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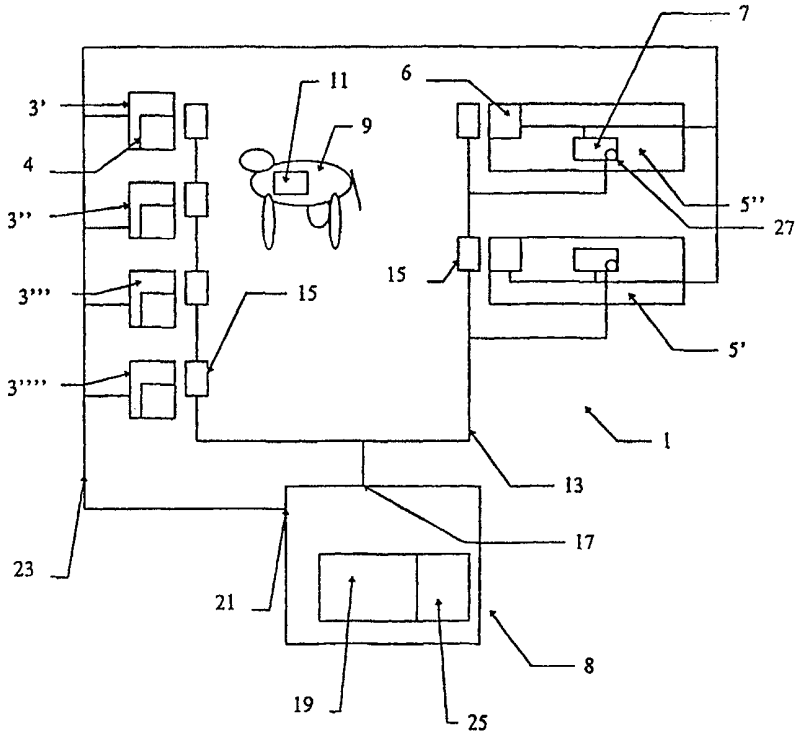
(54) Title: METHOD AND DEVICE FOR CONTROLLING ANIMAL FEEDING WHEN MILKING DAIRY ANIMALS

(57) Abstract

The present invention relates to a device and method for the milking of dairy animals (9), comprising: individual identifying means (11) attachable to each individual dairy animal (9); simple feeding station (3'–3''''), provided with food dispensing means (4) for dispensing fodder and sensing means (15) for sensing said individual identifying means (11); combined feeding and milking stations (5', 5''), provided with food dispensing means (6) for dispensing fodder, milking means (7) for milking animals (9) and sensing means (15) for sensing said individual identifying means (11); and control means (8, 19) for controlling the simple feeding stations (3'–3'''') and combined feeding and milking stations (5'–5''), wherein the control means (8, 19) comprises: determining means (19) for determining a time for the next milking of said individual animal (9); and output means (21) for commanding said simple feeding stations (3'–3'''') to stop dispensing food to said individual animal (9) if the actual time is after said time for the next milking of said animal (9).



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METHOD AND DEVICE FOR CONTROLLING ANIMAL FEEDING WHEN MILKING DAIRY ANIMALS

Technical Field of the Invention

The present invention relates to a method and a device for milking dairy animals.

Description of Related Art

Continuous efforts are being made in order to reduce the costs of producing milk. One way of doing this is to increase the frequency of milking from twice a day to four or more times a day as this can give a 15-20% increase in milk production. However to avoid increased labour costs the animals need to be milked automatically. One type of automatic milking system is the so-called voluntary milking system (VMS). In one such VMS system, known from US-A 4,508,058 dairy animals are permitted to move freely and can eat and be milked whenever they want. In this system each animal is provided with a coded transponder. A sensing means next to each of the feeding stations provided in the VMS is actuated by the transponder and is connected to a computer which senses which individual animal is visiting the feeding station, This computer further controls the dispensing of food to each animal. This depends on how much food the individual animal is supposed to be fed each day and how much the animal has already been fed that day. Some feeding stations are combined with milking machines and if the computer detects that a certain time has passed since the individual animal in the combined feeding and milking station was last milked then the computer can activate a means for restraining the animal in the combined feeding and milking station and it can also activate an automatic milking robot. The automatic milking robot then starts milking the animal. Once the milking operation is finished the animal is release from the station.

A disadvantage with the above system is that it is not possible to ensure that the animals enter a combined feeding and milking station at the optimum time to enable the maximum milk production. This is because an animal which could be milked

may choose to eat from a simple feeding station and thereby miss an opportunity to be milked at the optimum time.

Summary

The object of the invention is to solve the above stated problems.

The present invention solves the above stated problems by means of a device having the features mentioned in the characterising part of claim 1. The above problems are also solved by means of a method having the features mentioned in the characterising part of claim 8.

In a method and device in accordance with the present invention, a voluntary milking system is provided with means for controlling the dispensing of feed to the individual animals so that the individual animal is directed to the appropriate type of feeding station depending on whether it needs to be milked or not. In one embodiment of the invention at a predetermined time, corresponding, for example, to an optimum time to milk the animal after the last time that an individual animal has been milked, or to a time shortly before the optimum time, or to an average time between milkings, the computer commands all the simple feeding stations to stop supplying feed to the animal in question. The animal will then only be able to receive feed at the combined milking and feeding station. The animals soon learn that when the simple feeding stations do not dispense feed they have to go to a combined feeding and milking station. In this way the animals are encouraged to enter the combined feeding and milking stations.

In a second embodiment of the invention the combined feeding and milking stations are commanded to only dispense food to an individual animal if the actual time is after the commencement of the optimum time for milking the individual animal. In this way the animals which do are not ready for milking are discouraged from

staying in the combined feeding and milking stations. This leaves these stations free for use by animals which are ready for milking.

In a further embodiment of the invention the rate of feed supply in the simple feeding stations is lower than the rate of feed supply in the combined feeding and milking stations. The animals soon learn to try to eat in preference from the combined milking and feeding stations. This ensures that the combined feeding and milking stations are visited often by each animal and hence the chances are increased that an animal will be feeding in a combined feeding and milking station when the optimum time for milking occurs.

In another embodiment of the invention the computer also monitors the milking of the animal in the combined feeding and milking station and once the milking session is over it commands the combined feeding and milking station to stop supplying feed to the animal. At the same time it commands the simple feeding stations to allow feed to be dispensed to the animal. In this way the animal is encouraged to leave the combined feeding and milking station when the milking cycle is over.

The invention will be described more closely in the following by means of examples of embodiments and figure.

Brief Description of the Drawing

Figure 1 is a schematic view of the main components of one embodiment of a voluntary milking system in accordance with the invention.

Detailed Description of Embodiments

Figure 1 shows schematically one embodiment of a voluntary milking system (VMS) 1. The VMS 1 comprises a plurality of simple feeding stations 3'-3'''', four of which are shown here but this number is not limiting and naturally can be increased or decreased according to the number of animals in the VMS. As is well known in the art each feeding station comprises controllable feed dispensing means 4 which can be controlled to dispense feed or to stop dispensing feed. The VMS 1 also comprises a plurality of combined feeding and milking stations 5'-5''. Two combined feeding and milking stations 5'-5'' are shown here but this number may be varied according to the actual requirements of the animals in the VMS. Each feeding and milking station 5'-5'' also has a controllable feed dispensing means 6 and a controllable automatic milking means such as a milking robot 7. The VMS is controlled by control means 8, which normally is a computer 8. Each dairy animal 9 is provided with a transponder 11 which is individually, uniquely coded. The transponders 11 can be detected by sensors 15 provided at each feeding station 3'-3''' and at each combined feeding and milking station 5'-5''. These sensors send signals via connection 13 to an input 17 of the computer 8. In this way computer 8 is provided with information about which, if any, animals 9 are in the feeding stations 3'-3'''' and combined feeding and milking stations 5'-5''. Computer 8 contains software 19 which controls feed dispensing means 4, 6 and milking robots 7. Control instructions are outputted from computer 8 via output 21 to connection 23. Connections 13 and 23 could be transmission cables or they could be wireless connections using, for example, infra-red transmitters and receivers or radio transmitters and receivers. The computer 8 and associated software 19 perform the following functions:

they manage a memory means 25 such as a database 25 accessible by computer 8 which for each individual animal contains preferably information on its transponder code, the optimum amount of feed it should be fed each day, the amount of feed it has eaten in the last day or other time period of interest, the time when it was last milked, the optimum elapsed time between milkings, the average time between milkings;

they measure the elapsed time between the actual time and the last milking for each individual animal;

they determine for each animal when the optimum time to be milked will occur;

they control the dispensing of food from the simple feeding stations for each individual animal in order to ensure that when the optimum time for an animal to be milked approaches then the animal can only receive food if it enters a combined feeding and milking station.

The VMS works as follows:

when an animal 9 enters a feeding station 3'-3'''' then the sensor 15 associated with the station 3'-3''''sensors the unique transponder code of the animal 9. It then transmits a signal to the computer 8 that the animal is ready to be fed. The computer checks how much food the animal has eaten in the last day or other time period of interest, e.g. the last 12 hours and determines how much food the animal should be allowed to eat at the current time. The computer then checks when was the last time that the animal was milked. Using the information about the optimum time or average time between milkings for the animal which is stored in, for example, the computer database the computer determines the time for the next milking for this animal. This time is used to calculate the starting time of an optimum time window in which milking should take place. This time window could extend, for example, from one hour before the optimum time for milking onwards. If the actual time is before the start of this time window then the computer commands the feed dispensing means 4 to dispense a suitable amount of food to the animal 9 such that it can be expected to be hungry again when the optimum time occurs. The animal 9 then eats the food and leaves the feeding station 3'-3'''' as it will soon learn that it cannot continue to be fed once the feed dispensing means 4 has stopped dispensing food.

If. the actual time is after the start of this time window then it is desirable that the animal leaves the feeding station 3'-3'''' and goes instead to a combined feeding and milking station 5'-5''. In order to encourage the animal to do this the computer

commands the feed dispensing means 4 to not dispense any food to the animal 9 in the feeding station 3'-3''''. The animal will leave the feeding station 3'-3'''' after a while when it realises that it will not be supplied with any food there. The animal will soon learn that if it does not receive food in a simple feeding station 3'-3'''' then it must go to a combined feeding and milking station 5'-5''.

When an animal 9 enters a combined feeding and milking station 5'-5'' then the sensor 15 associated with the station 5'-5'' sensors the unique transponder code of the animal 9. It then transmits a signal to the computer 8 that the animal is ready to be fed. The computer checks how much food the animal has eaten in the last day or other time period of interest, e.g. the last 12 hours and determines how much food the animal should be allowed to eat at the current time. The computer then checks when was the last time that the animal was milked and as described above calculates the starting time of an optimum time window in which milking should take place. If the actual time is before this time window then the computer commands the feed dispensing means 4 to not dispense any food to the animal 9 in the combined feeding and milking station 5'-5''. The animal will leave the combined feeding and milking station 5'-5'' after a while when it realises that it will not be supplied with any food there. The animal will soon learn that if it does not receive food in a combined feeding and milking station 5'-5'' then it must go to a simple feeding station 3'-3''''.

If the actual time is after the commencement of the optimum time window then it is desirable that the animal is milked. The computer therefore commands the food dispensing means 6 to start dispensing food to the animal 9. At the same time the computer orders the milking robot 7 to restrain the animal and to start milking it. As the animal 9 eats the food it is milked. The milk flow from the animal 9 is sensed by milk flow sensing means 27 of any suitable type which produce an output signal which can be received by computer 8. Once the milking cycle is completed as sensed and reported to the computer by milk flow sensing means 27 the food

dispensing means 6 is ordered to stop dispensing food to the animal. Alternatively the dispensing of food can be stopped in anticipation of the end of the milking cycle, for example, when the milk flow from the animal falls below a predetermined flow rate. The animal is released from the restraining means. The animal will then soon leave the combined feeding and milking station 5'-5'' as it will have learnt that it will not continue to be fed there once the milking cycle is over.

In a second embodiment of the invention the food dispensing means 4 in the simple feeding stations 3'-3'''' are further controlled to dispense food at a slower rate then the food dispensing means 6 in a combined feeding and milking station 5'-5''. Preferably the rate in food dispensing means 4 is slower than the average eating rate of an animal so that the animal has to occasionally wait for food to be dispensed in a simple feeding station 3'-3''''. The rate in food dispensing means 6 is preferably faster then the average eating rate of an animal so that the animal does not have to wait so long for food to be dispensed in the combined feeding and milking stations. In this way the combined feeding and milking stations will tend to be used first by the animals and therefore there is a greater chance that an animal will enter a combined feeding and milking station 5'-5'' during the optimum time window for milking.

CLAIMS

1. Milking apparatus (1), for the milking of dairy animals (9), comprising:
individual identifying means (11) attachable to each individual dairy animal (9);
simple feeding stations (3'-3''''), provided with food dispensing means (4) for dispensing fodder and sensing means (15) for sensing said individual identifying means (11);
combined feeding and milking stations (5', 5''), provided with food dispensing means (6) for dispensing fodder, milking means (7) for milking animals (9) and sensing means (15) for sensing said individual identifying means (11); and
control means (8, 19) for controlling the simple feeding stations (3'-3'''') and combined feeding and milking stations (5'-5''),
characterised in that said control means (8, 19) comprises:
determining means (19) for determining a time for the next milking of said individual animal (9);
and output means (21) for commanding said simple feeding stations (3'-3'''') to stop dispensing food to said individual animal (9) if the actual time is after said time for the next milking of said animal (9).

2. Milking apparatus in accordance with claim 1 characterised in that said control means comprises output means (21) for commanding said combined feeding and milking stations (5'-5'') to only dispense food to said individual animal (9) if the actual time is after said time for the next milking of said animal (9).

3. Milking apparatus in accordance with claim 1 or 2 characterised in that the maximum rate of supply of feed in a simple feeding station (3'-3'''') is less than the maximum rate of supply of feed in a combined feeding and milking station (5'-5'').

4. Milking apparatus in accordance with any of the previous claims characterised in that each combined feeding and milking station (5'-5'') is provided with milk flow sensing means (27) and that said control means (8, 19) is provided with output means (21) for signalling a combined feeding and milking stations (5'-5'') to stop dispensing feed when the sensed milk flow from the combined feeding and milking station (5'-5'') is below a predetermined value.

5. Milking apparatus in accordance with any of the previous claims characterised in that it comprises memory means (25) for recording when an individual animal (9) was last milked.

6. Milking apparatus in accordance with any of the previous claims characterised in that said time for the next milking of said individual animal (9) is calculated by the determining means (19) to be the optimum time for the next milking of said animal.

7. Milking apparatus in accordance with any of the previous claims characterised in that said time for the next milking of said individual animal (9) is calculated by the determining means (19) based on the average time between milkings for said animal.

8. Method for the milking of dairy animals in a voluntary milking system (1) comprising:
individual identifying means (11) attachable to each individual dairy animal (9);
simple feeding stations (3'-3''''), provided with food dispensing means (4) for dispensing fodder and sensing means (15) for sensing said individual identifying means (11);
combined feeding and milking stations (5', 5''), provided with food dispensing means (6) for dispensing fodder, milking means (7) for milking animals (9) and sensing means (15) for sensing said individual identifying means (11); and

control means (8, 19) for controlling the simple feeding stations (3'-3'''') and combined feeding and milking stations (5'-5''),characterised by the steps of:
recording when an individual animal (9) was last milked;
determining an time for the next milking of said individual animal (9);
signalling said simple feeding stations (3'-3'''') to stop dispensing food to said individual animal (9) if the actual time is after said time for the next milking of said animal (9).

9. Method in accordance with claim 8 characterised by the further step of commanding said combined feeding and milking stations (5'-5'') to only dispense food to said individual animal (9) if the actual time is after said time for the next milking of said animal (9).

10. Method in accordance with claims 8 or 9 characterised by the step of setting the maximum rate of supply of feed in a simple feeding station (3'-3'''') to be less than the maximum rate of supply of feed in a combined feeding and milking station (5'-5'').

11. Method in accordance with any of claims 8-107 characterised by the steps of:
providing each combined feeding and milking station (5'-5'') with milk flow sensing means (27); and
signalling a combined feeding and milking stations (5'-5'') to stop dispensing feed when the sensed milk flow from the combined feeding and milking station (5'-5'') is below a predetermined value.

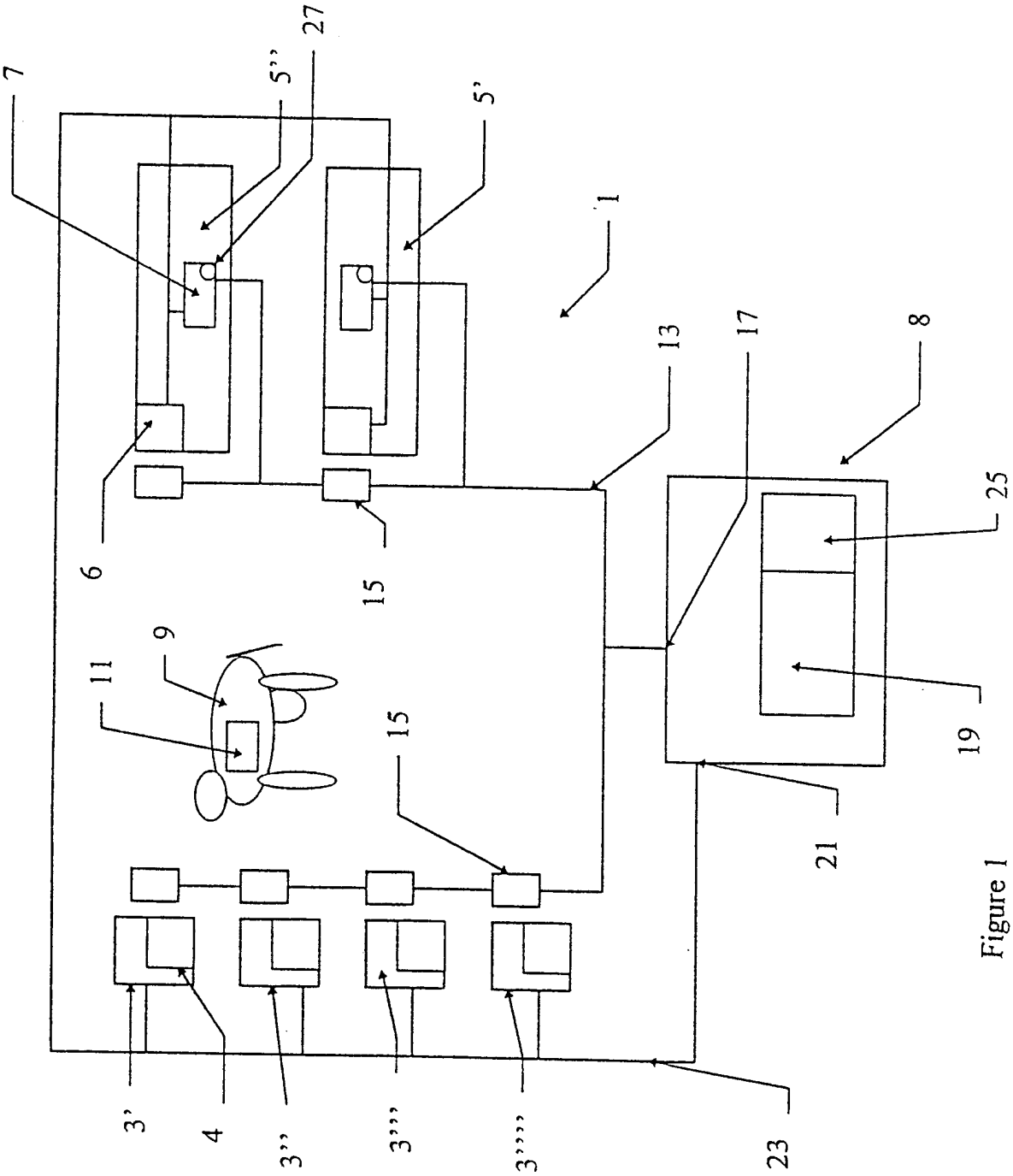

Figure 1

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE 99/01531

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: A01K 1/12
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

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IPC7: A01K

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

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C. DOCUMENTS CONSIDERED TO BE RELEVANT

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[X] Further documents are listed in the continuation of Box C. [X] See patent family annex.

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