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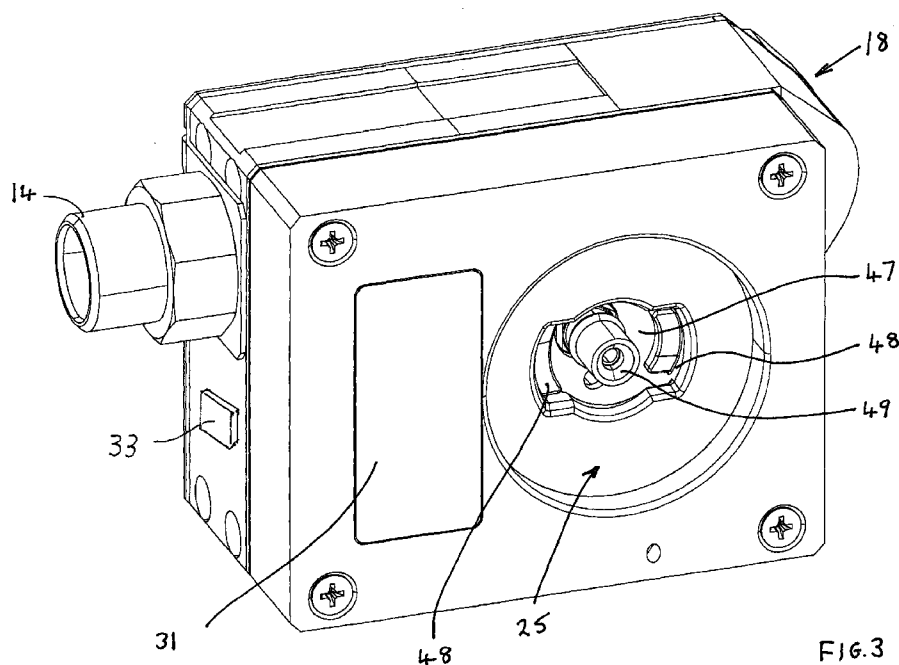
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(54) Title: APPARATUS FOR AND OPERATION OF A LIQUID FLOW CIRCUIT CONTAINING A CHEMICAL ADDITIVE



(57) Abstract: A liquid flow system (10) comprises a dosing device (18) for introduction of a chemical additive into a liquid flow circuit, said dosing device comprising an inlet port (25) in fluid communication with the liquid flow circuit and a container (30) of chemical additive secured or adapted to be secured to said inlet port, said container comprising a radio frequency identification (RFID) device (50,51) which stores data of a parameter related to the correct operation of the liquid flow circuit, and the system comprising a communication device (33) to receive data from the container whereby the liquid flow system is responsive to data received by the communication device.



MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM,
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APPARATUS FOR AND OPERATION OF A LIQUID FLOW CIRCUIT CONTAINING A CHEMICAL ADDITIVE

This invention relates to the operation of and apparatus for a liquid flow circuit, such as the closed circuit of a central heating or cooling system, in which the circulated liquid, typically water or a water-based liquid, contains a chemical additive such as an additive selected to inhibit corrosion within the system and or the formation of scale deposits which potentially would reduce the efficiency of the system.

The liquid flow circuit may be that of a system which comprises a heat source such as a boiler and one or more heat emitting units such as radiators, or which comprises a cooling system comprising one or more heat extraction units.

A feature of closed circuit type heating and cooling systems is that it is necessary to fully or partially drain the system in the event of a system component, such as a central heating boiler, a radiator or heat extraction unit needing to be removed or replaced.

A problem which then arises is that often the system is re-filled or topped up only with water and either lost inhibitor is not replaced or an incorrect type of inhibitor is added to the system. Thus the system is then operated without any inhibitor in the case of a system that has been fully drained, or with only an excessively diluted solution or incorrect inhibitor in the case of a system which has been partially drained. In either case the system components are then exposed to a heightened risk of corrosion and or scale formation.

Similarly, for example, there is the risk of an incorrect additive instead of an appropriate cleaning fluid being employed during a system flushing operation

The present invention seeks to provide apparatus for and a method of operation of a liquid flow system which requires the introduction of a chemical additive such as a corrosion inhibitor or a cleaning solution.

In accordance with one aspect of the present invention a liquid flow system comprises a liquid flow circuit and a dosing device for introduction of a chemical additive into the liquid flow circuit, said dosing device comprising an inlet port for fluid communication with the liquid flow circuit and a container of chemical additive removably secured or adapted to be removably secured to said inlet port, said container comprising a Radio Frequency Identification (RFID) device which stores data of a parameter related to the correct operation of the liquid flow circuit, and the system comprising a communication device to receive data from the container whereby the liquid flow system is responsive to data received by the communication device.

The dosing device may be permanently secured to the liquid flow circuit or be removable therefrom. A valve may be provided between the dosing device and liquid flow circuit whereby the dosing device may be isolated from fluid communication with the liquid flow circuit.

The liquid flow circuit may be a closed loop pressurised type circuit.

The RFID device may, for example, store data related to one or more of the identity of chemical within the container, date of filling of the container, pressure of chemical in the container, volume of the container, volume of chemical remaining in the container when part used, whether the container should be replaced or whether the container should be rendered non reusable.

The communication device may be an integral part of the dosing device or may be separate therefrom and in either wired or wireless communication with the dosing device.

In addition to the communication device being able to receive data from the container it may be operable to transmit data to the container. Thus, for example, the communication device may be operable to send to the RFID device a status report related to the volume of chemical supplied from the container to the dosing device, or volume of chemical remaining. It may be

operable to cause the RFID device to record the container as used or non-reusable, for example when all or substantially all chemical has been dispensed from the container, whereby subsequent use of the container in the same or another system is inhibited.

The RFID device may comprise an active type tag or a passive type tag.

A part of the system, for example the communication device or the dosing device, may comprise a charging circuit operable to provide power to the RFID device by electromagnetic induction. The container may have secured thereto an RFID device which comprises an RFID chip and a wire coil which acts both as an aerial and to receive power for the chip by electromagnetic induction.

The system may comprise an alarm or other visual or audible alert to signal the need to replace a container, for example if a container has become empty or is a container containing an incorrect type of chemical for use in the liquid flow circuit or insufficient chemical additive to provide the required level of concentration.

The system may comprise a data store in communication with the communication device or dosing device and which stores data related to the type(s) of chemical appropriate for use in the system. The data store may be responsive to information related to the operational phase of the liquid flow system, for example whether the system is being flushed with cleaning fluid or is being filled or topped up with chemical additive for long term corrosion inhibition.

The communication device may be operable to transmit to a remote server, such as a cloud based server, information received by or transmitted from the communication device, for example to or from the RFID device or a separate monitoring device that monitors the concentration of additive in the system or a parameter related to that concentration.

A monitoring device may be operable to provide information to the dosing device relating to the required quantity of chemical additive to be introduced into the liquid flow circuit and/or the monitoring device may be operable to receive information from the dosing device in respect of the quantity of chemical additive that has been introduced into the liquid flow circuit. The dosing device may be operable automatically to introduce chemical additive into the liquid flow circuit in response to a signal from the monitoring device or it may be manually operable.

The container of chemical, typically a liquid chemical, may have the RFID device, such as a chip and coil, directly secured thereto. The container may comprise an adaptor for securing the container to the dosing device and the RFID device may be secured to the adaptor. The adaptor, irrespective of whether or not it supports an RFID device, may be positioned in use to lie between a pressurised body of the container and the inlet port of the dosing device.

The adaptor may comprise a retention formation whereby it may be a click type fit to the container body and may engage with the container body in a manner that permits relative rotation of the adaptor and container body. Alternatively the adaptor may be non-rotatable relative to the container body.

The adaptor preferably is non removable from the container body. The retention formation may provide permanent attachment of the adaptor to the container body.

The adaptor may define a through bore through which the outlet nozzle of the container body may extend or into which a part of the dosing device outlet port may extend for connection and fluid communication with the container nozzle. In the case of an adaptor to which an RFID chip and coil are secured, the coil may extend around the through bore, for example for alignment with an induction coil that extends around the inlet port of the dosing device.

The adaptor may comprise a cap receiving formation, such as a circumferentially extending groove to receive a standard aerosol cap to protect a nozzle extending through the adaptor when not secured to the dosing device.

The adaptor may comprise a location formation to engage with a receiving formation of the inlet port. The location and receiving formations may comprise shape features which are complementary and the receiving formation may have a shape and dimension that is engagable substantially only by an adaptor having a location formation of a complementary shape.

The adaptor may comprise a location formation that comprises at least two inclined wing formations that extend radially outwards from a central spigot portion of the adaptor and define helically shaped surfaces to engage with the complementary grooves in the dosing module inlet port.

The location and receiving formations may be of a type which causes the container nozzle to engage progressively with the inlet port as the adaptor is rotated relative to the inlet port and, in contrast to a bayonet type configuration, guide movement of the nozzle in a direction away from the inlet port only when rotation is in a reverse direction.

The invention accordingly further provides an adaptor having a retention formation for securing to a complementary formation of a container of chemical additive and a location formation for engaging with a receiving formation of the inlet port of a dosing device, the location formation being shaped whereby rotation of the adaptor in a first direction relative to the dosing device progressively draws the container towards the dosing device and wherein the container moves away from the dosing device only in the event of relative rotation in a reverse direction.

The adaptor may incorporate one or more other features as more specifically described herein and either in combination with an RFID device or devoid of any such device.

In accordance with another aspect of the present invention there is provided a series of containers each containing a different chemical additive and each container comprising an attachment formation for securing the container to a dosing device of a liquid flow circuit for introduction of the chemical additive into the liquid flow circuit, wherein each container contains a chemical additive different from the additive of other containers of the series and wherein each attachment formation is different from the attachment formations of the other containers of the series. The attachment formation of a container may be that of an adaptor of a type as herein described.

Preferably there is provided a series of dosing modules each having an inlet port formation for securing a container of said series to the dosing module and wherein each container of the series comprises a formation that is engagable with only one of the dosing modules of the series. Alternatively one dosing module may comprise a plurality of inlet ports each of which is engagable with only one of the dosing modules of the series. The inlet port formation(s) of a dosing module for engagement by a container of the series of containers may be of a type as herein described.

The invention yet further provides a container of chemical additive provided with an RFID device. The container may comprise an adaptor and container body. An RFID device may be provided and may be supported either by the container body or the adaptor.

The dosing device may incorporate or be responsive to software which is substantially integral with that of a monitoring device and or a communication device.

Embodiments of the present invention will now be described, by way of example only, with reference to the accompanying diagrammatic drawings in which: -

Figure 1 is a schematic view of a central heating system in accordance with the present invention;

Figure 2 shows a part of the system of figure 1 comprising a dosing module;

Figure 3 is a perspective view of the dosing module of figures 1 and 2;

Figure 4 is a view of a container of chemical additive, part cut away;

Figure 5 is a perspective view of an upper part of the container of Figure 4;

Figure 6 is a side view of an adaptor for securing to the container of Figure 4;

Figure 7 is a perspective view of an upper part of the adaptor of Figure 6;

Figure 8 is a perspective view of an underside of the adaptor of Figure 6, and

Figure 9 is a perspective view of part of the container assembled with the adaptor of Figure 6.

A domestic central heating system 10 comprises a condensing boiler heat exchanger 11, two radiators 12 located at first floor level and two radiators 13 at ground floor level, said radiators and boiler being inter-connected in a closed loop pressurised circuit by pipe work 14. A valve 15 facilitates drainage of the system and a pressurised dosing device 18 facilitates addition of corrosion and lime scale inhibitor into the water contained within the circuit.

In proximity to the heat exchanger 11 there is a supply pipe 16 which is substantially permanently connected to a mains water supply and, via a

pressure control valve 22 facilitates flow of water into the pipe work 14 of the liquid flow circuit of the system 10. Fitted to that pipe 16 is a T connector which houses a volume flow sensor 17 which is operable to measure the volume flow of water through the pipe 16. The volume flow sensor 17 is positioned upstream of the position at which the dosing device 18 introduces inhibitor for the liquid flow circuit.

Associated with the sensor 17 is a display 19 which provides a visual display of the volume of water that has flowed through the pipe 16. The sensor and display form part of a management device that also comprises a data store and processing function whereby, in use, the volume flow information may be used to calculate the quantity of a chemical additive, whether a cleaning additive or inhibitor, that should be added to the water in the pipe work 14 via the dosing device 18. The required quantity is then indicated on the display 19.

The heat exchanger 11, the volume flow sensor 17 and the dosing device in the example of this embodiment of the invention are all provided integrally within a boiler casing 21.

The system may comprise a monitoring device that monitors the concentration of additive in the system or a parameter related to that concentration.

The dosing device 18 comprises an inlet port 25 which is shaped and dimensioned to receive and retain a container 30 of pressurised liquid chemical additive.

The dosing device 18 also comprises an indicator panel 31 provided with three lights which indicate whether or not the dosing device is functioning correctly and, if necessary, to provide a visual alarm signal.

The container 30 (see Figures 4 and 9) comprises a container body 29 and an adaptor 32 which is secured to the body for connecting the container body 29 relative to the inlet port 25 of the dosing device.

The container body 29 (see Figure 4) comprises a metal can which features bag-on-valve technology such that within the container body 29 liquid chemical is contained within a flexible bag 34 that is in communication with an outlet valve 35 having an outlet nozzle 41.

Within the container body the flexible bag 34 separates the liquid chemical therein from surrounding propellant gas present in a space 36 between the bag and container body. Typically the propellant gas is initially pressurised to a pressure of approximately 10 bar.

The adaptor 32 has an internal rib 28 (see Figure 8) which enables it to be secured to the container body by a snap fit type engagement of that rib with a corresponding circumferentially extending bead 37 that is formed integrally with an end region of the container body 29 and positioned to extend around the outlet valve 35. The rib 28 and bead 37 are dimensioned such that, following snap-fit assembly, removal of the adaptor from the can is prevented but the adaptor remains rotatable relative to the can.

The adaptor has an outer cylindrically shaped skirt 38 of a diameter greater than that of the rib 28 and bead 37 for ease of gripping to rotate the adaptor for engagement with or removal from the inlet port 25 of the dosing device 18.

The upper end 40 of the adaptor has a cylindrical formation 42 which defines an opening 39 through which a nozzle 49 of the dosing device inlet port extends when the container is secured to the inlet port.

The cylindrical formation 42 has a radially outer surface 43 that is provided with a pair of diametrically opposed wing type formations 44 that define helically shaped retention surfaces 45, 46. The inlet port of the dosing device (see Figure 3) is shaped to provide a cavity 47 which receives the adaptor

cylindrical formation 42, with the wings 44 initially aligned with complementary shaped recess regions 48 of the cavity 47. Subsequently, with light axial pressure, the adaptor may be rotated relative to the dosing device inlet port to move the adaptor outlet nozzle 41 into communication with a central spring loaded one way inlet valve associated with the nozzle 49 of the dosing device inlet port as the helically extending surfaces 45, 46 of the wing formations 44 and corresponding surfaces of the inlet port slide relative to one another during said rotation thereby progressively to move the adaptor into full engagement with the dosing device.

The adaptor 32 is provided with an RFID device (see Figure 6) comprising an RFID chip 50 and a coil 51 which acts as an aerial and also as a power source for the chip when the adaptor is secured to the dosing device. The coil 51 extends circumferentially around the longitudinal axis of the adaptor, between the cylindrical formation 42 and skirt 38 thereby to receive power by electro-magnetic induction from a power source coil (not shown) provided within the dosing device.

The chip 50 is pre-programmed with information such as data relating to the type and volume of chemical within the container and said data may then be received by a communication receiver 33, which may be positioned within the dosing device, to facilitate control and operation of the dosing device.

Subsequent to use, a container may be removed from the dosing device by the simple action of rotation of the adaptor relative to the dosing device in a reverse direction.

A further feature of the adaptor is the provision of a cap retention groove 55 that extends circumferentially around the outer surface of the adaptor, this providing a means for temporary location of a protective cap (not shown) to protect the nozzle until the container is engaged with the dosing device.

In this embodiment of the invention the display 19 facilitates manual operation of the dosing device for introduction of cleaning fluid or inhibitor. However it is

to be understood that the central heating system may be modified to incorporate for example automatic operation of the dosing device via a connection 24 in response to a signal from a monitoring device comprising said sensor 17 and display 19 and in response to data from the RFID chip 50.

Optionally the feed pipe 16 may incorporate a shut off valve 23 which operates automatically to prevent further flow of water into the pipe work 14 in the event that the sensor 17 has detected a high volume of flow at a time other than initial commissioning or flushing or cleaning of the system, and which therefore is indicative of a significant leakage or drainage of liquid from the pipe work 14. Thus wastage of chemical additive from the container may be avoided or minimised

Optionally the system may incorporate, as a check on the concentration of chemical additive in the system, an on-line monitoring device such as that the subject of our UK patent GB 2462518.

Although the invention has been described by way of example in relation to a domestic central heating system it may be employed also in respect of other liquid flow systems such as that of a cooling system.

Having regard to the foregoing it will be understood that the present invention facilitates a more reliable and correct operation of a liquid flow circuit such as that of a heat transfer system.

Claims.

1. A liquid flow system comprising a liquid flow circuit and a dosing device for introduction of a chemical additive into the liquid flow circuit, said dosing device comprising an inlet port for fluid communication with the liquid flow circuit and a container of chemical additive removably secured or adapted to be removably secured to said inlet port, said container comprising a radio frequency identification (RFID) device which stores data of a parameter related to the correct operation of the liquid flow circuit, and the system comprising a communication device to receive data from the container whereby the liquid flow system is responsive to data received by the communication device.
2. A system according to claim 1 wherein the RFID device is adapted to store data related to one or more of the identity of chemical within the container, date of filling of the container, pressure of chemical in the container, volume of the container, volume of chemical remaining in the container when part used, whether the container should be replaced or whether the container should be rendered non reusable.
3. A system according to claim 1 or claim 2 wherein the communication device is an integral part of the dosing device.
4. A system according to claim 1 or claim 2 wherein the communication device is separate from the dosing device and in either wired or wireless communication with the dosing device.
5. A system according to any one of the preceding claims wherein the communication device is operable to transmit data to the container.
6. A system according to claim 5 wherein the communication device is operable to send to the RFID device a status report related to the volume of chemical supplied from the container to the dosing device and or volume of chemical remaining.

7. A system according to claim 5 or claim 6 wherein the communication device is operable to cause the RFID device to record the container as used or non-re-usable whereby subsequent use of the container in the same or another system is inhibited.
8. A system according to any one of the preceding claims wherein the system comprises a charging circuit operable to provide power to the RFID device by electro-magnetic induction.
9. A system according to claim 8 wherein the container has secured thereto an RFID device comprising an RFID chip and a wire coil which acts as an aerial and to receive power for the chip by electro-magnetic induction.
10. A system according to any one of the preceding claims and comprising a visual or audible alarm device to signal the need to replace a container.
11. A system according to any one of the preceding claims and comprising a data store in communication with the communication device or dosing device and which stores data related to the types of chemical allowable for use in the system.
12. A system according to any one of the preceding claims and comprising a data store responsive to information related to the operational phase of the liquid flow system.
13. A system according to any one of the preceding claims wherein the communication device is operable to transmit to a remote server information transmitted between the communication device and a monitoring device that monitors the concentration of additive in the system or a parameter related to that concentration.

14. A system according to claim 13 wherein the monitoring device is operable to provide information to the dosing device related to the required quantity of chemical additive to be introduced into the liquid flow circuit.
15. A system according to claim 13 or 14 wherein the monitoring device is operable to receive information from the dosing device in respect of the quantity of chemical additive that has been introduced into the liquid flow circuit.
16. A system according to any one of claims 13 to 15 wherein the dosing device is operable automatically to introduce chemical additive into the liquid flow circuit in response to a signal from the monitoring device.
17. A system according to any one of the preceding claims wherein the RFID device is secured directly to the container of chemical additive.
18. A system according to any one of claims 1 to 16 wherein the container comprises an adaptor for securing the container to the dosing device whereby in use the adaptor is positioned to lie between a pressurised body of the container and the inlet port of the dosing device.
19. A system according to claim 18 when dependent on any one of claims 1 to 16 wherein the RFID device is secured to the adaptor.
20. A system according to claim 18 or claim 19 wherein the adaptor comprises a retention formation whereby it is secured as a click-type fit to the container body.
21. A system according to any one of claims 18 to 20 wherein the adaptor is non-rotatable relative to the container body.
22. A system according to any one of claims 18 to 21 wherein the adaptor is provided with a retention formation for permanent attachment of the adaptor to the container body.

23. A system according to any one of claims 18 to 22 wherein the adaptor defines a through-bore through which an outlet nozzle of the container body extends or into which a part of a dosing device outlet port extends for connection and fluid communication with the container nozzle.

24. A system according to claim 23 wherein the RFID device comprises a chip and coil and wherein the coil extends circumferentially around the through-bore.

25. A system according to any one of claims 18 to 24 wherein the adaptor comprises a cap receiving formation for attachment of a removable protective cap.

26. A system according to any one of claims 18 to 25 and comprising a location formation to engage with a receiving formation of the inlet port, said location and receiving formations comprising shape features which are complementary and the receiving formation having a shape and dimension that is engagable substantially only by an adaptor having a location formation of a complementary shape.

27. A system according to claim 26 wherein the adaptor comprises a location formation comprising at least two circumferentially spaced inclined wing formations extending radially outwards from a central spigot portion of the adaptor to define helically shaped surfaces to engage with complementary grooves in the dosing module inlet port.

28. A system according to claim 26 or claim 27 wherein the location and receiving formations cause the container nozzle to engage progressively with the inlet port as the adaptor is rotated relative to the inlet port and wherein the container moves away from the dosing device only in the event of relative rotation in a reverse direction.

29. An adaptor for securing a container of chemical additive to the inlet port of a dosing device, said adaptor comprising one or more of the features recited in any one of claims 18 to 29.

30. A series of containers each containing a different chemical additive and each container comprising an attachment formation for securing the container to a dosing device of a liquid flow circuit for introduction of the chemical additive into the liquid flow circuit, wherein each container contains a chemical additive different from the additive of other containers of the series and wherein each attachment formation is different from the attachment formations of the other containers of the series

31. A series of containers of chemical additive and a series of dosing modules for introduction of the chemical additive into a liquid flow circuit, each dosing module having an inlet port formation for securing a container of chemical additive to the dosing module and wherein each container of the series comprises a formation that is engagable with only one of the dosing modules of the series.

32. A series of containers of chemical additive and a dosing module for introduction of the chemical additive into a liquid flow circuit, the dosing module having a plurality of inlet port formations for securing a container of chemical additive to the dosing module and wherein each container of the series comprises a formation that is engagable with only one of the dosing module inlet port formations.

33. A container of pressurised chemical additive comprising an adaptor and container body, and wherein said container comprises one or more of the features recited in any one of the preceding claims.

A series of containers of chemical additive and a series of dosing modules for introduction of the chemical additive into a liquid flow circuit, each dosing module having an inlet port formation for securing a container of chemical additive to the dosing module and wherein each container of the series

comprises a formation that is engagable with only one of the dosing modules of the series

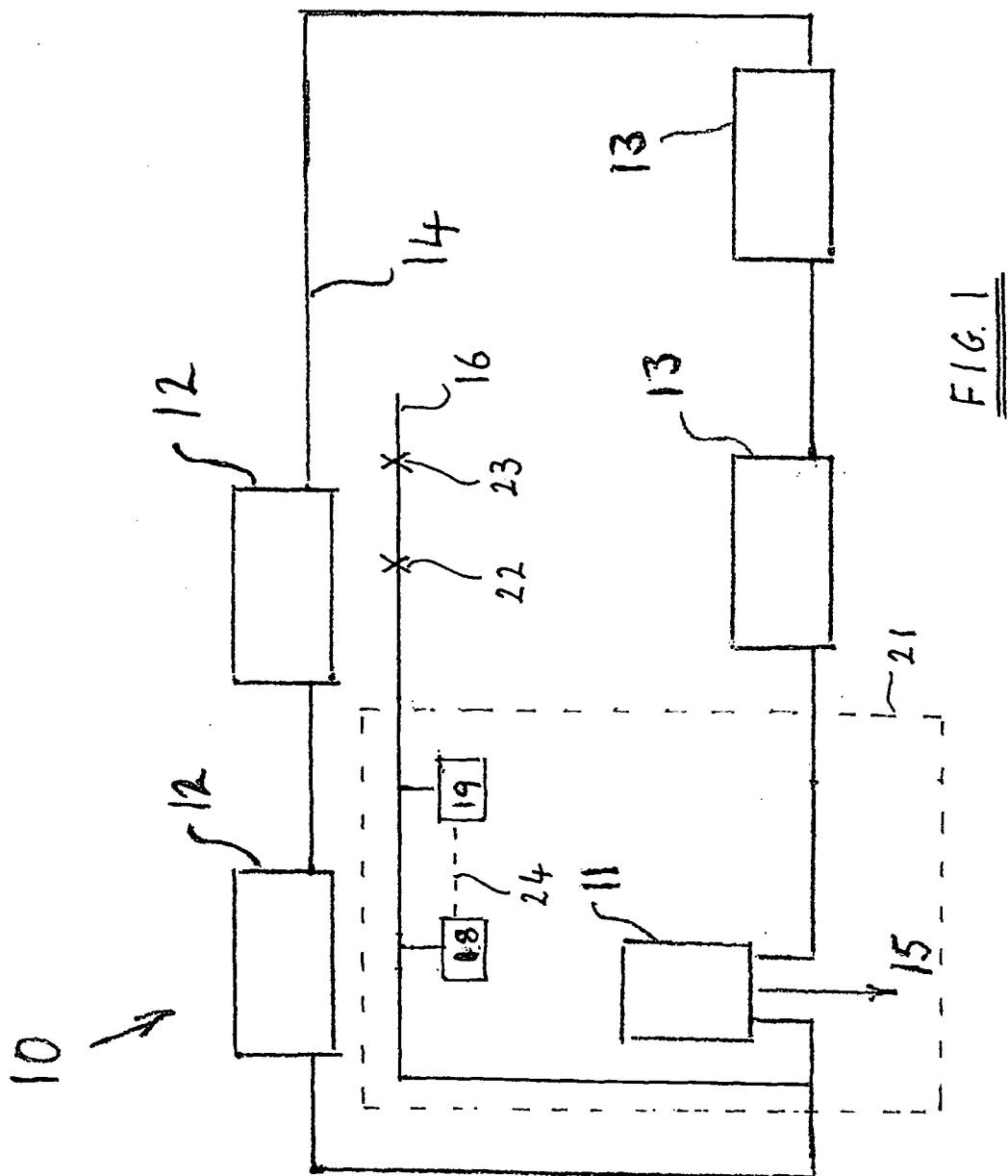


FIG. 1

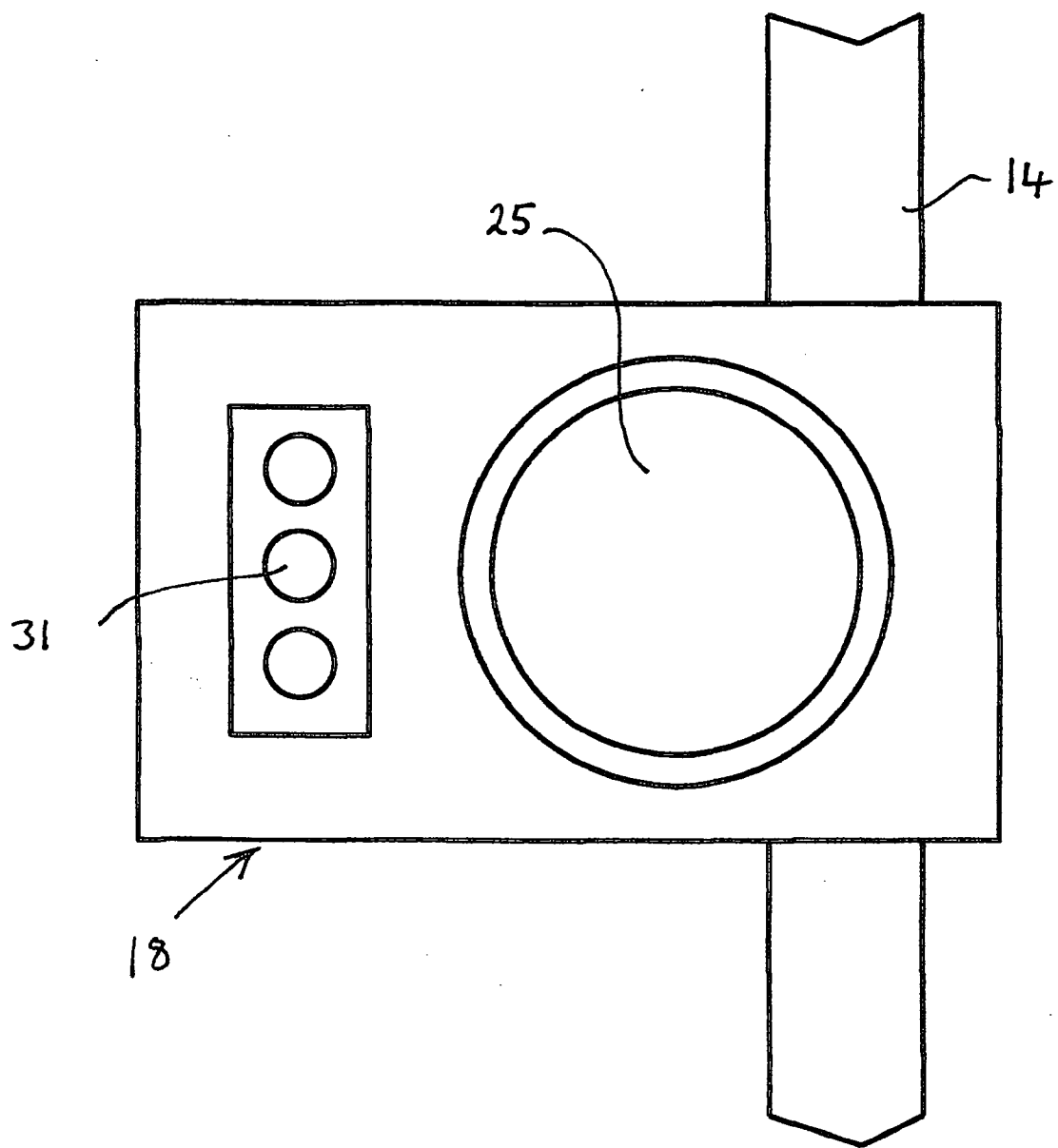


FIG. 2

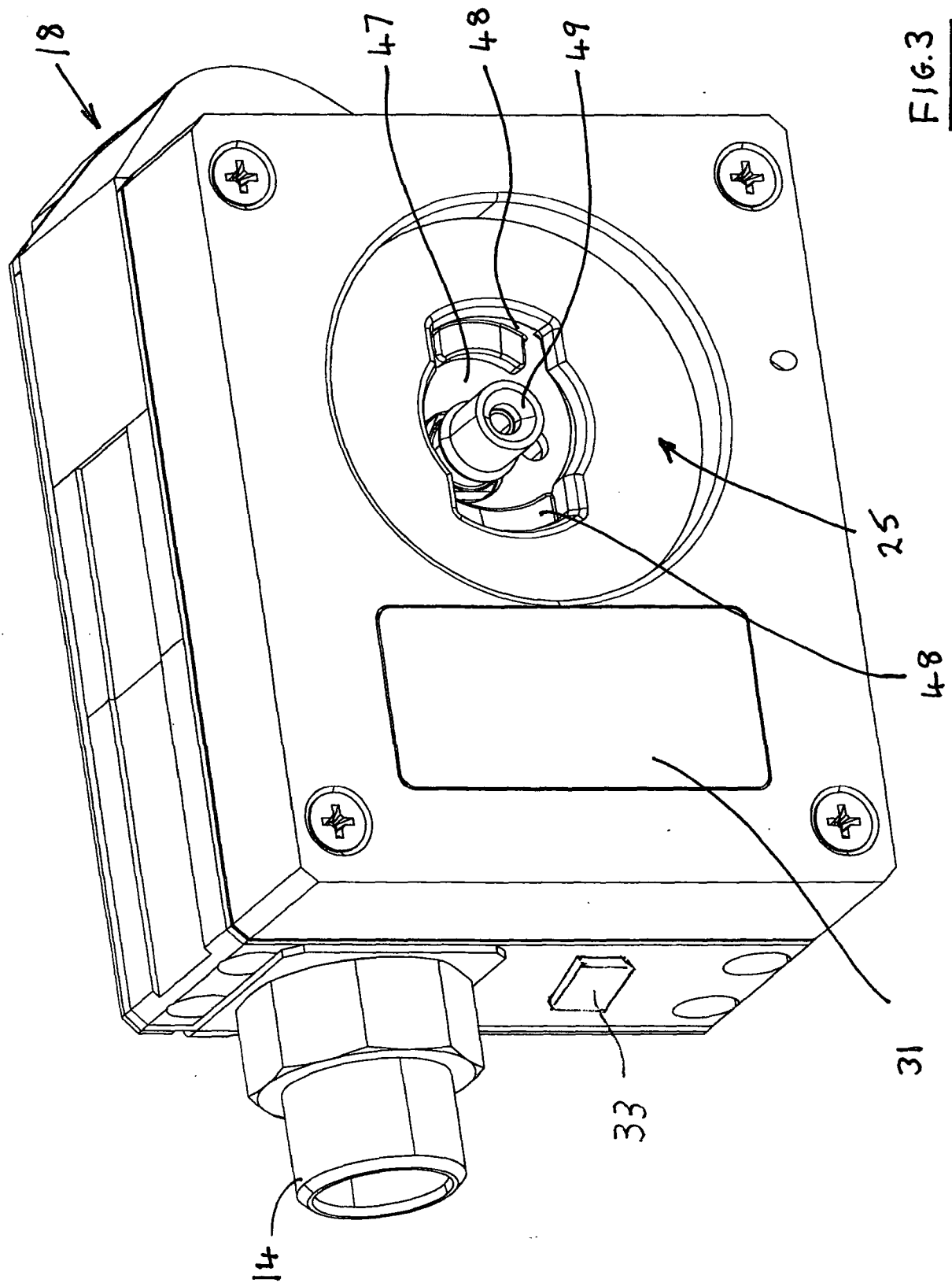


FIG. 3

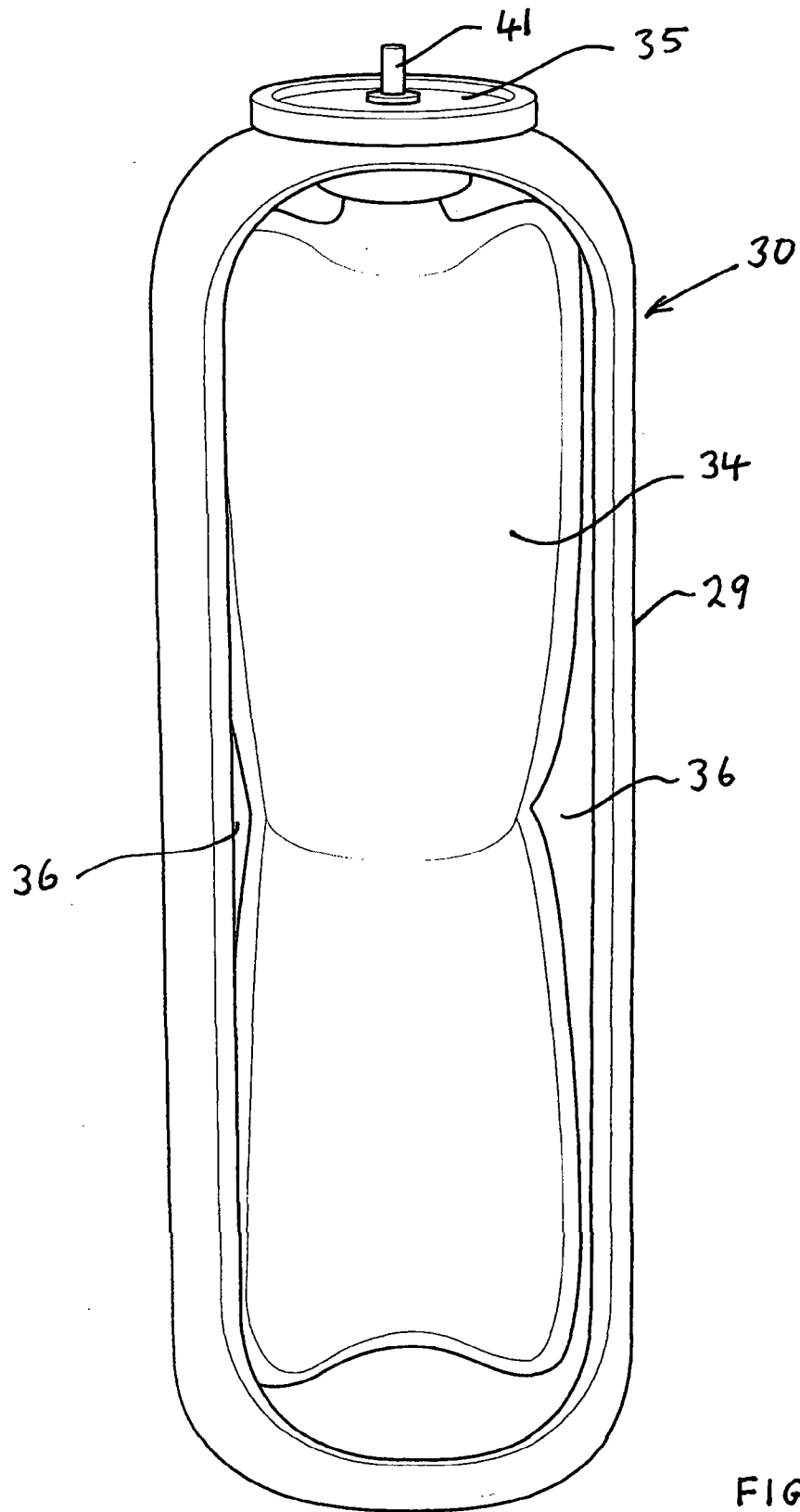


FIG. 4

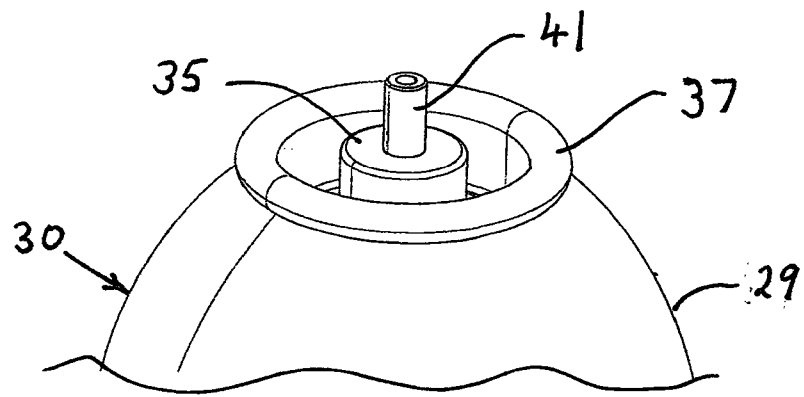


FIG. 5

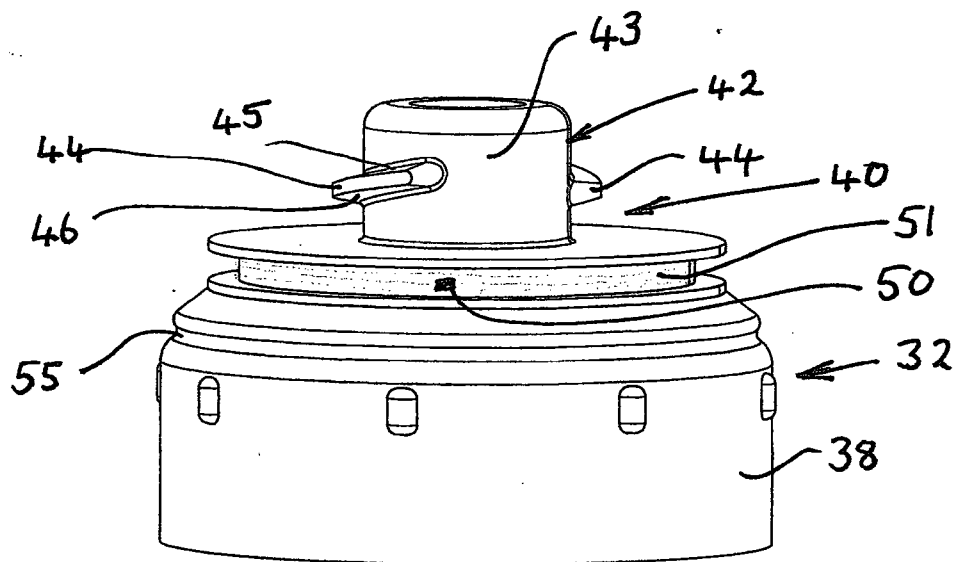


FIG. 6

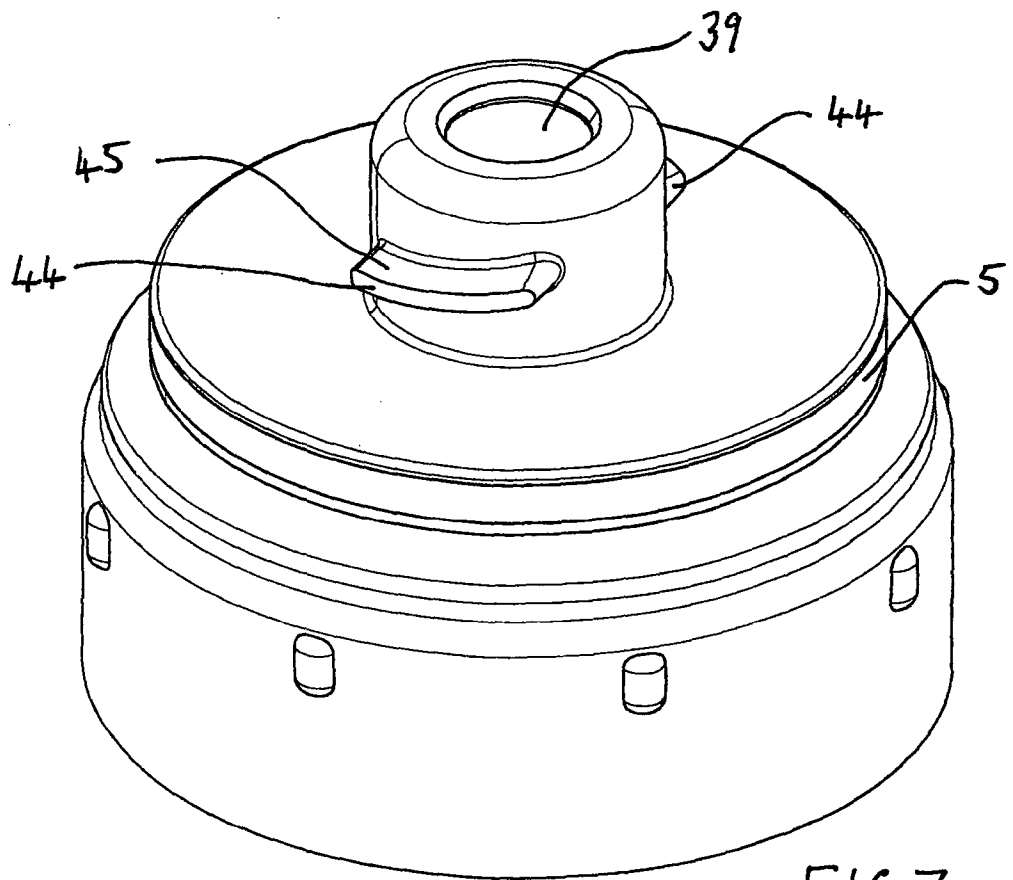


FIG. 7

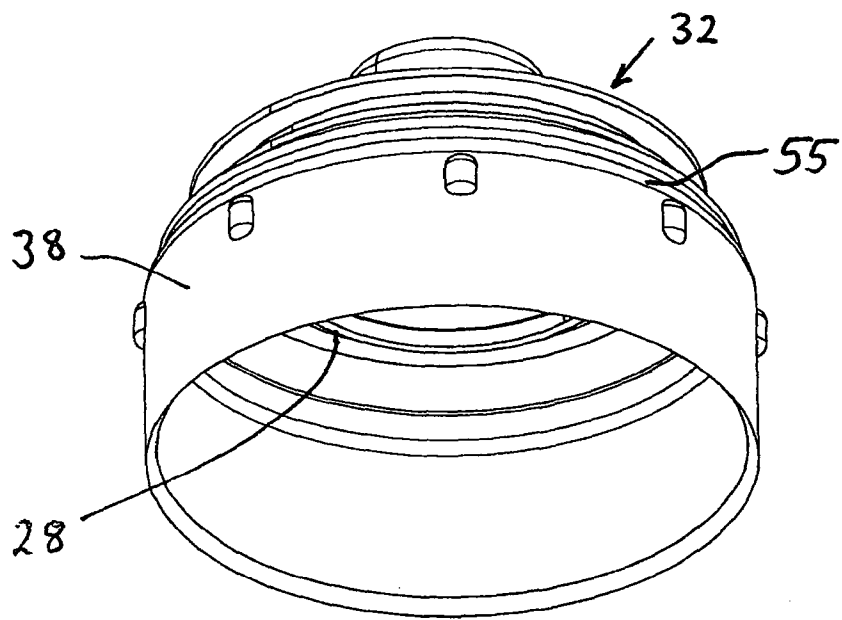


FIG. 8

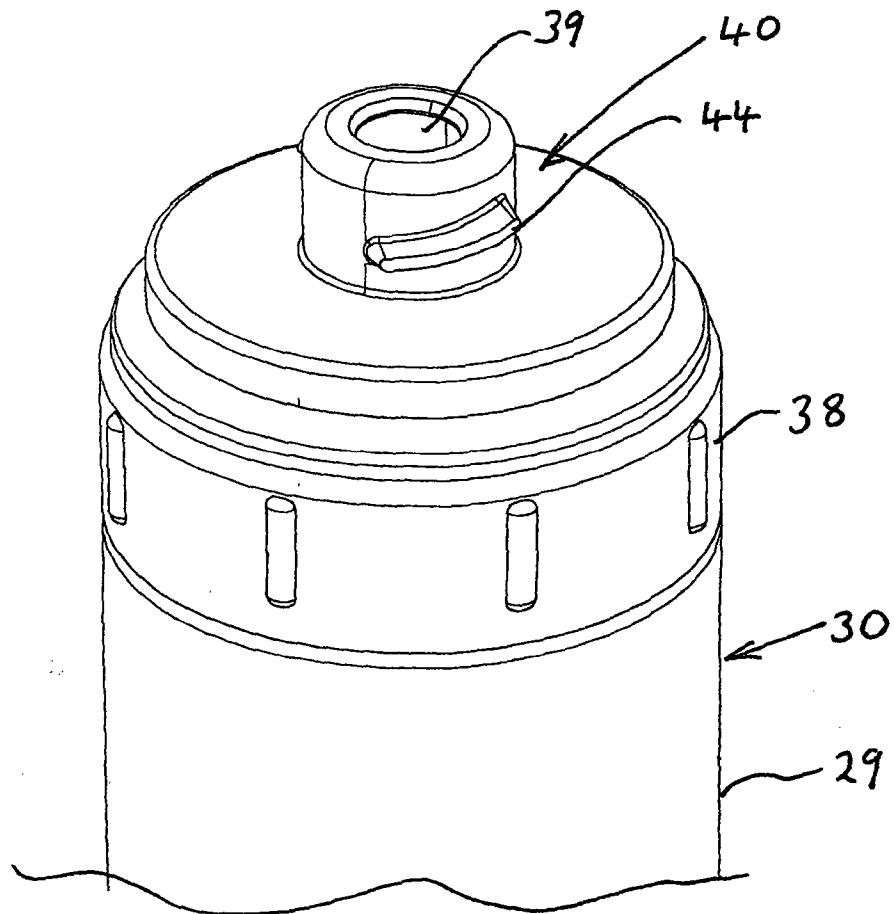


FIG. 9

INTERNATIONAL SEARCH REPORT

International application No

PCT/GB2017/000074

A. CLASSIFICATION OF SUBJECT MATTER

INV. F24D19/00 C02F1/00 C02F5/08 F25B47/00
ADD.

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)

F24D C02F F25B

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)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2014/145337 A2 (STEP AHEAD INNOVATIONS INC [US]) 18 September 2014 (2014-09-18)	1-7, 11-17
Y	paragraphs [0006] - [0018], [0025]; figure 1	8,9

X	US 2006/060512 A1 (ASTLE ROBERT E [US] ET AL) 23 March 2006 (2006-03-23)	1-7, 10-17
Y	paragraphs [0008] - [0020], [0085] - [0087]; figure 25	8,9

Y	US 2009/045919 A1 (FUKUI TOMOYASU [JP] ET AL) 19 February 2009 (2009-02-19)	8,9
	paragraphs [0073], [0074], [0083] - [0087] -----	



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

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"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

19 July 2017

Date of mailing of the international search report

03/11/2017

Name and mailing address of the ISA/

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Authorized officer

Schwaiger, Bernd

INTERNATIONAL SEARCH REPORT

International application No.
PCT/GB2017/000074

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.:
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:
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:

see additional sheet

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 an 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.:

1-17

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.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-17

liquid flow system comprising a liquid flow circuit, a communication device, a container of chemical additive with a RFID device, and a dosing device for introduction of a chemical additive into the liquid flow circuit

2. claims: 18-29, 33

liquid flow system comprising a liquid flow circuit, a communication device, a container of chemical additive with a RFID device, and a dosing device for introduction of a chemical additive into the liquid flow circuit, the liquid flow system further comprising a container having an adaptor for securing the container of chemical additive to the inlet port of a dosing device

3. claims: 30-32

a series of containers, each container of the series comprising a formation for securing the container to a dosing device of a liquid flow circuit for introduction of the chemical additive into the liquid flow circuit

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/GB2017/000074

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