slaughtered, which may be costly for the owner of the animals.

Another advantage is that by using a plurality of classes the sequences of movements, adapted for different shapes of udders on the animal, may speed up the process for positioning the teat cups and thereby increase the through-put of animals in the system.

An advantage, with a further embodiment of the invention, is that by assigning a basic sequence of movements for new animals, they may be introduced without any manual assistance.

A still further advantage, with a still further embodiment, is that the behaviour of a milking animal is taken into consideration when assigning a sequence of movements, so that, for example, the animals are not disturbed by the positioning device and/or the positioning device is not damaged due to animal movements.

The invention will now be described in more detail with reference to the accompanying drawings.

#### **Brief description of drawings**

Fig. 1 shows a flow chart describing the present invention.

Fig. 2 shows a plan view of a part of a milking system.

#### **Detailed description of preferred embodiments**

Fig. 1 shows a flow chart describing the present invention for positioning of teat cups relative to teats of a milking animal, such as a cow, in an automatic milking system.

The flow starts in box 101, where the system receives information regarding the animals identity. A computer uses that information to determine if that animal previously has

WO 00/41559

PCT/SE00/00049

5

been subject to milking in this milking system, as is illustrated by box 102.

If the animal has been subject to previous milking, a registration in a memory and classification regarding said animal have been made earlier. According to the present invention, the classification is performed by classifying means that assign said milking animal to one class out of a plurality of classes. Such a plurality of classes may, as an example, be limited to consist of classes 0-5. In box 103a the system retrieves information regarding which class said animal belongs to, for instance class 3. In this example class 3 could mean that the distance between the fore teats is much larger than what is usual.

It is possible to extend the number of classes in the system so that each animal has its own individual class.

If the animal is not presently registered in the system the flow proceeds to box 103b, where the system assigns a default class to the animal, for instance class 0.

The system also comprises an automatic positioning device being initialised, in box 104, to use a sequence of positioning movements, associated with said class of the animal, to identify said positions of the teats. Both boxes 103a and 103b are connected to box 104. The associated sequence of movements may be very different with respect to the different classes. A default sequence for the default class, in this example class 0, is more extensive than all the other sequences of movements, because it must cover all the other classes. The rest of the classes are designed to optimise the sequence of movements dependent of the shapes of

WO 00/41559

PCT/SE00/00049

6

the udders and the positions of the teats within the ranges of that particular class.

After having been subjected to the sequence of movements related to the default class, class 0, the animal may now be  
5 assigned to a more specific class based on the findings with respect to udder shape and teat positions.

In box 105 a counter  $n$  is set to zero ( $n=0$ ) and the number of teats  $k$  for this type of animal is retrieved from the system. An increment of  $n$  to  $n+1$  is performed in box 106, which causes  
10 the positioning device to perform the sequence of movements to identify teat number 1 ( $n=1$ ), as illustrated in box 107.

A teat cup for teat 1 is positioned, box 108, and the position of the teat is recorded and stored in the system memory illustrated by box 109.

15 In box 110, a comparison between the sequence number of presently processed teat  $n$  and the total number of teats  $k$  is performed, if the numbers are not equal the flow is fed back, via line 111, to a point 112, between box 105 and 106.

The steps 106 to 110 are repeated until  $n=k$  and the flow  
20 proceeds to box 113, where a comparison between the ranges of positions of the assigned class for this animal and the recorded positions for all teats is done. Dependent on the result of this comparison the animal may be reassigned to a new class, which information is stored in the system to be  
25 used on the next visit.

The flow ends in box 114.

This flow is repeated every time an animal enters the milking system to be milked.

The animals may also be classified dependent on their behaviour during the previously described process flow. The flow only needs to be complemented with a box containing means for detecting behaviour during the positioning and extend the number of available classes to contain some classes depending on the behaviour.

An animal may either be assigned to one class, being a combined class of the teat positions and the behaviour, or the animal may be assigned to two separate classes, one for teat positions and one for behaviour.

If the shape of an udder or the teats position on the udder is altered between two subsequent milking events, and the assigned sequence of movements still can identify the teats, the system may reassign the animal to a different class corresponding to the new position of the teats.

On the other hand, if the assigned sequence of movements does not identifies the position of the teats within a predetermined time period, the system may reassign the animal to a different class and repeat the positioning with another sequence of movements. A reassignment is preferably made to the default class.

Fig. 2 shows a part of a milking system 200 comprising a parlour 201, which is provided with an entrance door 203 at the rear longitudinal side, via which an animal 202 can enter the milking parlour 201, and with an exit door 204 at the front longitudinal side, via which the animal can leave the milking parlour 201. At the front of the parlour 201 there is furthermore disposed a feeding trough 205 in which fodder, such as concentrate, can be fed to the animal 202. The doors are operated by means of a computer (not shown).

WO 00/41559

PCT/SE00/00049

8

The milking system further comprises a milking robot 206 for automatic positioning of teat cups 207 relative to teats 208 on an udder 209 of the milking animal 202. The milking system is also provided with an automatic detection system for  
5 identifying said animal (not shown).

The inventive methods and device may naturally be used to position any kind of animal related means relative to any desired part of an animal.

**CLAIMS:**

1. A method for positioning at least one animal-related means relative to at least one teat of a milking animal wherein the animal occupying a defined space is provided with an automatic positioning device comprising the steps of:

obtaining an identity of the animal,

determining a class, to which the animal belongs among a plurality of classes, corresponding to the identity of the animal, wherein the animal is beforehand assigned to the class based on an individual location of each of said at least one teat,

initializing said automatic positioning device to utilize a sequence of positioning movements associated with the class, and

positioning said animal-related means using said sequence of movements,

whereby the process for positioning the animal-related means is adapted for varying locations of each of said at least one teat of said animal.

2. Method according to claim 1, and further comprising the step of:

comparing an established location of said at least one teat with a predetermined range of locations associated with the assigned class for the animal, and

updating the class assignment if said established location is outside said predetermined range.

3. Method according to claim 1, wherein selecting said plurality of classes to contain a default class having a basic

sequence of movements associated with said default class, to which default class the animal is reassigned when the automatic positioning device fails to establish a location of the at least one teat utilizing the sequence of positioning movements associated with the assigned class.

4. Method according to claim 1, further comprising selecting said animal-related means to be a teat cup, selecting said at least one teat of said milking animal, the milking animal being a cow, and selecting said defined space to be a parlour of an automatic milking system having a teat cup attachment device.

5. Method according to claim 4, and further comprising the steps of:

(a) moving said positioning device in the sequence of movements, corresponding to said class, to establish a location of said teat,

(b) applying said teat cup to said at least one teat,

(c) recording the location of said at least one teat,  
and

(d) repeating step (a) to (c) to establish said location, applying said teat cup and recording the location for all present teats on the milking animal,

whereby an adapted sequence of movements is applied for the specific class establishing said location for each teat one by one.

6. Method according to claim 4, said method further comprises a step of recording the behavior of the milking

animal during the positioning, and said updating further comprises the step of:

updating the class assignment to which the animal belongs emanating from at least one of said identified positions of the teats and the behavior of the milking animal,

whereby the method for positioning of the teat cups is adapted for different positions of the at least one teat or the behavior of said milking animal.

7. Method according to claim 1, wherein said plurality of classes are selected to be a limited number of classes.

8. A method for automatic treatment of a milking animal occupying a defined space, provided with an automatic positioning device for positioning at least one animal-related means relative to at least one teat of the animal, said method comprising the steps of:

obtaining an identity of the animal,

defining a plurality of classes to one of which the animal is assigned, each class is based on an individual location of each of the at least one teat,

defining for each class a sequence of movements to be performed by the positioning device,

establishing the location of each of the at least one teat, and

assigning the animal to one of said classes based on the established position and relating the identity of the animal to said one class,

allowing thereby the operation of the positioning device to be adapted to the animal using its identity.

9. Method according to claim 8, and further comprising the step of:

establishing the location of said at least one teat by initializing said automatic positioning device to use a basic sequence of movements.

10. Method according to claim 9, and further comprising the steps of:

selecting said plurality of classes to contain a default class having said basic sequence of movements associated with said default class, and

assigning said animal to said default class prior to the step of establishing the location of said at least one teat.

11. Method according to claim 8, wherein said animal-related means is a teat cup, and further comprising selecting said at least one teat of said milking animal, the milking animal being a cow, and selecting said defined space to be a parlour of an automatic milking system having a teat cup attachment device.

12. Method according to claim 8, wherein said plurality of classes is selected to be a limited number of classes.

13. A control device for positioning at least one animal-related means relative to at least one teat of a milking animal, the animal occupying a defined space provided with an automatic positioning device, wherein said device comprises:

an arrangement for obtaining an identity of the animal,  
an arrangement for determining a class to which the animal belongs among a plurality of classes corresponding to

the identity of the animal being beforehand assigned to the class based on an individual location of each of said at least one teat,

an arrangement for initializing the automatic positioning device to utilize a sequence of positioning movements associated with the class, and

an arrangement for positioning said animal-related means using said sequence of positioning movements,

whereby the control device for positioning of the animal-related means is adapted for different locations of each of said at least one teat of said animal.

14. Device according to claim 13, wherein said device further comprises an arrangement for comparing established locations of said at least one teat with a predetermined range of locations of the assigned class for the animal, and an arrangement for updating the class assignment if said established location is outside said predetermined range.

15. Device according to claim 13, wherein said animal-related means is a teat cup, said milking animal is a cow, and said defined space is a parlour of an automatic milking system having a teat cup attachment device.

16. Device according to claim 13, wherein said plurality of classes is a limited number of classes.

17. A method for positioning at least one animal-related means relative to at least one defined part of an animal wherein the animal occupying a defined space is provided with an automatic positioning device comprising the steps of:

obtaining an identity of the animal,

determining a class, to which the animal belongs among a plurality of classes, corresponding to the identity of the animal, wherein the animal is beforehand assigned to the class based on an individual positioning of each of the at least one defined part,

initializing said automatic positioning device to utilize a sequence of positioning movements associated with the class,

positioning said animal-related means using said sequence of movements, and

updating the class assignment based on the position of said at least one defined part as established by said positioning device,

whereby the process for positioning the animal-related means is adapted for varying positions of each of said at least one defined part of the animal.

18. Method according to claim 17, and further comprising the steps of:

comparing the established position of said at least one defined part with a predetermined range of positions associated with the assigned class for the animal, and

updating the class assignment if said established position is outside said predetermined range.

19. Method according to claim 17, wherein selecting said plurality of classes to contain a default class having a basic sequence of movements associated with said default class, to which default class the animal is reassigned when the automatic positioning device fails to establish the position

of the at least one defined part utilizing the sequence of positioning movements associated with the assigned class.

20. Method according to claim 17, further comprising selecting said animal-related means to be a teat cup, selecting said at least one defined part to be a teat of the animal, the animal being a cow, and selecting said defined space to be a parlour of an automatic milking system having a teat cup attachment device.

21. Method according to claim 20, and further comprising the steps of:

(a) moving of said positioning device in the sequence of movements, corresponding to said class, to establish a position of a teat,

(b) applying said teat cup to said teat,

(c) recording the position of said teat, and

(d) repeating step (a) to (c) to establish a position, applying said teat cup and recording the position for all present teats on the milking animal,

whereby an adapted sequence of movements is applied for a specific class establishing said position for each teat one by one.

22. Method according to claim 20, said method further comprises a step of recording the behavior of the milking animal during the positioning, and said updating further comprises the step of:

updating the class assignment to which the animal belongs emanating from at least one of said identified positions of the teats and the behavior of the milking animal,

whereby the method for positioning of the teat cups is adapted for different positions of the at least one teat or the behavior of said milking animal.

23. Method according to claim 17, wherein said plurality of classes are selected to be a limited number of classes.

24. A method for automatic treatment of an animal occupying a defined space, provided with an automatic positioning device for positioning at least one animal-related means relative to at least one defined part of the animal, said method comprising the steps of:

obtaining an identity of the animal,

defining a plurality of classes to one of which the animal is assigned,

defining for each class a sequence of movements to be performed by the positioning device,

establishing the position of each of the at least one defined animal part,

assigning the animal to one of said classes based on the established position and relating the identity of the animal to said one class, and

updating the class based on the position of the at least one defined part,

allowing thereby the operation of the positioning device to be adapted to the animal using its identity.

25. Method according to claim 24, and further comprising the step of:

establishing the position of said at least one defined animal part by initializing said automatic positioning device to use a basic sequence of movements.

26. Method according to claim 25, and further comprising the steps of:

selecting said plurality of classes to contain a default class having said basic sequence of movements associated with said default class, and

assigning said animal to said default class prior to the step of establishing the position of said at least one defined animal part.

27. Method according to claim 24, wherein said animal-related means is a teat cup, and further comprising selecting said at least one defined part to be a teat of the milking animal, the milking animal being a cow, and selecting said defined space to be a parlour of an automatic milking system having a teat cup attachment device.

28. Method according to claim 24, wherein said plurality of classes is selected to be a limited number of classes.

29. A control device for positioning at least one animal-related means relative to at least one defined part of an animal, said animal occupying a defined space provided with an automatic positioning device, wherein said device comprises:

an arrangement for obtaining an identity of the animal,  
an arrangement for determining a class to which the animal belongs among a plurality of classes corresponding to the identity of the animal being beforehand assigned to the

class based on an individual position of each of the at least one defined part,

an arrangement for initializing the automatic positioning device to utilize a sequence of positioning movements associated with the class,

an arrangement for positioning said animal-related means using said sequence of positioning movements, and

an arrangement for updating the class assignment to which said animal belongs based on the position of each of the at least one defined part as established by said positioning device;

whereby the control device for positioning of the animal-related means is adapted for different positions of each of the at least one defined part of the animal.

30. Device according to claim 29, wherein said device further comprises an arrangement for comparing the established position of said at least one defined part with a predetermined range of positions of the assigned class for the animal, and an arrangement for updating the class assignment if said established position is outside said predetermined range.

31. Device according to claim 29, wherein said animal-related means is a teat cup, said at least one defined part is a teat of the milking animal, the milking animal being a cow, and said defined space is a parlour of an automatic milking system having a teat cup attachment device.

32. Device according to claim 29, wherein said plurality of classes is a limited number of classes.

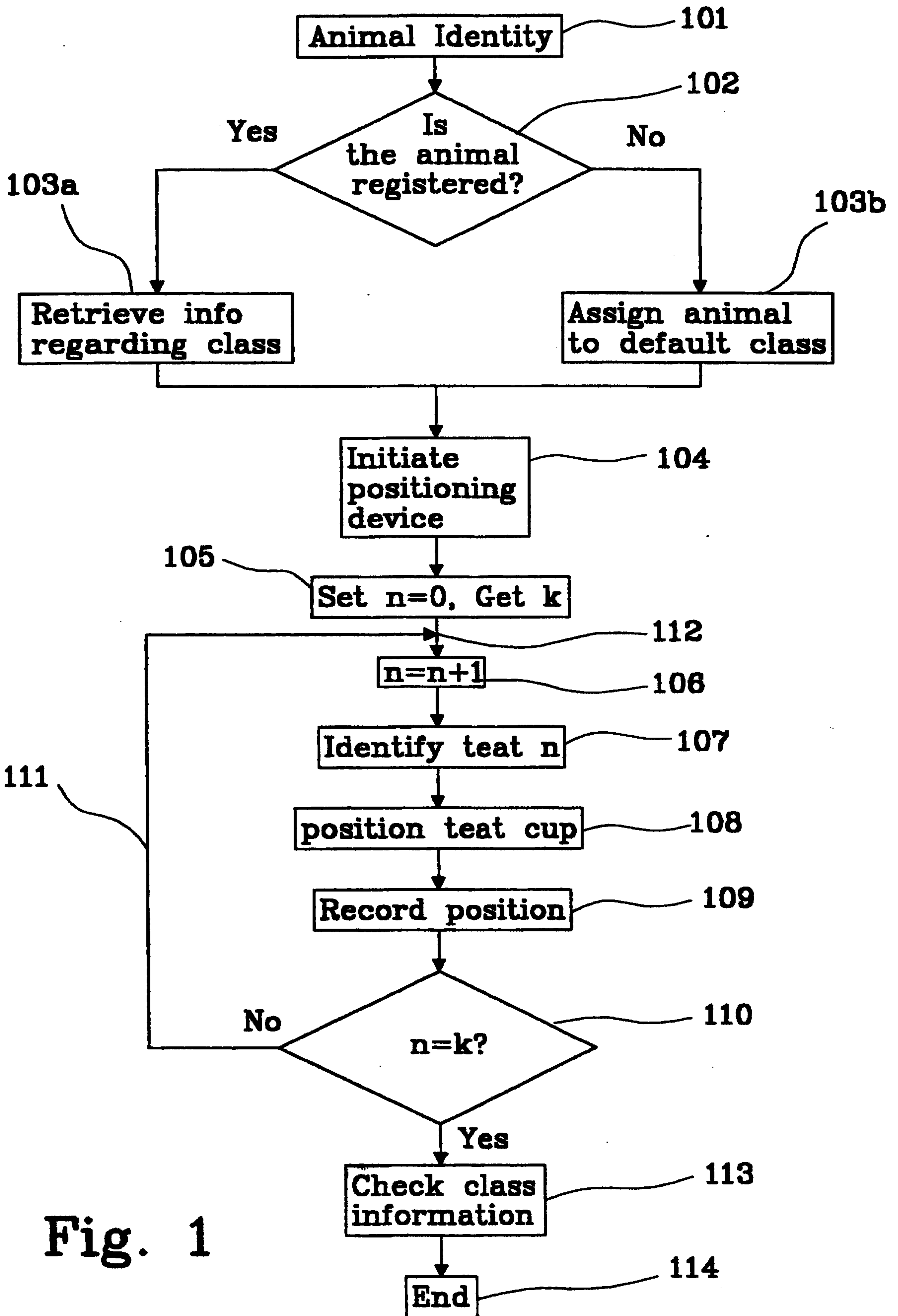


Fig. 1

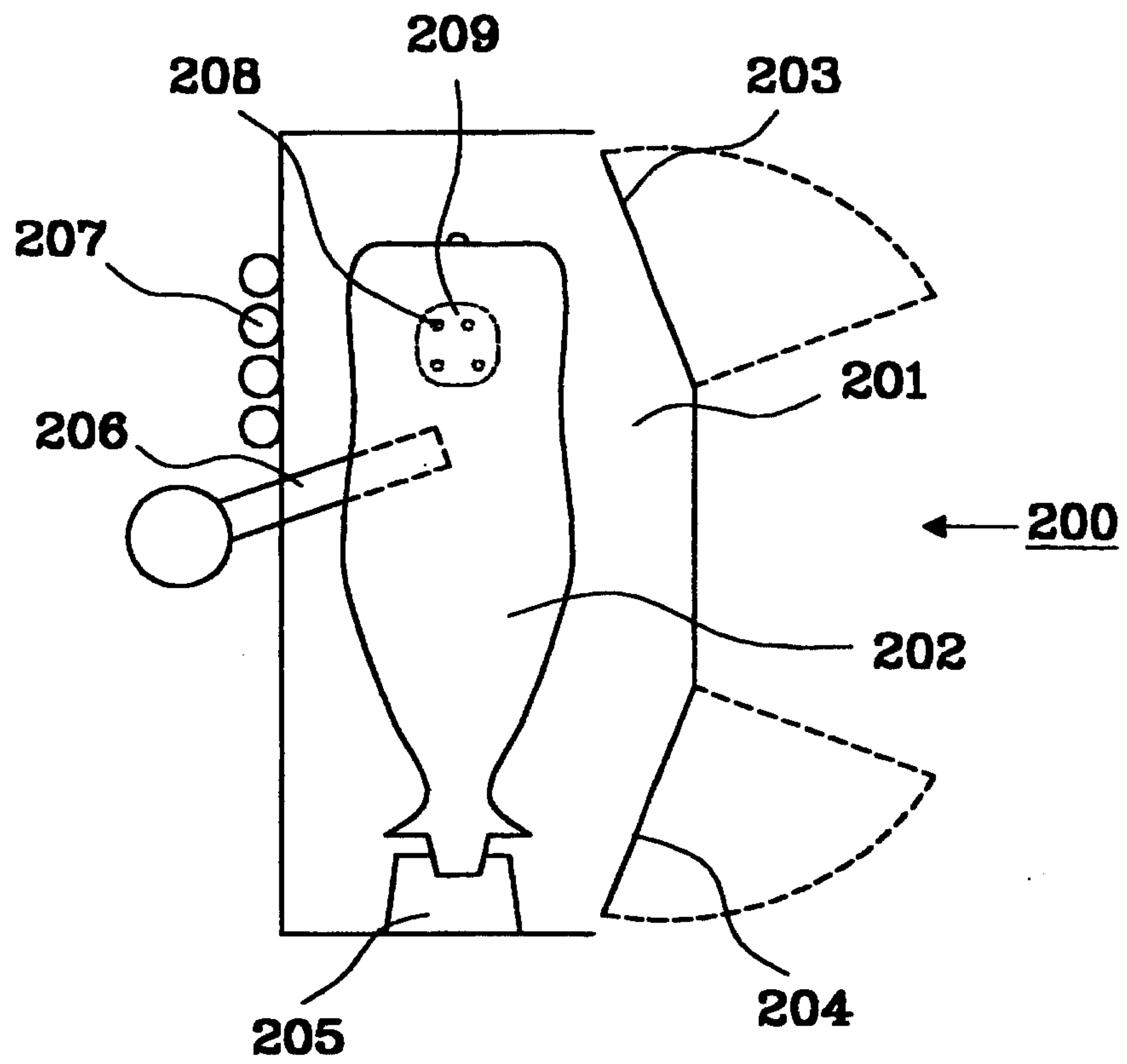


Fig. 2

