



(51) International Patent Classification:
A01J 7/04 (2006.01) *B05B 15/10* (2006.01)

(21) International Application Number:
PCT/NZ2010/000259

(22) International Filing Date:
20 December 2010 (20.12.2010)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
577970 24 December 2009 (24.12.2009) NZ

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(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PE, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

— with international search report (Art. 21(3))

(54) Title: FLUID DELIVERY DEVICE

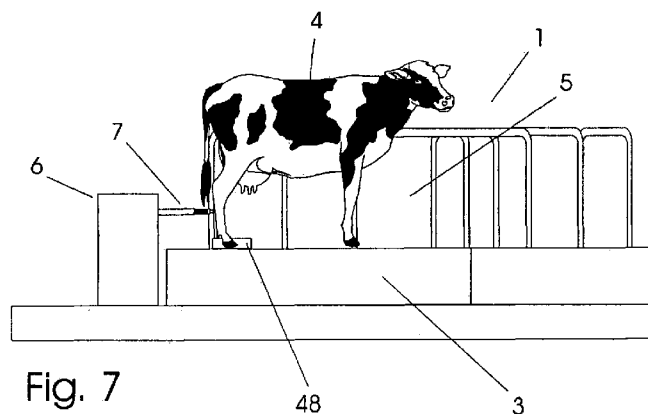


Fig. 7

(57) Abstract: This invention relates to a fluid delivery device for applying fluid to an object, including a spray head a fluid conduit connected to the spray head the device characterised in that there is provided a driver to move the spray head into a spray position relative to the object, wherein the spray head includes a support arm, the support arm including at least a flexible section, an actuator to cause fluid to be sprayed via the spray head, and a control mechanism that ensures that a) the spray head is moved by the driver substantially to an area of the object to be sprayed, b) the fluid is supplied to the spray head once the spray head is in position, and the fluid device actuated, c) the spray head is withdrawn from position after spray has been supplied to the object.

FLUID DELIVERY DEVICE

TECHNICAL FIELD

This invention relates to a fluid delivery device.

Particularly, this invention relates to a fluid delivery device for spraying fluids onto the
5 underside of objects. Most preferably, the objects are milking animals such as cows
and the fluid is sprayed onto the teats. Reference throughout the specification shall
now be made to the present invention being in relation to a teat sprayer. However it
should be appreciated that the principles of the present invention could be applied to
other situations, for example spraying under vehicles, or objects on a factory line.

10 **BACKGROUND ART**

Mastitis is a serious problem within the milking industry and significant research has
been conducted to ameliorate this problem. Mastitis is caused by bacteria infecting
the mammary gland. Mastitis may be clinical (where there are visible signs of
inflammation of the mammary gland or there are changes to the normal colour or
15 consistency of milk); or mastitis may be subclinical where there is no visible changes
to the mammary gland or milk.

Clinical mastitis when detected during lactation is normally treated with antibiotics.
There is in addition to the cost of antibiotic treatment a requirement to with-hold the
milk from supply, until it is clear of any antibiotic residues resulting in lost of milk
20 income.

Subclinical mastitis is normally treated with dry cow antibiotic therapy at dry off. If
clinical or subclinical mastitis is deemed un-curable; the animal is normally culled and

sent to slaughter.

Both forms of mastitis results in significant financial loss to the farmer.

Therefore, it is best if practices can be put into place that prevent mastitis from occurring.

- 5 One such prevention method is the use of teat sanitisation or disinfection that prevents the contamination that occurs from one cow to another through using the same teat cups. Typically bacteria is deposited onto the teat skin by the contaminated teat cup and after milking occurs can migrate down to the teat end and enter the teat canal to cause a mastitic condition. This may occur as a consequence
- 10 of being contacted with contaminated teat cups or merely from the environment in which the animals are kept.

Currently, there are two main methods by which teats are disinfected.

In countries that have smaller herds with high labour content, teats are disinfected by dipping teats in disinfectant.

- 15 The teat dipping process requires each teat to be dipped in turn until all four teats have been dipped.

In countries that have a lower labour content and larger herds (such as New Zealand and Australia) the teats are sprayed.

- The teat spraying process involves spraying disinfectant on to all four teats at the
- 20 same time and therefore this is less time consuming than teat dipping. In most cases, teat spraying and dipping are manual processes requiring high labour input which leads to expense and time. Further, the effectiveness of the operation is dependent

on the diligence of the operator – which may be variable.

To address these issues, automated teat spraying systems have been developed, however these have problems associated with them.

One type of automated spray system is situated in the race and can spray the cow
5 either prior to or after the cow enters the milking shed. The spray nozzles are located
on the floor of the race and are triggered by a sensor.

However, in this situation the cow is moving in relation to the spray unit thus,
dependent upon the speed of the cow movement, the delivery of the spray can vary.
This mistimed spray can result in uneven coverage, insufficient spray delivered or
10 even a complete miss.

Further, as a consequence of the spray unit being floor mounted a significant volume
of disinfectant is required to be used to ensure that the spray reaches teats.

Yet another problem associated with race spray systems is the effect of wind drift
which can cause some or all of the disinfectant solution to miss the teats. An
15 alternative to spraying teats in the race is to spray while the cows in the milking shed.

Currently, there are three main types of milking sheds utilised.

One is the herringbone shed whereby there is a number of stationary bales
surrounding a milking pit from which the farmer places the teat cups on to the cows.

Another system is the use of rotary platforms whereby the cow enters the platform
20 which rotates (usually one full rotation per milking cycle – depending on the cow), and
then exists the platform.

Finally, robotic milking systems have been gaining in popularity, particularly in Europe. This system has only one set of teat cups which animals approach in accordance with the animals whim, rather than being herded for mass milking as with the other systems.

- 5 As you can see, the position of the cow is known in relation to all of these systems. However, existing devices have a fixed location spray head or the floor which unfortunately is usually positioned too far away in relation to the cows teats making it difficult to spray the cows teats successfully.

- With the herringbone system, or a rotary system, it could be possible to have
10 individual spray heads in each bale. However this is an expensive means in terms of set up costs and maintenance.

New Zealand Patent Number 502723 describes how an existing rotary platform can be modified by cutting apertures in front of the platform. The spray head is then mechanically timed to rise through the aperture and spray the teat/udder.

- 15 Modifying a rotary platform to include this device requires the apertures to be cut in the platform and the mechanical system installed during manufacture for new installations. A retrofit installation into an existing dairy shed would require apertures to be accurately cut into the platform and the mechanical timing system installed. As can be appreciated, this exercise is likely to be too expensive and time consuming.

- 20 Further, by having spray heads located at or just above the floor of the platform can still have problems as described previously if poor coverage or excess amounts of sanitizer is being used due to the distance between the teats and the spray nozzle.

It is therefore an object of the present invention to address the above problems or at least to provide the public with a useful choice.

All references, including any patents or patent applications cited in this specification are hereby incorporated by reference. No admission is made that any reference
5 constitutes prior art. The discussion of the references states what their authors assert, and the applicants reserve the right to challenge the accuracy and pertinency of the cited documents. It will be clearly understood that, although a number of prior art publications are referred to herein, this reference does not constitute an admission that any of these documents form part of the common general knowledge in the art, in
10 New Zealand or in any other country.

Throughout this specification, the word "comprise", or variations thereof such as "comprises" or "comprising", will be understood to imply the inclusion of a stated element, integer or step, or group of elements integers or steps, but not the exclusion of any other element, integer or step, or group of elements, integers or steps.

15 Further aspects and advantages of the present invention will become apparent from the ensuing description which is given by way of example only.

DISCLOSURE OF THE INVENTION

According to one aspect of the present invention there is provided a fluid delivery device for applying fluid to an object, including

20 a spray head

a fluid conduit connected to the spray head

the device characterised in that there is provided a driver to move the spray head into a spray position relative to the object, wherein the spray head includes a support arm, the support arm including at least a flexible section

an actuator to cause fluid to be sprayed via the spray head, and

5 a control mechanism that ensures that

- a) the spray head is moved by the driver substantially to an area of the object to be sprayed,
- b) the fluid is supplied to the spray head once the spray head is in position, and the fluid device actuated,
- 10 c) the spray head is withdrawn from position after spray has been supplied to the object.

According to another aspect of the present invention there is provided a method of applying fluid to an object with a fluid delivery device,

wherein the fluid delivery device includes a spray head

15 a fluid conduit connected to the spray head

a driver configured to move spray head into spray position relative to the object, wherein the spray head includes a support arm, the support arm including at least a flexible section,

an actuator to cause fluid to be sprayed via the spray head

20 a control mechanism

the method characterised by the steps of

- a) moving the spray head by the driver substantially to an area of the object to be sprayed, and
- b) supplying fluid to the spray head once the spray head is in position, and
- 5 c) actuating the fluid device,
- d) withdrawing the spray head from position after spray has been supplied to the object.

In preferred embodiments of the present invention, the object that is most likely to be used with the fluid delivery device is a milking animal such as a cow. However, the
10 present invention could be used in other situations and this should not be seen as limiting.

Reference throughout the specification shall now be made to the present invention as being a teat sprayer. Again however this could be used for spraying other parts of the cows anatomy as required.

15 It is envisaged that in most embodiments of the present invention that the fluid being sprayed would be a sanitizer or disinfectant. However, the present invention could be used to spray other fluids, for example palliatives, dye or even water.

It is envisaged that the spray head would be any suitable nozzle that would provide sufficient coverage of fluid onto the teats. Such spray nozzles are well known in the
20 industry.

The fluid conduit can be in a variety of forms, its main function being to convey fluid to the spray head. In one embodiment, the fluid conduit may form part of a support arm

which acts to hold the spray head when in operation. Alternative embodiments may have a separate support arm to the fluid conduit with a conduit being a hose or the like depending from the spray head supported by the arm.

Reference throughout the specification will be made to a teat sprayer having a
5 support arm for the spray head which includes the fluid conduit.

A preferred embodiment of the present invention, the support arm includes a flexible section which may form part or all of the support arm.

The purpose of having a flexible section is to minimise damage to the teat sprayer, cow or milking system if any of these are hit by the flexible section.

10 For example, in the preferred embodiment of the present invention, the present invention is used in relation to a rotary platform. Thus, it is possible that movement of the platform relative to the sprayer could at some occasions cause the support arm to impact upon the bales of the platform or cow legs. Thus, a flexible section can minimise damage occurring as a result. Further, it could be that the cows own
15 movements could impact upon the sprayer.

In other embodiments of the present invention it may be that the teat sprayer is used in relation to a herringbone system whereby the teat sprayer could travel along the outside of the lines of cows being milked. Again, having a flexible section could prevent damage occurring if accidentally the arm impacted on a bale or the cows leg.

20 The flexible section may be provided by a number of means. In one embodiment, there is provided a coil at or near the end of the support arm. A flexible hose or sufficiently small fluid conduit may be positioned within the coil such that if the coil flexes with impact, the hose is largely unaffected.

However, the flexible section may be constructed differently. For example, this may be in the form of an articulated arm or a solid tube in a rubber like material. The main requirements of the flexible section is that it can deflect sufficiently if hit, but is sufficiently strong and rigid to support and locate the spray head.

- 5 The driver to move the spray head may come in a number of forms. In one embodiment this may be at least one ram, say pneumatic or hydraulic rams as these are robust enough to withstand the milking shed environment.

Alternate embodiments of the present invention may have the driver swing the support arm and spray head in position. For example, the motion of the spray head
10 may not be relative to the horizontal plane of the milking shed floor or platform, but may have an arcuate motion being suspended from a pivot point above or below the cows udder.

An important thing to note is that as the present invention can move the spray head into position relative to the cow, a single teat sprayer can be used in relation to a
15 milking shed. This saves considerable expense and obviates the need to modify existing milking platforms to receive a teat sprayer.

The sprayer position is critical to the present invention.

The purpose of having a movable spray head is to ensure that the spray head can be placed in such a position to give optimum coverage of spray on the cow teats without
20 any of the problems identified previously – particularly with floor mounted sprayers. Thus, it is envisaged that the spray head will be positioned significantly above the floor during operation of the teat sprayer.

In preferred embodiments, the spray head is designed to spray forward and upwards of the spray arm. This way, the spray head can be positioned to optimise spray coverage of the cows teats.

In preferred embodiments the spray head extends past the cows legs.

- 5 It should be appreciated that there is considerable variability in cow anatomy and therefore in preferably the position of the spray head is adjustable both vertically and horizontally so that it can be positioned to achieve full coverage of all teats of the animal.

- 10 It is also envisages that with preferred applications of the present invention, a leg spreader would be utilised. This is usually in the form of a block of plastics material place on the ground between the cows legs. Its configuration is generally difficult to stand on – thus it is a simple way to keep the cows legs separate for spraying.

In one embodiment, the position of the spray head relative to the animal is determined through feedback from sensors on the position of the animals udder.

- 15 However in preferred embodiments the spray activation and spray head positioning is timed.

- Numerous other sensors and control mechanisms may be used with the present invention. These can be used to regulate parameters such as position of the spray head, pressure of the fluid delivered to the spray head, flow rate of the fluid as well as
20 information that the location and position of an animal in the stall including hind legs, udder and so forth.

In one embodiment, there may be provided a simple sensor system that indicates when a stall has an animal therein and that can be used to activate the teat sprayer.

Sensor systems can include any of photo-electric sensors, proximity sensors, ultrasonic sensors, electro-mechanical switches to sense cow's presence, bail position and cups on.

5 The timing and the amount of spray to be delivered can depend on a number of factors. In one embodiment, there may be trigger signals. For example, the support arm may pass through a first trigger point as it moves towards an operational position. Then the actuator either immediately or after a set time or distance causes fluid to be pumped through the spray head. Upon withdrawal of the spray head from the cow, a second trigger signal may be generated thus causing the supply of fluid to the spray
10 head to be terminated.

Timing adjustments may be made by buttons on a control panel. These timings are Spray time, Extend time and Spray Start delay time.

However, in other embodiments control of the fluid might be by a certain amount of time or volume of spray being supplied to the udder area.

15 In a particular embodiment of the present invention, the disinfectant being sprayed may be coloured and there could be an optical sensor that determines when sufficient coverage of the udder has been achieved or whether the correct concentration of spray solution is being used.

It can be seen that the present invention has a number of advantages over the prior
20 art. Firstly, by being able to position a spray head relative to the udder, rather than relying on a floor position spray head adequate coverage of the udder is readily achieved.

Further, the present invention allows for a single teat sprayer to be used in relation to a milking shed, rather than having individual teat sprayers per stall.

Another advantage is that existing milking platforms do not have to be modified to install the teat sprayer. This can be added as a stand alone device.

- 5 A teat sprayer is also less likely to be damaged in the rugged environment of a milking shed as preferred embodiments have a flexible section in the support arm for the spray head.

Finally, the present invention is capable of being fully automated thus removing all of the problems associated with the manual application of disinfectant through either teat
10 dipping or spraying.

BRIEF DESCRIPTION OF DRAWINGS

Further aspects of the present invention will become apparent from the following description which is given by way of example only and with reference to the accompanying drawings in which:

- 15 Figure 1 is a plan view of a rotary milking platform without ancillary equipment with a cow in one stall and the automatic teat sprayer;
- Figure 2 is a side view of the automatic teat sprayer in isolation;
- Figure 3 is a side view of the spray unit separated from the automatic teat spray;
- Figure 4 is a cross sectional view of the spray unit in the retracted (rest)
20 position;
- Figure 5 is a cross sectional view of the spray unit in the extended position;

Figure 6 is a side view of a quadrant of the rotary milking platform in the direction of arrows A -A with the automatic teat sprayer in the rest position;

5 Figure 7 is a side view of a quadrant of the rotary milking platform in the direction of arrows A -A with the automatic teat sprayer in the extended position;

Figure 8 is a pictorial diagram of the control system including sensors.

BEST MODES FOR CARRYING OUT THE INVENTION

10 Referring to Figure1 a rotary milking platform (1), of known type, including a number of stalls (2) mounted on a moving platform (3). A cow (4) is shown in a first stall (5) and an automatic teat sprayer (6) is shown mounted on a non moving part of the rotary milking platform (1). The automatic teat sprayer (6) could equally be mounted on a stationary surface alongside the milking platform (1).

15 It should be noted that though the term cow (4) is used herein it is intended to cover any animal that is similarly milked; for example goats, sheep, water buffalo, horses, camels, reindeer, moose, etc, where this milking occurs (or could occur) on a moving platform (3).

Referring to Figure2 the automatic teat sprayer (6) including a spray unit (7) and housing (8) is shown. The housing (8) supports and locates the spray unit (7) at the correct vertical and horizontal location. The housing (8) includes means (not shown) 20 of known type to adjust the vertical and horizontal position of the spray unit (7) ready for use. In this embodiment the housing (8) is releasably, but rigidly, fixed to a non

moving part of the milking platform (1) or stationary surface alongside the milking platform (1).

Referring to Figures 3 to 5 the spray unit (7) including a spray head (10), flexible section (11), extending section (12) and mounting section (13) is shown separated from the housing (8). The spray head (10) is connected to a first end (15) of the flexible section (11) which, by a second end (16), is connected to a primary end (17) of the extending section (12). The first and second ends (15,16) are opposite ends of the flexible section (11). The extending section (12) includes a secondary end (18) such that the primary and secondary ends (17,18) are the distal ends of the extending section (12).

The flexible section (11) is a coil spring of known type, is rigid and strong enough to support and locate the spray head (10), but resilient enough to deflect if hit by the cow, (4) or part of the milking platform (1), without significant damage to either.

The mounting section (13) includes two separated bushes (20,21), a casing (22) and an extension means (23). The bushes (20,21) and extension means (23) are inside the casing (22), which is a hollow prism. Each bush (20,21) is a hollow prism attached to an inner surface (25) of the casing (22). Each bush (20,21) includes an aperture (26) dimensioned to be a sliding fit with the extending section (12). The bushes (20,21) casing (22) and extending section (12) have coincident centrelines.

The extension means (23) includes a fixed section (30), an extender (31) and a connector (32). The connector (32) is attached to an inner surface (33) of the extending section (12), and the fixed section (30) is connected to the mounting section (13) by known means. The extension means (23) for this embodiment is a

hydraulic or pneumatic ram, with the fixed section (30) being the barrel, and the extender (31) being the piston.

The mounting section (13) is attached to the housing (B) by known means, for example rigid or flexible fixings such as nuts and bolts, welds, rubber bushes, pins,
5 clamps etc.

The spray unit (7) also includes a flexible pipe (35) which runs along the inside of the spray unit (7) and connects the spray head (10) to a feed tank (not shown). The feed tank contains a fluid to be sprayed onto the cow's (4) udder or teats.

The spray head (10) includes a spray nozzle (40) and mounting block (41). The spray
10 nozzle (40) is attached to the mounting block (41), and is adapted to deliver the fluid from the feed tank to the cow's (4) udder or teats.

Referring to Figures 6 and 7 a preferred means of operation is shown. The cow (4) Being carried around by the moving platform (3) arrives at the teat spraying station. The moving platform (3) includes leg spreaders (48) which due to their dimensions
15 and shape force the hind legs of the cow (4) to be spread apart.

The automatic teat sprayer (6) detects the arrival of the cow (4), or the first stall (5), and extends the extending section (12) from a rest position to an extended position. The fluid is sprayed onto the cow's (4) teats through the spray nozzle (40) during its movement from its resting position through to its extended position and back to its
20 rest position. The first stall continues moving to bring the next stall (2) into line, noting that the movement of the stall is not controlled by the automatic teat sprayer (6).

In use the spray head (10) passes beyond the hind legs of the cow (4). The spray nozzle (40) directs the spray between the hind legs and onto the teats of the cow (4).

Referring to Figure 8 a control system (49) including a control unit (50), sensors (51,52,53), input/control lines (54,55) to/from the spray unit (7) and inputs (56,57) from the milking platform (1) are shown. The sensors (51,52,53) are sensors of a known type and could include sensors such as infra red/ultrasonic/microwave or pressure sensors which detect the location of the cow (4), position sensors such as reed switches (or similar magnetic switches) / micro switches / pressure sensors / switches or optical sensors that detect or report the position of the stall or cow, photographic or video sensor to locate the cow (4) or similar. The input/control lines (54,55) from the spray unit transfer information such as the position of the spray head (10), the level of fluid in the feed tank, the pressure in any hydraulic lines, the pressure of the fluid in the flexible pipe (35) and/or control information to the extension means (23) and feed tank pump/valves (not shown). The inputs (56,57) from the milking platform (1) can include an indexing signal that indicates the position of the stall, a stall occupancy indication and a leg spreader (48) indication (i.e. an indication if the cows (4) legs are wide enough apart for spraying to occur).

In use the control unit (50) receives a signal from one or more of the sensors (51,52,53) and determines there is an animal in the stall. The control unit then extends the extending section (12) from the rest position to the extended position and back to the rest position as the animal moves past. As the extending section (12) extends one or more of the sensors (51,52,53) detects the point at which spraying should commence, the first trigger position, and sends a signal to the control unit (50) which initiates the fluid flow to the spray nozzle (40). The extending section (12) continues to move to the extended position, spraying the animals teats, then returns. On the return stroke of the extending section (12) one or more of the sensors

(51,52,53) detects a point at which spraying should stop, the second trigger point and sends a signal to the control unit (50) which then shuts off the fluid flow to the spray nozzle (40) and stops spraying the teats. The extending section (12) continues moving until it has returned to the rest (retracted) position ready for the next occupied stall.

In an alternative embodiment, in use the spray head (10) does not pass beyond the hind legs of the cow (4) and the fluid is sprayed onto the teats of the cow (4) on both the movement to its extended position and its movement back to the rest position. This minimises the likelihood of damaging the cow (4) if the spray cycle is mistimed.

10 In an alternative embodiment the housing (8) is rigidly, and semi-permanently or permanently fixed to a stationary surface on or away from the milking platform (1).

In an alternative embodiment (not shown) the bushes (20,21) are part of the outer surface of the casing (22) and an inner surface of the extending section (12) is dimensioned and configured to slidingly engage with an outer surface of the bushes (20,21).

15 In an alternative embodiment the flexible section (11) is a strip of resilient material, thick walled tube of resilient material or similar.

In an alternative embodiment the movement of the milking platform (1) is timed wholly, or in part by the automatic teat sprayer(6).

20 In an alternative embodiment sensors (51,52,53) determine the height of the udders and teats and adjust the vertical plane of the spray head (10) accordingly.

In an additional embodiment at least one sensor (51,52,53) determines the position of the animal (4) and the control unit(5) adjusts the path of the spray head (10) for optimum coverage.

Aspects of the present invention have been described by way of example only and it
5 should be appreciated that modifications and additions may be made thereto without departing from the scope of the appended claims.

WHAT WE CLAIM IS:

1. A fluid delivery device for applying fluid to an object, including

a spray head

a fluid conduit connected to the spray head

the device characterised in that there is provided a driver to move the spray head into a spray position relative to the object, wherein the spray head includes a support arm, the support arm including at least a flexible section,

an actuator to cause fluid to be sprayed via the spray head, and

a control mechanism that ensures that
 - a) the spray head is moved by the driver substantially to an area of the object to be sprayed,
 - b) the fluid is supplied to the spray head once the spray head is in position, and the fluid device actuated,
 - c) the spray head is withdrawn from position after spray has been supplied to the object.
2. A fluid delivery device as claimed in claim 1 wherein the support arm includes a fluid conduit.
3. A fluid delivery device as claimed in either claim 1 or claim 2 wherein the flexible section is in the form of a coil.

4. A fluid delivery device as claimed in any one of claims 1 to 3 wherein the driver is in the form of at least one ram.
5. A fluid delivery device as claimed in any one of claims 1 to 4 configured to be positioned significantly above the floor during operation of the fluid delivery device.
6. A fluid delivery device as claimed in any one of claims 1 to 5 wherein the spray head is designed to spray forward and upwards of the support arm.
7. A fluid delivery device as claimed in any one of claims 1 to 6 configured such that the spray activation and the spray head positioning is timed.
8. A method of applying fluid to an object with a fluid delivery device,

wherein the fluid delivery device includes a spray head

a fluid conduit connected to the spray head

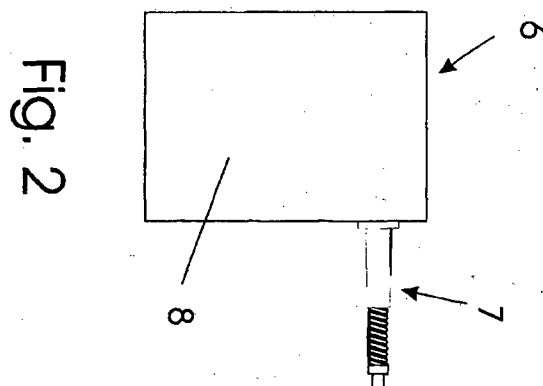
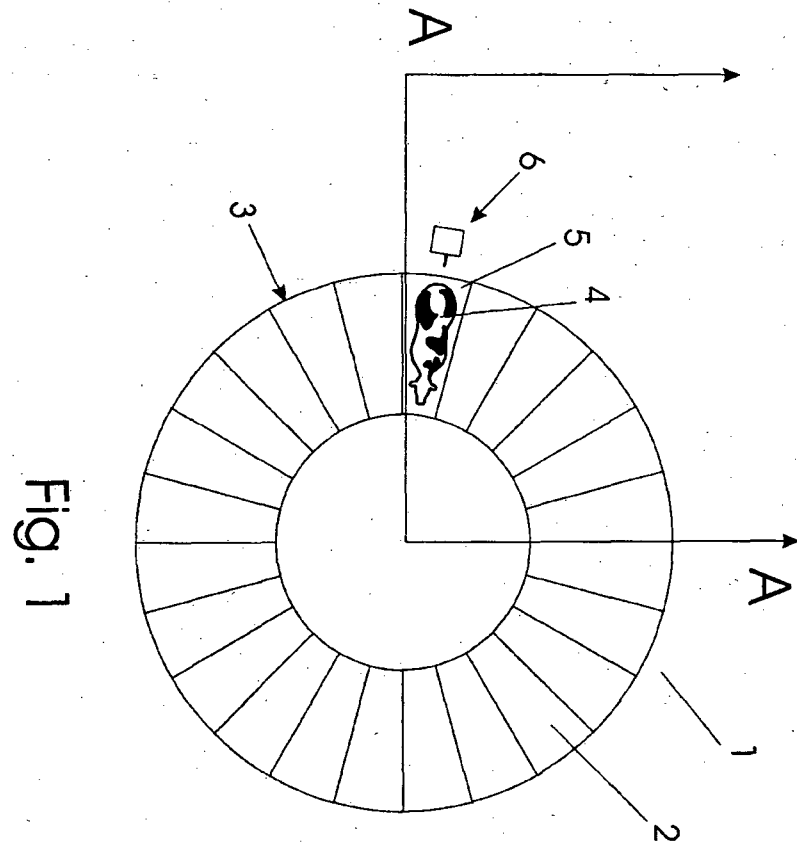
a driver configured to move spray head into spray position relative to the object,
wherein the spray head includes a support arm, the support arm including at least a flexible section,

an actuator to cause fluid to be sprayed via the spray head,

a control mechanism

the method characterised by the steps of
 - a) moving the spray head by the driver substantially to an area of the object to be sprayed, and

- b) supplying fluid to the spray head once the spray head is in position, and
 - c) actuating the fluid device,
 - d) withdrawing the spray head from position after spray has been supplied to the object.
9. A method as claimed in claim 8 wherein the object is a cow.
10. A method as claimed in either claim 8 or claim 9 wherein the object are the teats of a milking animal.
11. A method as claimed in any one of claims 8 to 10 wherein the fluid is a sanitizer.
12. A method as claimed in any one of claims 8 to 11 wherein the method is operated in relation to a rotary milking platform.
13. A method as claimed in anyone of claims 8 to 12 wherein the operation of the fluid delivery device is timed.
14. A method as claimed in anyone of claims 8 to 13 wherein the steps of operation are controlled through the use of trigger points.
15. A fluid delivery device substantially as herein described with reference to and as illustrated in the Best Modes section of the specification.
16. A method of applying fluid to an object with a fluid delivery device substantially as herein described with reference to and as illustrated in the Best Modes section of the specification.



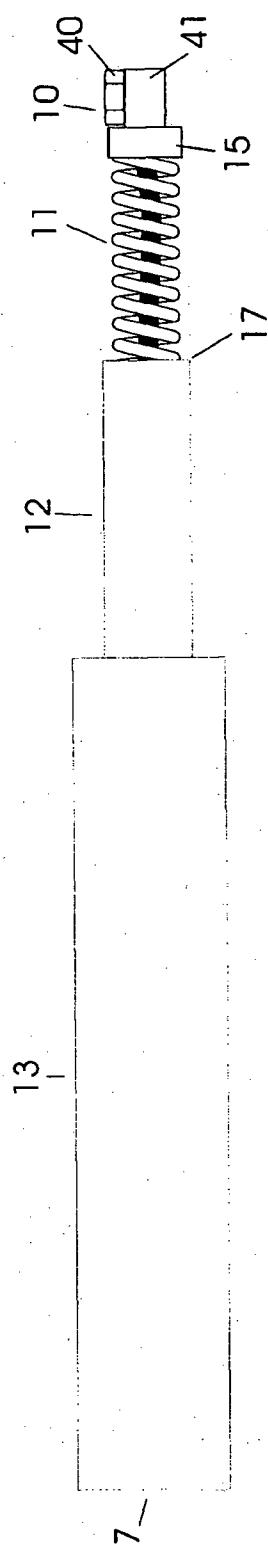


Fig. 3

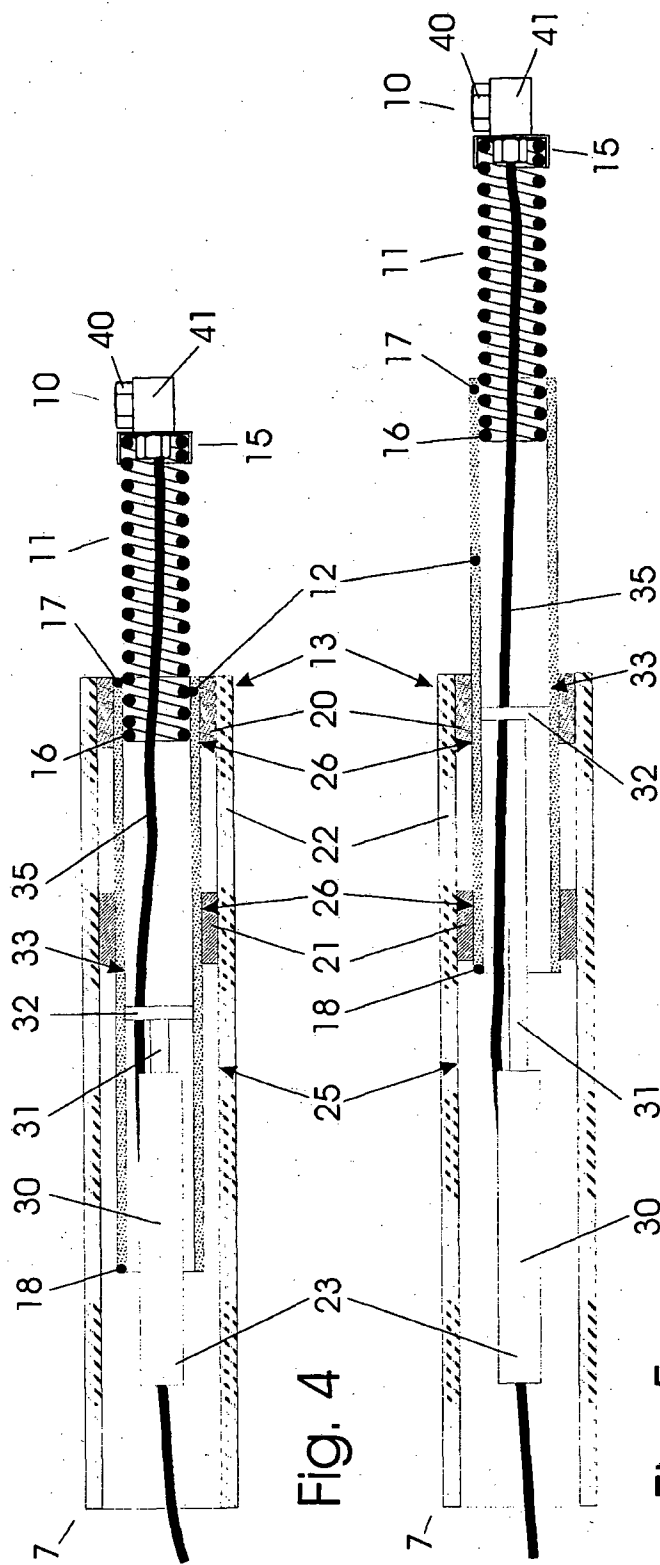


Fig. 4

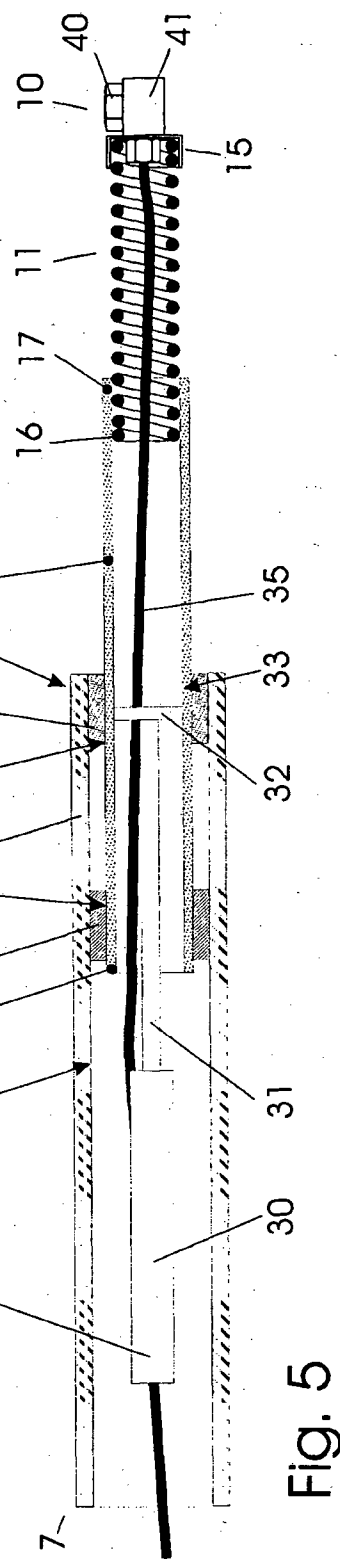


Fig. 5

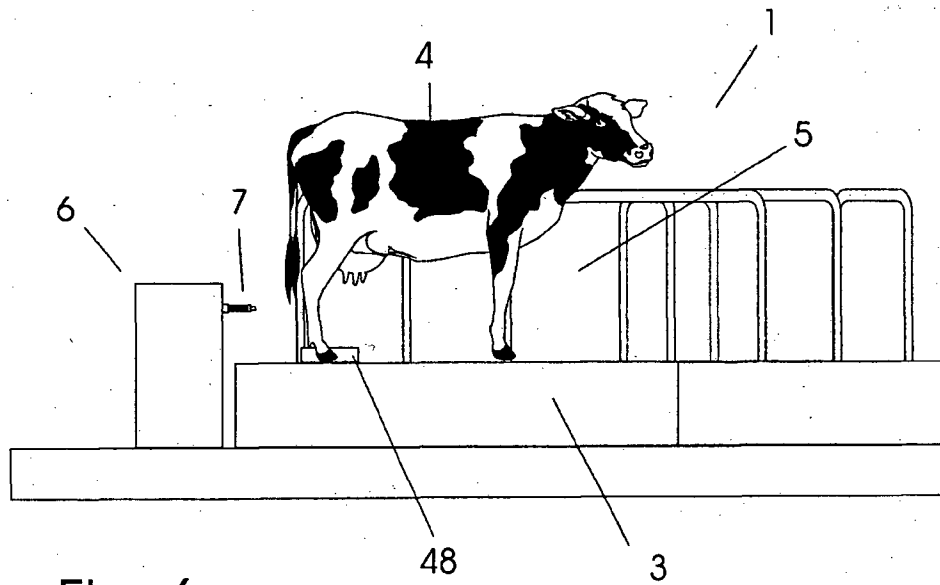


Fig. 6

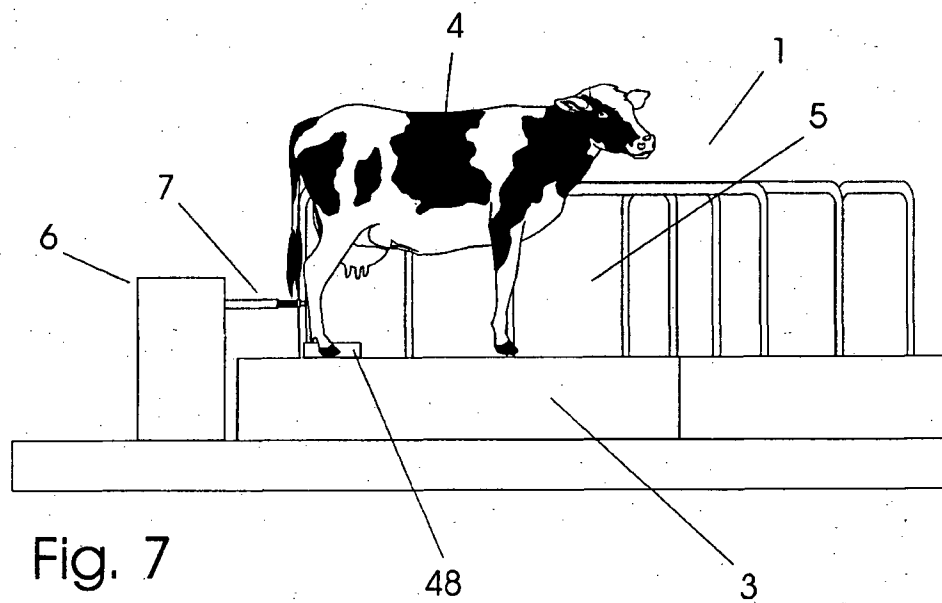


Fig. 7

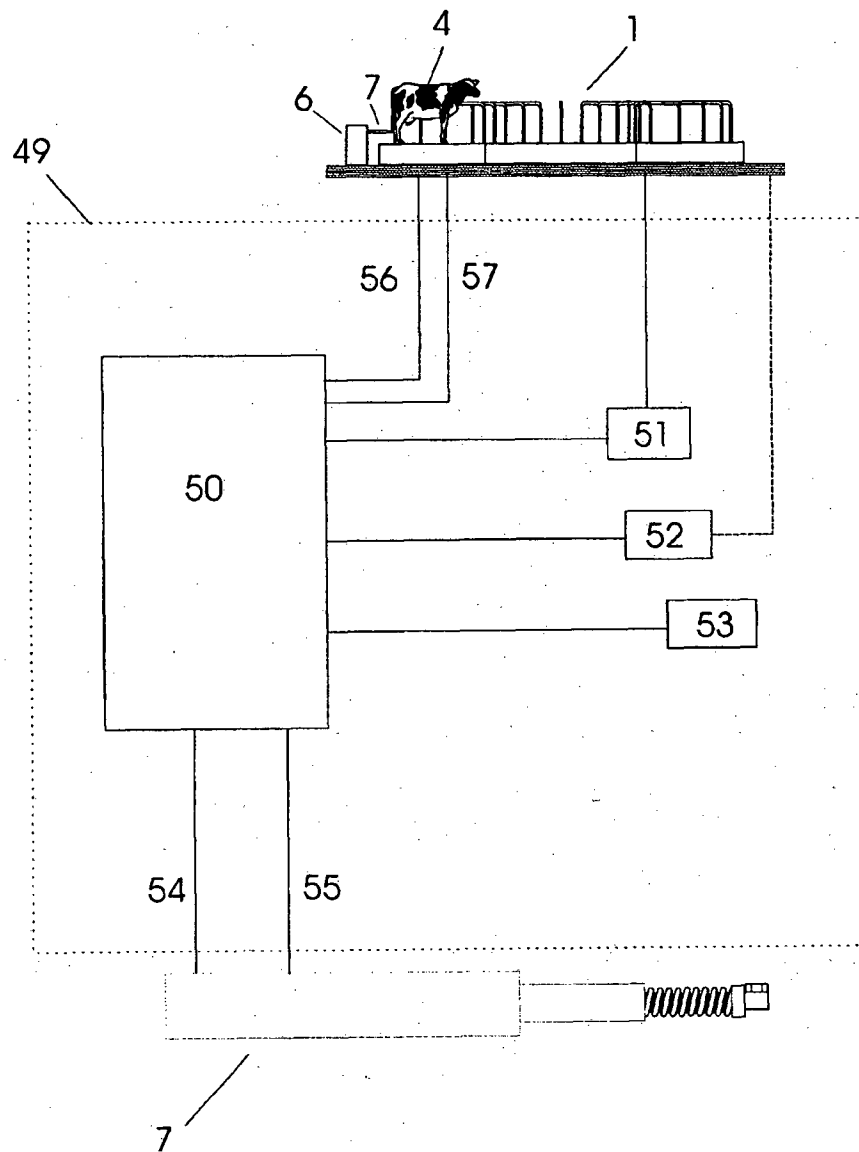


Figure 8.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/NZ2010/000259

A. CLASSIFICATION OF SUBJECT MATTER

Int. Cl.

A01J 7/04 (2006.01)

B05B 15/10 (2006.01)

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)

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

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

WPI; EPODOC: class marks: A01J 7/04, b08b3/02, b05b12, b05b3, b05b15/10, b05b15/06, b05b15/08 and keywords: spray; head, move, withdraw, retract, position, reciprocate, control, automatic, actuate.

Google Patents; Patent Lens: with various combinations of above mentioned keywords.

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 6443094 B1 (DeWAARD) 03 September 2002 Abstract; figs. 1-9; col. 1, lines 40-53; col. 2, line 58 – col. 3, line 4; col. 5, lines 43-51	1-14
X	US 6394029 B1 (BOWERS) 28 May 2002 Abstract; figs.; col 2, line 16 – col. 3, line 17; col. 5, lines 39-49.	1-14
X	GB 1415318 A (HOSIER EQUIPMENT) 26 November 1975 Page 1, L.H.S. col. Lines 27-37; page 1, R.H.S. col. Line 69 – page 2, L.H.S. col. Line 57; fig. 1	1-14
A	EP 1384400 A2 (A.M. De ROOY Bv) 28 January 2004 Whole document	



Further documents are listed in the continuation of Box C



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	"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
"E" earlier application or patent but published on or after the international filing date	"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
"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)	"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
"O" document referring to an oral disclosure, use, exhibition or other means	"&" document member of the same patent family
"P" document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search
22 February 2011Date of mailing of the international search report
25 FEB 2011

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Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☒ Claims Nos.: **15, 16**
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
The claims do not comply with Rule 6.2(a) because they rely on references to the description and/or drawings.
3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a)

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- ☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- ☐ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/NZ2010/000259

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report				Patent Family Member			
US	6443094	AU	20885/01	CA	2336838	WO	0141560
US	6394029	AU	35398/00	NZ	502723		
GB	1415318	NONE					
EP	1384400	NONE					
Due to data integration issues this family listing may not include 10 digit Australian applications filed since May 2001.							
END OF ANNEX							