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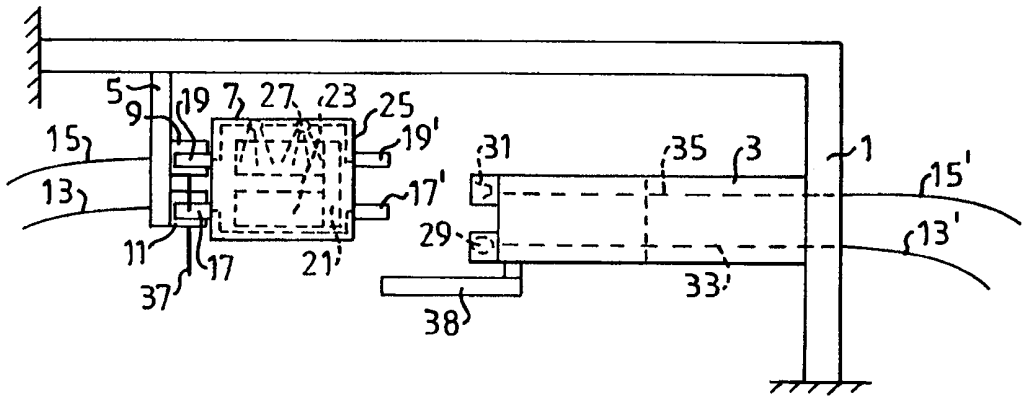


(57) Abstract

The present invention relates to a teat cleaning device comprising a cleaning tool able to be releasably coupled to a docking station (5) or a movable arm (3) by means of the cleaning fluid (15) and/or power supply (13) coupling means (9, 11, 17, 19, 17', 19', 29, 31, 43, 43').

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Docking Arrangement

The present invention relates to an apparatus according to the preamble of claim 1 for cleaning the teats of animal.

A problem when milking dairy animals is how to ensue that the teats of the animal are clean before milking commences. As manual teat cleaning is labour-intensive, inefficient and time-consuming various robots for cleaning teats have been proposed. EP-A 0 643 910 describes once such robot having two movable arms which can co-operate with a detachable cleaning member. The cleaning member contains rotating cleaning means which are driven by an electric motor. The cleaning member can be moved under an animal to clean its teats and then moved from under the animal and placed into a washing machine in order to wash it before the next animal is cleaned. This device requires two robot arms and a separate washing machine and is consequently expensive to construct and use. In addition the power supply line to the electric motor which extends from the first robot arm under the animal to the second robot arm is susceptible to damage during use. Such damage could be caused for example by the animal stepping on the power supply line or it being caught on some part of the frame of the milking apparatus. Furthermore the immersion of the electric motor in a liquid-filed washing machine requires extremely good sealing of the electric motor.

The object of the present invention is to provide an apparatus by means of which the problems discussed above may be avoided.

This object is obtained by means of an apparatus of the type mentioned in the introduction having the features mentioned in the characterising part of claim 1.

The cleaning apparatus with these features is able to be manoeuvred by a single robot arm between idle/washing position which is not under the teats and a working position under the teats which need cleaning without exposing the power supply

means to hazards. Said apparatus is furthermore cheaper to construct and maintain than prior art devices.

The invention will be illustrated by examples of embodiments with reference to the appended drawings in which:

Figure 1 shows schematically a lateral view of a first embodiment of an apparatus in accordance with the invention in an idle/washing position;

Figure 2 shows schematically a lateral view of the apparatus of figure 1 in a teat cleaning position;

Figure 3 shows schematically a lateral view of a second embodiment of a teat cleaning device according to the invention;

Figure 4 shows a lateral view of a third embodiment of a teat cleaner in accordance with the invention.

Figure 5 shows a nipple for a teat cleaner in accordance with the invention.

Figure 6 shows a lateral view of a fourth embodiment of a teat cleaner in accordance with the invention.

The apparatus shown in figure 1 comprises a frame 1 which supports a movable robot arm 3. Frame 1 has a docking station 5 for a cleaning tool 7. Docking station 5 comprises a pair of spaced apart female quick-release couplings 9, 11 connected to compressed air 13 resp. cleaning fluid 15 supplies. Cleaning tool 7 has a body 25 on one side of which are mounted corresponding spaced apart male quick-release coupling parts such as nipples 17 resp 19. These nipples 17, 19 can co-operate with female quick-release couplings such as couplings 9, 11 in order to, for example, retain the cleaning tool 7 on the docking station 5. Compressed air nipple 17 leads

to drive means such as an air powered motor 21 which drives movable cleaning means 23 mounted on the body 25 of the cleaning tool 7. Cleaning fluid nipple 19 leads to nozzles or other fluid emitting means 27. As shown here nipples 17, 19 are mounted on one side of body 25 while on another side of body 25 are mounted a second pair of nipples 17', 19' for compressed air resp. cleaning fluid. Compressed air nipple 17' also leads to drive means 21 and cleaning fluid nipple 19' also leads to fluid emitting means 27.

Robot arm 3 is provided with a pair of spaced apart female quick-release couplings 29, 31 also connected to compressed air 13 resp. cleaning fluid 15' supplies. The air and fluid supply lines 33 resp. 35 are preferably enclosed in, or otherwise protected and guided by robot arm 3. Cleaning fluid supply 15' is shown here as being different from cleaning fluid supply 15 as it is possible that different cleaning fluids are used to clean the cleaning tool respectively the teats. It is however possible to use the same supply for both purposes, possibly with provision being made to change the composition of the cleaning fluid dependent on its intended use. The spacing between couplings 29, 31 corresponds to the spacing between the nipples 17', 19' so that they can co-operate in order to, for example, retain the cleaning tool 7 on the robot arm 3. In the case that any of the quick-release couplings or nipples 11, 13, 17, 17', 19, 19', 29, 31 are provided with release mean 37 robot arm 3 is preferably provided with actuating means 38 which can actuate the release means.

When the cleaning tool is not cleaning an animal it can be held on docking station by nipples 17, 19 inserted into quick-release couplings 9, 11 on the docking station as shown in figure 1. Valves (not shown) connected to the compressed air and cleaning fluid supplies 13 resp. 15 can be opened to cause the cleaning means 23 to rotate and the fluid emitting means 27 to emit fluid in order to wash the cleaning tool 7. When it is desired to clean an animal then robot arm 3 is positioned so that quick-release couplings 29, 31 co-operate with nipples 17', 19' and actuating means 38 actuates any release means 37 which would otherwise prevent cleaning tool 7 from leaving the docking station 5. Cleaning tool 7 can then be removed from

docking station 5 and positioned in a working position around the teats . Valves (not shown) connected to the compressed air and cleaning fluid supplies 13 resp. 15' can be opened to cause the cleaning means 23 to rotate and the fluid emitting means 27 to emit cleaning fluid in order to clean the teats 40 of the animal. Preferably the nipples 17, 17', 19, 19' have flow preventing or limiting means such as non-return valves which can prevent air or fluid leakage from the nipples when they are not connected to the robot arm 3 or docking station 5 while at the same time permitting flow when correctly coupled. In one embodiment of the invention the nipples are preferably provided with non-return valve actuating means which can open said non-return valves in order to permit a flow through the nipple in order to blow or wash away any dirt or other contaminants in the nipple. In another embodiment of the invention shown in figure 5 the flow limiting means are adapted to allow a constant leakage of air or liquid in order to blow or wash away any dirt or other contaminants in the nipple and to prevent further contamination entering the nipples. Figure 5 shows a nipple 17 in section. Nipple 17 has a through channel 47 for the passage of compressed air. Channel 47 has a first section 49 with a first diameter d1 and a second section 51 with a greater diameter d2. The first section 49 is separated from the second section 51 by a flow limiting disc 53 which one or more radial sprung legs 55 projecting from its circumference. These legs 55 grip on the inside of the second section 51 to hold the disc 53 into place. If the pressure in the first section 49 is greater than the pressure in the second section 51 then the disc 53 is pushed against the resilience of legs 55 away from the shoulder 57 at the transition between the first section 49 and the second section 51. Air can then flow through the gap between shoulder 57 and the disc 53. If there is a higher pressure in the second section 51 than in the first section 49 then the disc 53 is pushed against the shoulder 57. Air can then no longer flow through the gap between shoulder 57 and the disc 53. Disc 53 is provided with controlled leakage means such as circumferential grooves or serration 59. These form small openings between the disc 53 and shoulder 57 through which compressed air can leak out. This leakage air can be made to travel at high speed along the walls of the first section 49 and thereby

blow away any dirt or contamination entering the nipple. Naturally similar arrangements can be provided for nipples intended for liquids and female couplings.

While the couplings 17, 17', 19, 19' are shown mounted on opposite sides of body 25 it is also possible that in other embodiments of the invention they could be mounted on the same side (as shown in figure 3) or adjacent sides (as shown in figure 4) and/or on the top and/or bottom surfaces of the body 25. It is also possible that the male couplings can be comprised of a pair of units 39, 41 each having two male parts (e.g. nipples) 43, 43' resp 45, 45' projecting at an angle to each other, e.g. mutually perpendicular, from the cleaning tool. In the example shown in the lateral view of figure 6, male parts 43 project horizontally for co-operation with a docking station 5 while parts 43' project vertically downwards for co-operation with the robot arm 7 which can approach the docking station 5 e.g. from below and then rise up to engage parts 43', 45'.

Thus the coupling means function both as means for enabling the supply of power and/or fluids and as means for retaining the tool on the robot arm and docking station.

In further conceivable embodiments of the invention (not shown) the couplings in each pair of couplings can have the same mutual spacing in order to allow either pair of couplings to be attached to the docking station or robot arm, or they can have different spacings in order to ensure that tool can only be attached in one way to the robot arm or docking station.

While the invention has been illustrated using so-called quick-release couplings it is also possible to use any other sort of coupling means which preferably provide a connection that can both locate and hold the two parts of the connection together and at the same time allow the transmission of power or control signals or the flow of a medium. It is naturally possible to provide the nipples on the robot arm and docking station and the female couplings on the cleaning tool. The invention is not

limited to cleaning tools using two coupling means but can be adapted to any number of coupling means.

While the invention has been illustrated using an air powered motor it is conceivable that any other suitable drive means may be used instead such as an hydraulic motor, vacuum motor, worm-driven motor etc. In the event that an electric motor or other electrical device is used in the cleaning tool it is possible to use releasable electrical coupling means. Electrical motors can be safely used as the cleaning tool is not immersed in a washing machine and hence the risk of damaged seals leading to water coming into contact with electrically live parts is reduced.

Furthermore the invention is not limited to use with robot arms but is also able to be used with teat cleaners mounted on manually movable cleaning arms.

Claims

1. Teat cleaning device, couplable to a movable arm (3), wherein said device comprises a body (25) supporting movable cleaning means (23), drive means (21) for said movable cleaning means (23) and coupling means (17', 19', 43', 45') for co-operation with coupling means (29, 31) on said arm (3) characterised in that said co-operating coupling (17', 19', 29, 31, 43', 45') means comprise coupling means (17', 29) for the power supply (13) for said drive means (21).

2. Teat cleaning device according to claim 1 characterised in that said co-operating coupling means (17', 29) consists of coupling means (17', 29) for the power supply (13) for said drive means (21).

3. Teat cleaning means according to claim 1 characterised in that said device comprises cleaning fluid emitting means (27) wherein said coupling means (17', 19', 29, 31, 43', 45') comprise coupling means (19, 19', 31) for the cleaning fluid supply (15, 15') for said cleaning fluid emitting means (27).

4. Teat cleaning device, couplable to a movable arm (3), wherein said device comprises a body (25) supporting cleaning fluid emitting means (27) and coupling (17', 19', 29, 31, 43', 45') means for co-operation with coupling means (29, 31) on said arm (3) characterised in that said coupling means (19, 19', 31) comprise coupling means (19, 19', 31) for the cleaning fluid supply (15, 15') for said cleaning fluid emitting means (27).

5. Teat cleaning device according to claim 5 characterised in that said coupling means (17', 19', 29, 43', 45') consist of coupling means (9, 19, 19', 31) for the cleaning fluid supply (15, 15') for said cleaning fluid emitting means (27).

6. Teat cleaning device according to any of the previous claims characterised in that said at least one of said coupling means (9, 11, 17, 17', 19, 19', 29, 31) comprise flow limiting means (53).

7. Teat cleaning device according to claim 6 characterised in that said flow limiting means (53) comprises leakage means (59).

8. Teat cleaning device according to any of the previous claims characterised in that said body (23) supports at least two coupling means (17, 17'; 19, 19').

9. Teat cleaning device according to claim 8 characterised in that at least two coupling means (17, 17', 19, 19') are parallel with each other.

10. Teat cleaning means according to claim 8 characterised in that at lease two coupling means (43, 43') are not parallel with each other.

11. Teat cleaning device according to any of the previous claims characterised in that at least one coupling means is a compressed air or vacuum or electricity coupling means (11, 17, 17', 29).

12. Teat cleaning device according to any of the previous claims characterised in that at least one coupling means is a cleaning fluid coupling means (9, 19, 19', 31).

13. Teat cleaning device according to any of the previous claims characterised in that at least one of said coupling means (17) comprises a flow limiting means (53) which prevents or limits flow when said at least one said coupling means (17) is disconnected and which permits flow when said at least one said coupling means (17) is connected to a complementary coupling means (11, 29).

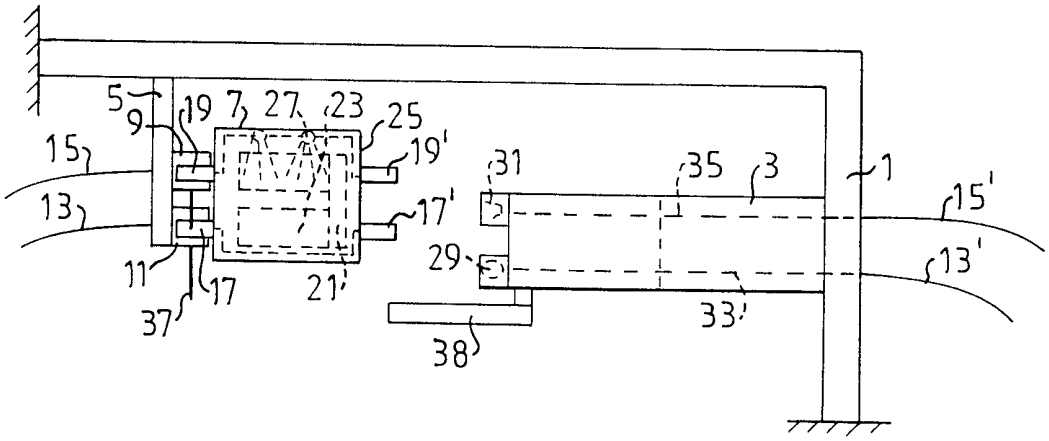


FIG. 1

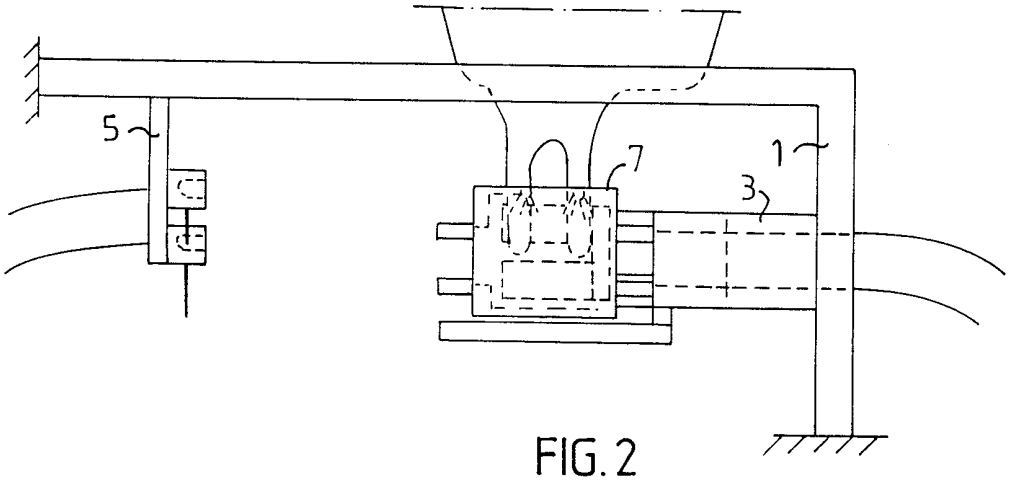


FIG. 2

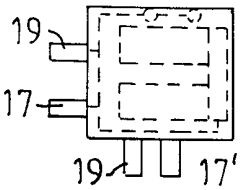


FIG. 3

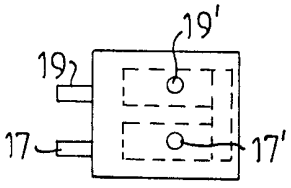


FIG. 4

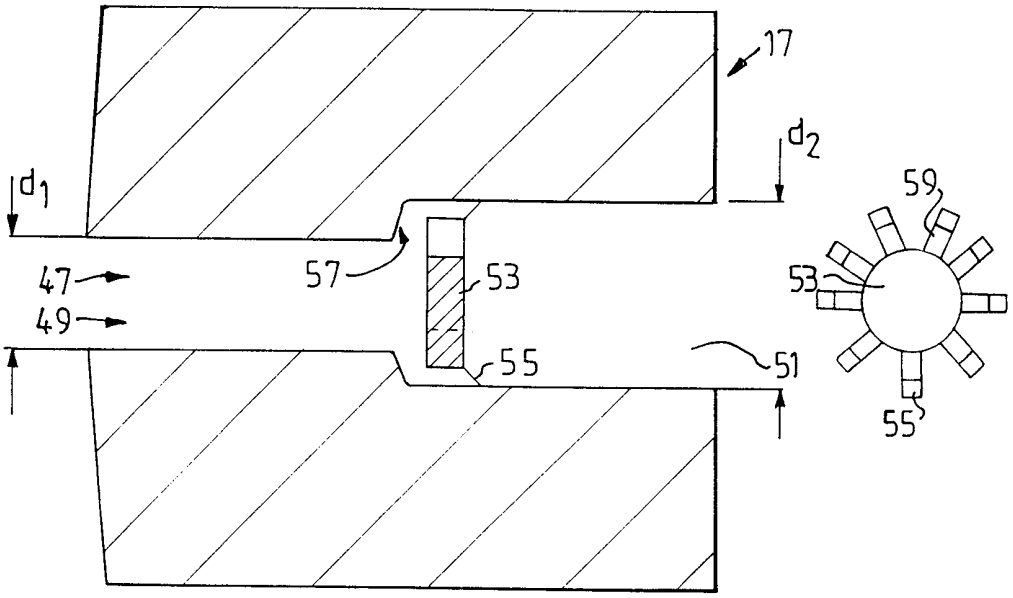


FIG.5

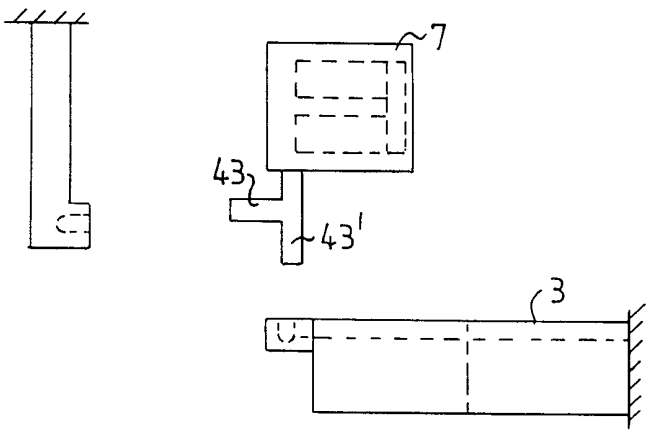


FIG. 6

# INTERNATIONAL SEARCH REPORT

International application No.
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A. CLASSIFICATION OF SUBJECT MATTER

IPC6: A01J 5/017, A01J 7/04 // B25J 15/04
According to International Patent Classification (IPC) or to both national classification and IPC

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C. DOCUMENTS CONSIDERED TO BE RELEVANT

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Information on patent family members

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