(12) STANDARD PATENT (11) Application No. **AU 2017294962 B2**
(19) AUSTRALIAN PATENT OFFICE

(54) Title
Spray device having a replaceable cartridge

(51) International Patent Classification(s)
A01M 7/00 (2006.01) ***B05B 9/08*** (2006.01)

(21) Application No: **2017294962** (22) Date of Filing: **2017.07.04**

(87) WIPO No: **WO18/011012**

(30) Priority Data

(31) Number	(32) Date	(33) Country
62/360,548	**2016.07.11**	**US**
62/360,555	**2016.07.11**	**US**
16178764.3	**2016.07.11**	**EP**
16178766.8	**2016.07.11**	**EP**

(43) Publication Date: **2018.01.18**
(44) Accepted Journal Date: **2023.07.13**

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(56) Related Art
WO 2013/030117 A2
US 4790454 A
WO 2013/165684 A2

(12) NACH DEM VERTRAG ÜBER DIE INTERNATIONALE ZUSAMMENARBEIT AUF DEM GEBIET DES PATENTWESENS (PCT) VERÖFFENTLICHTE INTERNATIONALE ANMELDUNG

(19) Weltorganisation für geistiges Eigentum
Internationales Büro

(43) Internationales Veröffentlichungsdatum
18. Januar 2018 (18.01.2018)

WIPO | PCT

(10) Internationale Veröffentlichungsnummer
WO 2018/011012 A1

(51) Internationale Patentklassifikation:
A01M 7/00 (2006.01) *B05B 9/08* (2006.01)

(21) Internationales Aktenzeichen: PCT/EP2017/066612

(22) Internationales Anmeldedatum:
04. Juli 2017 (04.07.2017)

(25) Einreichungssprache: Deutsch

(26) Veröffentlichungssprache: Deutsch

(30) Angaben zur Priorität:

16178764.3	11. Juli 2016 (11.07.2016)	EP
16178766.8	11. Juli 2016 (11.07.2016)	EP
62/360,548	11. Juli 2016 (11.07.2016)	US
62/360,555	11. Juli 2016 (11.07.2016)	US

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(81) Bestimmungsstaaten *(soweit nicht anders angegeben, für jede verfügbare nationale Schutzrechtsart)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JO, JP, KE, KG, KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW,

WO 2018/011012 A1

(54) **Title:** SPRAY DEVICE HAVING A REPLACEABLE CARTRIDGE

(54) **Bezeichnung:** SPRÜHGERÄT MIT AUSWECHSELBARER KARTUSCHE

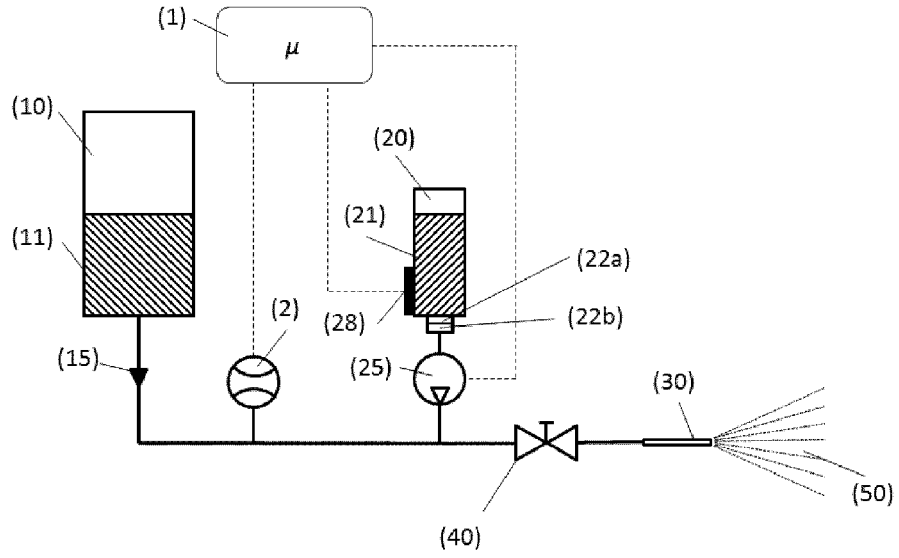

Fig. 1

(57) **Abstract:** The invention relates to the application of liquid active substances with the aid of a portable spray device. The subject matter of the present invention is a system comprising a portable spray device and a replaceable cartridge that contains an active substance concentrate. The invention also relates to a method for applying a liquid active substance formulation. In addition, the invention discloses a replaceable cartridge that has a memory unit in which information is stored relating to an adjustable dilution ratio for the active substance concentrate contained in the cartridge. The invention also relates to a spray device comprising a control unit that can read out a memory unit of a cartridge attached to the spray device and, on the basis of the read out information, adjust a dilution ratio for the active substance concentrate contained in the cartridge.

(57) **Zusammenfassung:** Die vorliegende Erfindung betrifft die Applikation von flüssigen Wirkstoffen mit Hilfe eines tragbaren Sprüh-

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SA, 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) **Bestimmungsstaaten** *(soweit nicht anders angegeben, für jede verfügbare regionale Schutzrechtsart)*: ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), eurasisches (AM, AZ, BY, KG, KZ, RU, TJ, TM), europäisches (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, KM, ML, MR, NE, SN, TD, TG).

Erklärungen gemäß Regel 4.17:

— *hinsichtlich der Berechtigung des Anmelders, ein Patent zu beantragen und zu erhalten (Regel 4.17 Ziffer ii)*

Veröffentlicht:

— *mit internationalem Recherchenbericht (Artikel 21 Absatz 3)*

— *vor Ablauf der für Änderungen der Ansprüche geltenden Frist; Veröffentlichung wird wiederholt, falls Änderungen eingehen (Regel 48 Absatz 2 Buchstabe h)*

geräts. Gegenstand der vorliegenden Erfindung ist ein System umfassend ein tragbares Sprühgerät und eine auswechselbare Kartusche, die ein Wirkstoffkonzentrat enthält. Gegenstand der vorliegenden Erfindung ist ferner ein Verfahren zur Applikation einer flüssigen Wirkstoffformulierung. Ein weiterer Gegenstand der vorliegenden Erfindung ist eine auswechselbare Kartusche, die über eine Speichereinheit verfügt, in der Informationen über einen einzustellenden Verdünnungsgrad für das in der Kartusche enthaltende Wirkstoffkonzentrat abgelegt sind. Ein weiterer Gegenstand der vorliegenden Erfindung ist ein Sprühgerät mit einer Kontrolleinheit, die eine Speichereinheit einer an das Sprühgerät angeschlossenen Kartusche auslesen und auf Basis der ausgelesenen Informationen einen Verdünnungsgrad für das in der Kartusche enthaltende Wirkstoffkonzentrat einstellen kann.

2017294962 26 Jun 2023

Spraying device with replaceable cartridge

The present invention relates to the application of liquid active substances using a portable spraying device. The subject matter of the present invention is a system comprising a portable spraying device and a replaceable cartridge which contains an active substance concentrate. The subject matter of the present invention is further a method for applying a liquid active substance formulation. A further subject matter of the present invention is a replaceable cartridge which has a memory unit in which information about a degree of dilution to be set for the active substance concentrate contained in the cartridge is stored. A further subject matter of the present invention is a spraying device with a control unit which can read out a memory unit of a cartridge connected to the spraying device and set, on the basis of the read-out information, a degree of dilution for the active substance concentrate contained in the cartridge.

Portable spraying devices for applying active substances such as pesticides, insecticides, herbicides and fungicides are known (DE102013109785A1, US2006/0249223A1, US2006/0102245A1, US2006/0261181A1, US2005/0006400A1).

Spraying devices which are referred to as compression sprayers are widespread in this context. They comprise a tank for holding the liquid to be sprayed. An air pressure pump which is usually manually activated and forms part of the tank contains a customary piston rod structure and activation handle for it. This air pressure pump is used to generate an air pressure by means of the liquid to be sprayed. The tank is pressurized by the operator periodically activating the pump until a desired tank pressure is reached. Owing to the air pressure acting on the spray liquid, the latter exits through a pipe dipping into the liquid in the tank and then flows through a hose, a spray jet valve at the outer end of the hose, an extension pipe and finally through a spraying nozzle to the selected target region.

Pesticides, insecticides, herbicides and fungicides are being increasingly marketed in the form of concentrates nowadays. Concentrates have the advantage of lower transportation costs. The user has to dilute the active substance before use. The dilution instructions are usually provided on the packaging or on an accompanying leaflet.

2017294962 26 Jun 2023

However, dilution which is performed by the user is disadvantageous for the following reasons:

The user can come into undesired contact with the active substance. It is conceivable that the user will make an error during the calculation of the quantities of concentrate and diluent. A high viscosity of the concentrate can lead to inaccurate volumetric dimensioning of the necessary quantity.

Inaccurate dosing of active substances can result in a series of undesired consequences: the treatment of the sprayed object may be ineffective, or overdosage may occur. It is conceivable that official instructions about dispensed quantities are not complied with. It is conceivable that faults occur in the stock monitoring, since the dispensed quantities have been calculated incorrectly.

A further disadvantage of the spraying device described above is that when another active substance is used the tank firstly has to be cleaned. Under certain circumstances, the cleaning fluid has to be disposed of.

There may be a need for a device for applying active substances which may be easy to handle and with which no manual dilution of concentrates may be necessary, which may output an accurately definable quantity of active substance and which may be convenient to transport and to be carried and transported by the user, with which no costly cleaning may be necessary and which may be used in a versatile way.

A first subject of the present invention is a cartridge containing a concentrate of a pesticide, insecticide, herbicide or fungicide, wherein the cartridge comprises means for reversible connection of the cartridge to a sprayer, wherein the cartridge has an electronic storage unit, and wherein in the storage unit information about an adjustable degree of dilution of the concentrate is stored, and wherein the sprayer comprises a container for receiving a diluent, an outlet for the diluent, and a control unit configured to regulate the flow of the concentrate and the diluent towards the outlet according to the stored degree of dilution of the concentrate.

A further subject matter of the present invention is a sprayer for the application of a pesticide, insecticide, herbicide or fungicide, comprising

2017294962 26 Jun 2023

- a container for receiving a diluent,
- an outlet,
- means for conveying the diluent towards the outlet,
- means for the reversible connection of a replaceable cartridge containing a concentrate to the spraying device of the pesticide, insecticide, herbicide or fungicide to the sprayer,
- means for conveying the concentrate towards the outlet,

a control unit and

- a flow meter for determining the flow of the diluent towards the outlet, wherein the flow meter is connected to the control unit,

wherein the control unit has means for reading a degree of dilution from an electronic storage unit belonging to the cartridge, and

wherein the control unit is configured to regulate the flow of the concentrate by means of the flow of the diluent towards the outlet so that a mixture of the concentrate and the diluent escapes from the outlet in which the concentrate is diluted according to the degree of dilution read.

A further subject of the present invention is a system comprising:

- a portable sprayer for the application of a pesticide, insecticide, herbicide or fungicide comprising the following components:
  - a container for receiving a diluent,
  - an outlet,
  - means for conveying the diluent towards the outlet,
  - means for the reversible connection of a replaceable cartridge containing a concentrate of a pesticide, insecticide, herbicide or fungicide to the sprayer,
  - means for conveying the concentrate towards the outlet,
  - a flow meter to determine the flow of the diluent towards the outlet, wherein the flow meter is connected to the control unit, and
  - a control unit
- and a replaceable cartridge comprising means for reversible connection of the cartridge to the sprayer,

wherein the control unit has means for reading a degree of dilution from an electronic storage unit belonging to the cartridge,

2017294962 26 Jun 2023

wherein the control unit is configured to regulate the flow of the concentrate by means of the flow of the diluent towards the outlet so that a mixture of the concentrate and the diluent escapes from the outlet in which the concentrate is diluted according to the read degree of dilution, and

wherein the cartridge has an electronic storage unit that is read out by the control unit of the sprayer when the cartridge is connected to the sprayer and in which information about an adjustable degree of dilution of the concentrate with the diluent is stored.

A further subject matter of the present invention is a method for administering an active ingredient formulation comprising the following steps:

- providing a replaceable cartridge with an active ingredient concentrate, wherein the cartridge comprises an electronic storage unit, wherein a dilution wheel is stored in the storage unit,
- wherein the active ingredient concentrate is a concentrate of a pesticide, insecticide, herbicide or fungicide,
- providing a sprayer for the application of a pesticide, insecticide, herbicide or fungicide comprising a diluent, wherein the sprayer comprises a control unit, wherein the control unit has to read the degree of dilution from the storage unit,
- connecting the interchangeable cartridge to the sprayer by a user,
- reading the degree of dilution from the storage unit by the control unit,
- determining the flow of the diluent through the flow meter connected to the control unit,
- regulating the flow/s of the active substance concentrate and/or the diluent from their containers through the control unit towards outlet, so that a mixture of the active substance concentrate and the diluent emerges from the outlet in which mixture the active ingredient concentrate is diluted according to the read degree of dilution.

According to the present invention, the active substance concentrate and the diluent are present in separate containers. However, the user does not have to carry out the dilution of the active substance concentrate manually himself. Instead, the mixing process takes place automatically during the spraying process. The user does not even have to be concerned with the ratio in which the active substance concentrate and the diluent have to be mixed.

The correct mixing ratio is set by a control unit which receives the mixing ratio to be set from the concentrate cartridge and regulates the flow of diluent and/or concentrate in such a way that the mixture leaves the spraying device via the outlet in the correct mixing ratio.

The individual elements which characterize the system, the cartridge, the spraying device and the method according to the invention are explained in more detail below. During this explanation, no differentiation is made between the individual subjects of the invention (cartridge, spraying device, system and method). Instead, the following descriptions apply analogously to all subjects of the invention, irrespective of their context.

One subject matter of the present invention is a portable spraying device. The term "portable" is intended to mean that the device can be transported by a person from one location to another without machine aids.

The spraying device comprises a container for holding the diluent. The diluent is used for mixing with the concentrate in order thereby to bring about dilution of the concentrate.

The diluent, like the concentrate also, is a liquid. The term "liquid" is to be understood as also including solutions, emulsions and suspensions.

In a preferred embodiment, the diluent is water.

The concentrate is preferably an active substance concentrate. The term "active substance concentrate" is understood to mean a formulation of an active substance which is present in a more concentrated form and must/should be diluted before its use. An active substance is a substance or mixture of substances which has a biological effect. Examples of active substances are pesticides, insecticides, herbicides and fungicides. In a further preferred embodiment, the concentrate is a pesticide concentrate.

The container for holding the diluent can be composed of any desired material which is compatible with the diluent. The term "compatible" means that the material should not be chemically attacked by the diluent and that the material should be impermeable to the diluent.

2017294962 26 Jun 2023

The container can be embodied as a tank which withstands excess pressure. The excess pressure can be used to feed the diluent from the tank in the direction of the outlet.

In a preferred embodiment, the container is operated in unpressurized fashion. The fact that the container does not have to withstand an excess pressure means that it can be fabricated from relatively thin-walled and more lightweight material.

In one quite particularly preferred embodiment, the container is embodied as a flexible bag. Such a bag preferably has straps so that it can be strapped onto the user's back and carried like a rucksack.

In one embodiment, the spraying device is embodied in such a way that during transportation, the user carries part of the spraying device, comprising the container, in one of his hands and another part of the spraying device, comprising the outlet, in the other. The device is preferably embodied in such way that the user can carry and transport part of the spraying device, comprising the container, on his back. Another part, comprising the outlet, continues to be carried with one hand, but the second hand is now free. The device is equipped with corresponding straps for this purpose.

The spraying device according to the invention also has means for feeding the diluent from the container in the direction of the outlet. As already described, the diluent can be fed from the container in the direction of the outlet by means of pressure. This pressure can be generated, for example, with a manually or electrically operated air pump or with a pressure cartridge. The diluent is preferably fed in the direction of the outlet with an electrically operated pump.

The spraying device according to the invention also comprises means for reversibly connecting a replaceable cartridge to the spraying device. The cartridge serves to hold the concentrate. The cartridge and the spraying device have means, compatible with one another, for connecting the cartridge to the spraying device. If the cartridge is connected to the spraying device, the concentrate contained in the cartridge can be fed from the cartridge through parts of the spraying device in the direction of the outlet of the spraying device.

The connection of the cartridge to the spraying device can be effected, for example, using a screw connection or a bayonet connection.

The cartridge is replaceable, that is to say it can be connected to the spraying device and removed again. The cartridge is then preferably removed again, and if appropriate replaced by another or new cartridge, when it has been emptied.

The cartridge is embodied in such a way that it is impermeable to the concentrate and cannot be chemically attacked by the concentrate.

In a preferred embodiment, the cartridge is embodied at least partially from plastic. Plastics are known to be chemically inert with respect to many substances. They are also lightweight, can be processed well and can be fashioned to virtually any desired shapes.

In a preferred embodiment, the cartridge is embodied as a pressurized container. It preferably contains not only the concentrate but also a propellant which is under pressure and which is separated from the concentrate. The cartridge preferably has a valve. The valve is preferably opened automatically when the cartridge is connected to the spraying device. The propellant which is under pressure forces the concentrate out of the cartridge into the spraying device. A further valve which is located in the spraying device stops the further flow of the concentrate. This further valve preferably opens when a user starts an application process, usually by activating a handle.

The cartridge which is preferably embodied as a pressurized container can be composed, for example, of aluminium or tin plate – materials which are pressure-resistant and are used, for example, in spray cans (e.g. shaving foam).

It is conceivable that the cartridge contains a bag with the concentrate, wherein the bag is connected to the valve (valve bag system). The propellant surrounds the bag filled with the concentrate and applies the necessary pressure to force the concentrate out of the cartridge (see e.g. DE69820260T2, US5505039, EP0718213A).

It is also conceivable however for the propellant and the concentrate to be separated from one another by a piston (see e.g. DE3934237A1). The propellant applies a pressure to the piston. If the valve is opened, the concentrate is forced out of the cartridge by the piston. For example, the use of a ZIMA piston is conceivable.

The cartridge can be embodied as a disposable cartridge or multiple-use cartridge.

The cartridge has an electronic memory unit.

The term electronic storage covers all memory media which store information in or on the basis of electronic (semiconductor) components. Examples are ROM (read only memory), PROM (programmable read only memory), EPROM (erasable programmable read only memory), EEPROM (electrically erasable programmable read only memory), flash EEPROM (e.g. USB memory sticks), FRAM (ferroelectric random access memory), MRAM (magnetoresistive random access memory) and phase-change RAM (phase-change random access memory).

A degree of dilution or information, on the basis of which a degree of dilution can be determined, is stored in the memory unit. The degree of dilution specifies the ratio with which the concentrate and a diluent (usually water) are to be mixed with one another in order to achieve a desired effect.

The spraying device has a control unit. The control unit is capable of reading the information on the degree of dilution from the memory unit of the cartridge. The means for reading out the memory unit and the memory unit itself are correspondingly matched to one another. There are a variety of possible ways of implementing this communication between the control unit and memory unit. Some of these possible ways are described below.

One possible way of reading out is, for example, to provide the cartridge with an RFID tag. An RFID tag has an electronic memory unit. The control unit correspondingly has means in order to read out the electronic memory unit in the RFID tag.

In this case, the reading out takes place in a contactless fashion. In addition to the specified form of communication, other contactless types of communication between the electronic memory unit and the control unit, such as Bluetooth or close-range communication, are conceivable.

However, the communication can also take place in a contact-based fashion. It is, for example, conceivable that both the cartridge and the spraying device have electrical or optical contacts which, when the cartridge is connected to the spraying device, bring about electrical or optical contact between the cartridge and the spraying device, via which contact the control unit can access the electronic memory unit of the cartridge.

In addition to a degree of dilution which is to be set, further information can be stored in the memory unit of the cartridge, such as, for example, the type of active substance, batch number, use-by date and the like.

It is conceivable that the degree of dilution is stored directly in the memory unit of the cartridge. However, it is also conceivable that an identifier for the cartridge and/or the concentrate contained in the cartridge is stored in the memory unit. Such an identifier can be, for example, an identification number. The control unit is able to read out the identifier from the memory unit. It is conceivable that the control unit has a register in which various concentrates are stored together with a degree of dilution which is to be set and the identifier, with the result that the control unit can infer from the register, by reading out the identifier, the degree of dilution which is to be set. However, it is also conceivable that the control unit can access an external database via a mobile network and determine a degree of dilution which is to be set from the external database on the basis of the identifier.

The spraying device according to the invention has means for feeding the concentrate from the cartridge in the direction of the outlet. This means is preferably an electrically operated pump.

In one particularly preferred embodiment, a stepping motor metering pump is used (see e.g. DE102004047584, WO2012048976, DE102009006203). Even small amounts of the concentrate can be added to the diluent by means of the stepping motor drive.

The control unit determines the necessary or desired degree of dilution and regulates the flow of the diluent and/or of the concentrate correspondingly. Different variants are also conceivable here; a number of them are described below.

It is, for example, conceivable that the diluent is fed from the container in the direction of the outlet, and the flow is determined by means of a flowmeter. The flowmeter can be connected to the control unit and can be configured in such a way that it regulates the flow of the concentrate using the flow of the diluent in the direction of the outlet, in such a way that a constant mixing ratio between the concentrate and the diluent is set. Therefore, while the diluent flows, the flow is measured and the precise amount of concentrate which results in a mixture with the desired/necessary mixing ratio (degree of dilution) is fed to the diluent.

The term “constant mixing ratio” is intended to mean that the mixing ratio is within a predefined range over the spraying duration.

The converse variant is, of course, also conceivable: the concentrate is fed in the direction of the outlet, the flow is measured and the precise amount of diluent which causes the desired/necessary degree of dilution to be set is fed to the concentrate.

It is also conceivable that the flows of the diluent and concentrate are matched to one another by regulating means in order to achieve the desired/necessary degree of dilution. In such a case, both flows are registered by means of corresponding sensors.

In a preferred embodiment, the diluent is fed from the container in the direction of the outlet with a first electric pump. The flow of the diluent is registered with a flowmeter and the measured values are transferred to the control unit. The control unit is connected to a second electric pump and regulates the flow of the concentrate in the direction of the outlet in such a way that the concentrate and diluent exit the spraying device via the outlet as a mixture with the desired/necessary mixing ratio.

The quantity of liquid flowing per unit of time in the direction of the spraying nozzle is registered with a flowmeter. The term "quantity of liquid” is understood to mean, depending on the measurement method used, the volume or the mass.

The flowmeter is preferably one which is usually used in closed pipelines such as, for example, a magneto-inductive flowmeter, a float-type flowmeter, an ultrasonic flowmeter, a Coriolis mass flowmeter, a calorimetric flowmeter or a vortex flowmeter. However, it is also conceivable to use a measuring orifice or a dynamic pressure probe.

In a preferred embodiment, the flow measurement is carried out using a differential pressure sensor.

In a further preferred embodiment, an impeller wheel sensor is used for measuring the flow rate. The measuring principle is based on the fact that an impeller wheel assumes a rotational speed in proportion to the rate of flow of a fluid by which the impeller wheel is driven. In order to measure the rotational speed a permanent magnet can be attached to the impeller wheel, which permanent magnet moves along with the impeller wheel. A Hall sensor, past which the permanent magnet moves, can be used as a pulse counter. The number of pulses measured per unit of time is proportional to the rotational speed of the impeller wheel and therefore to the rate of flow of the fluid.

Details on the flow measurement can be found, for example, in the following manual: K.W. Bonfig: Technische Durchflussmessung [technical flow measurement], Vulkan-Verlag Essen, 3rd edition 2002, ISBN 3-8027-2190-X.

Active substance concentrate and diluent exit the spraying device via the outlet as a mixture.

It is conceivable that diluent and concentrate are combined in a corresponding feed line directly before the outlet. However, it is also conceivable that upstream of the outlet there is a mixing chamber into which the diluent and concentrate are fed via two separate feed lines. The diluent and concentrate are then fed in the mixing chamber before the mixture then exits the spraying device via the outlet.

The thorough mixing of the diluent and concentrate can be promoted by means of suitable measures, for example by means of static mixing elements.

Preferably, a spraying nozzle is mounted on the outlet.

A desired spatial distribution of the applied mixture can be achieved using the spraying nozzle. The spraying nozzle usually converts the liquid passing through it into droplets with a specific droplet size distribution which depends, inter alia, on the pressure of the liquid, on the flow rate of the liquid and on the geometry of the spraying nozzle.

The spraying nozzle is preferably replaceable, with the result that a user can select a spraying nozzle which is adapted to the application and to the target object and which has a desired droplet size distribution and spatial distribution of the sprayed material.
The spraying nozzle can be, for example, in the form of a lance or pistol or in some other form. The spraying nozzle is preferably embodied in such a way that it is held with one hand by the user and can be directed onto the target object.
The spraying nozzle usually has a handle which is activated by the user in order to start a spraying process. Activation of the handle usually causes a valve to open in such a way that the diluent and the concentrate are fed from their respective containers in the direction of the spraying nozzle and through the spraying nozzle and onto the target object.

In a preferred embodiment, the replaceable spraying nozzle and the control unit have means which permit the control unit to detect the presence of a spraying nozzle and/or the type of the present spraying nozzle. It is conceivable, for example, that the control unit initiates the feeding of the liquids from its containers in the direction of the spraying nozzle only when a spraying nozzle is also connected. If no spraying nozzle is connected, no feeding occurs, for example for safety reasons. Furthermore, it is conceivable that the control unit adapts the parameters for feeding the liquids to the type of spraying nozzle which is present, in order to permit an optimum spraying result. It is conceivable that a spraying nozzle requires a minimum pressure of the incoming liquid in order to generate a desired spatial distribution of the spraying liquid. This minimal pressure could be encoded at the spraying nozzle in a way that the control unit can read, with the result that the user does not have to set such parameters manually.

A pressure is usually built up upstream of the spraying nozzle. It is conceivable that this pressure has to be in a defined range in order to achieve an optimum spraying result.

In a preferred embodiment, a pressure sensor which is connected to the control unit is therefore mounted upstream of the spraying nozzle. By means of the pressure sensor, the control unit regulates the flow of diluent and/or concentrate in such a way that the pressure always varies within a defined range.

A valve is preferably mounted upstream of the outlet. This valve can be opened and closed manually or automatically.

This valve can preferably be activated manually, with the result that the user can direct the spraying nozzle mounted on the outlet onto a target object and start the spraying process by manually opening the valve.
It is also conceivable that the valve is opened automatically. It is conceivable, for example, that the spraying device has a sensor which detects the position of the spraying nozzle in space and automatically opens or closes the valve in a specific position. It is conceivable, for example, that the valve is closed if the spraying nozzle is directed toward the floor and is opened when the spraying nozzle is raised into the horizontal position.
It is also conceivable that the valve is opened automatically when the spraying nozzle approaches the target object. This can be done, for example, by means of sensors or GPS assistance (GPS-Global Positioning System).

In a further preferred refinement, the quantity of applied concentrate is determined and stored. The storage can take place in the control unit of the spraying device and/or in the memory unit of the cartridge. The residual quantity of concentrate which is still in the cartridge is preferably determined and stored. The storage can in turn take place in the control unit of the spraying device and/or in the memory unit of the cartridge.

In a preferred embodiment, an external computer system is associated with the system according to the invention. The term “external” is understood to mean that the computer system is not an integral part of the spraying device and is not part of the cartridge either. The computer system can, however, accept a communicative connection with the control unit of the spraying device and/or the memory unit of the cartridge in order to perform a transfer of data. Data can be transmitted from the computer system to the memory unit, for example in order to transmit product data, the degree of dilution to be set for the concentration or the like. It is also conceivable that data from the memory unit can be

transmitted to the computer system, for example about the residual quantity of concentrate contained in the cartridge. It is also conceivable that data from the control unit, such as, for example, data about the quantity of applied concentrate and/or the spraying duration and/or the spraying location and/or the user, is transmitted to the computer system. It is also conceivable that data from the computer system, for example data about an order for a spraying operation, is transferred to the control unit.

The invention will be explained in more detail below with reference to exemplary embodiments without, however, wishing to restrict the invention to these examples.

Figure 1 shows a schematic view of an embodiment of the system according to the invention. The system comprises a spraying device according to the invention and a cartridge according to the invention.

The spraying device according to the invention comprises a container (10) with a diluent (11), an outlet (30), means (15) for feeding the diluent (11) from the container (10) in the direction of the outlet (30), a valve (40), means (22b) for connecting a replaceable cartridge (20), an electrically operated pump (25) for feeding a concentrate (21), located in the cartridge (20), from the cartridge (20) in the direction of the outlet (30), a flowmeter (2) for measuring the flow of the diluent (11) from the container (10) in the direction of the outlet (30) and a control unit (1).

The means (15) for feeding the diluent (11) from the container (10) in the direction of the spraying device (30) are illustrated schematically in figure 1 as an arrow which merely indicates the direction of flow. The arrow does not mean that the corresponding means have to be located at this point on the feed line.

The outlet (30) is embodied as a spraying nozzle. The diluent and the concentrate exit the spraying device in the form of a mixture (50) with a constant mixing ratio via the spraying nozzle.

The cartridge (20) according to the invention contains the concentrate (21). The cartridge has means (22a) for reversibly connecting the cartridge (20) to the spraying device. The cartridge (20) according to the invention also has a memory unit (28). A mixing ratio (degree of dilution) is stored in this memory unit (28).

The control unit (1) has access to the memory unit (28) (the access is illustrated by the dashed line) and can read out the mixing ratio stored there.

The control unit (1) is also connected to the flowmeter (2) and the pump (25). If the valve (40) is opened (manually or automatically), the diluent (11) is fed from the container (10) in the direction of the outlet (30). The flow of the diluent (11) is registered by means of the flowmeter (2). The control unit (1) regulates, on the basis of the flow measured by the flowmeter (2), the quantity of concentrate (21) which is fed to the diluent (11) by means of the pump (25), with the result that the mixing ratio read out from the memory unit (28) is set.

Fig. 2 shows a preferred embodiment of the spraying system according to the invention.

The spraying device according to the invention comprises a container (10) having a diluent (11), an outlet (30), a first pump (15) for feeding the diluent (11) from the container (10) in the direction of the outlet (30), a valve (40), means (22b) for connecting a replaceable cartridge (20), a second pump (25) for feeding a concentrate (21), located in the cartridge (20), from the cartridge (20) in the direction of the outlet (30), a flowmeter (2) for measuring the flow of the diluent (11) from the container (10) in the direction of the outlet (30), a pressure sensor (3) for measuring the pressure in a feedline to the outlet (30) and a control unit (1).

The outlet (30) is embodied as a spraying nozzle. The diluent (11) and the concentrate (21) exit the spraying device in the form of a mixture (50) with a constant mixing ratio via the spraying nozzle.

The container (10) is embodied as a flexible bag. It comprises an opening with a resealable closure (12) above which the diluent (11) can be filled into the bag.

The cartridge (20) according to the invention contains the concentrate (21). The cartridge has means (22a) for reversibly connecting the cartridge (20) to the spraying device. The cartridge (20) according to the invention also has a memory unit (28). A mixing ratio (degree of dilution) is stored in this memory unit (28).

The control unit (1) has access to the memory unit (28) (the access is illustrated by the dashed line) and can read out the mixing ratio stored there.

The control unit (1) is also connected to the flowmeter (2), the pump (25) and the pressure sensor (3). If the valve (40) is opened (manually or automatically), the diluent (11) is fed from the container (10) in the direction of the outlet (30). The flow of the diluent (11) is detected by means of the flowmeter (2). The control unit (1) regulates, on the basis of the flow measured by the flowmeter (2), the quantity of concentrate (21) which is fed to the

diluent (11) by means of the pump (25), with the result that the mixing ratio which is read out from the memory unit (28) is set.

The control unit (1) regulates the flow of diluent and/or concentrate by means of the pressure sensor (3) in such a way that the pressure in the feedline to the spray nozzle constantly remains in a defined range.

Throughout this specification and the claims which follow, unless the context requires otherwise, the word "comprise", and variations such as "comprises" or "comprising", will be understood to imply the inclusion of a stated integer or step or group of integers or steps but not the exclusion of any other integer or step or group of integers or steps.

The reference in this specification to any prior publication (or information derived from it), or to any matter which is known, is not, and should not be taken as, an acknowledgement or admission or any form of suggestion that that prior publication (or information derived from it) or known matter forms part of the common general knowledge in the field of endeavour to which this specification relates.

2017294962 26 Jun 2023

The claims defining the invention are as follows:

1. Cartridge containing a concentrate of a pesticide, insecticide, herbicide or fungicide, wherein the cartridge comprises means for reversible connection of the cartridge to a sprayer,

wherein the cartridge has an electronic storage unit, and wherein in the storage unit information about an adjustable degree of dilution of the concentrate is stored;

and wherein the sprayer comprises a container for receiving a diluent, an outlet for the diluent, and a control unit configured to regulate the flow of the concentrate and the diluent towards the outlet according to the stored degree of dilution of the concentrate.

2. Cartridge according to Claim 1, wherein the storage unit is part of an RFID tag.

3. Cartridge according to Claims 1 or 2, wherein in the storage unit information on the amount of concentrate contained in the cartridge is included.

4. Cartridge according to Claim 3, wherein in the storage unit a residual amount remaining in the cartridge after a spraying process is stored.

5. Sprayer for the application of a pesticide, insecticide, herbicide or fungicide, comprising:

- a container for receiving a diluent,
- an outlet,
- means for conveying the diluent towards the outlet,
- means for a reversible connection of a replaceable cartridge containing a concentrate of the pesticide, insecticide, herbicide or fungicide to the sprayer,
- means for conveying the concentrate towards the outlet,
- a control unit, and
- a flow meter for determining the flow of the diluent towards the outlet, wherein the flow meter is connected to the control unit,

wherein

2017294962 26 Jun 2023

- the control unit has means for reading a degree of dilution from an electronic storage unit belonging to the cartridge, and
- the control unit is configured to regulate the flow of the concentrate by means of the flow of the diluent towards the outlet so that a mixture of the concentrate and the diluent escapes from the outlet in which the concentrate is diluted according to the degree of dilution read.

6. A sprayer device according to Claim 5, wherein the container is designed as a flexible bag, and the diluent is water and the means for pumping the water towards the outlet comprises a first electrically operated pump, and the means for pumping the concentrate towards the outlet comprises a second electrically operated pump.

7. A sprayer device according to Claims 5 or 6, wherein the outlet comprises a replaceable spray nozzle, which is preferably in a communicative connection with the control unit.

8. System comprising

- a portable sprayer for the application of a pesticide, insecticide, herbicide or fungicide comprising the following components:
  - a container for receiving a diluent,
  - an outlet,
  - means for conveying the diluent towards the outlet,
  - means for reversible connection of a replaceable cartridge containing a concentrate of the pesticide, insecticide, herbicide or fungicide to the sprayer,
  - means for conveying the concentrate towards the outlet,
  - a flow meter to determine the flow of the diluent towards the outlet, wherein the flow meter is connected to the control unit, and
  - a control unit
- and a replaceable cartridge comprising means for reversible connection of the cartridge to the sprayer,

wherein

the control unit has means for reading a degree of dilution from an electronic storage unit belonging to the cartridge,

2017294962 26 Jun 2023

the control unit is configured to regulate the flow of the concentrate by means of the flow of the diluent towards the outlet so that a mixture of the concentrate and the diluent escapes from the outlet in which the concentrate is diluted according to the read degree of dilution, and

the cartridge has an electronic storage unit that is read out by the control unit of the sprayer when the cartridge is connected to the sprayer and in which information about an adjustable degree of dilution of the concentrate with the diluent is stored.

9. The system according to Claim 8, comprising a cartridge according to any one of Claims 1 to 4 and a sprayer according to any one of Claims 5 to 7.

10. The system according to any one of Claims 8 or 9, comprising an external computer system that may be in a communicative connection with the control unit of the sprayer and/or with the storage unit of the cartridge, wherein data can be transmitted from the computer system to the control unit and/or the memory unit and/or data from the control unit and/or the memory unit can be transmitted to the external computer system.

11. A method for administering an active ingredient formulation, comprising the following steps:

- providing a replaceable cartridge with an active ingredient concentrate, wherein the cartridge comprises an electronic storage unit, wherein a dilution wheel is stored in the storage unit, wherein the active ingredient concentrate is a concentrate of a pesticide, insecticide, herbicide or fungicide,
- providing a sprayer for the application of the pesticide, insecticide, herbicide or fungicide comprising a diluent, wherein the sprayer comprises a control unit, wherein the control unit has means to read the degree of dilution from the storage unit,
- connecting the interchangeable cartridge to the sprayer by a user,
- reading the degree of dilution from the storage unit by the control unit,
- determining the flow of the diluent through the flow meter connected to the control unit,
- regulating the flow(s) of the active ingredient concentrate and/or the diluent from their containers through the control unit towards the outlet, so that a mixture of the active ingredient concentrate and the diluent emerges from the outlet in which

the active ingredient concentrate is diluted according to the read degree of dilution.

12. The method according to Claim 11 using a sprayer according to any one of Claims 5 to 7 and/or using a cartridge according to any one of Claims 1 to 4.

13. The method according to Claim 11 using a sprayer according to any one of Claims 8 to 10.

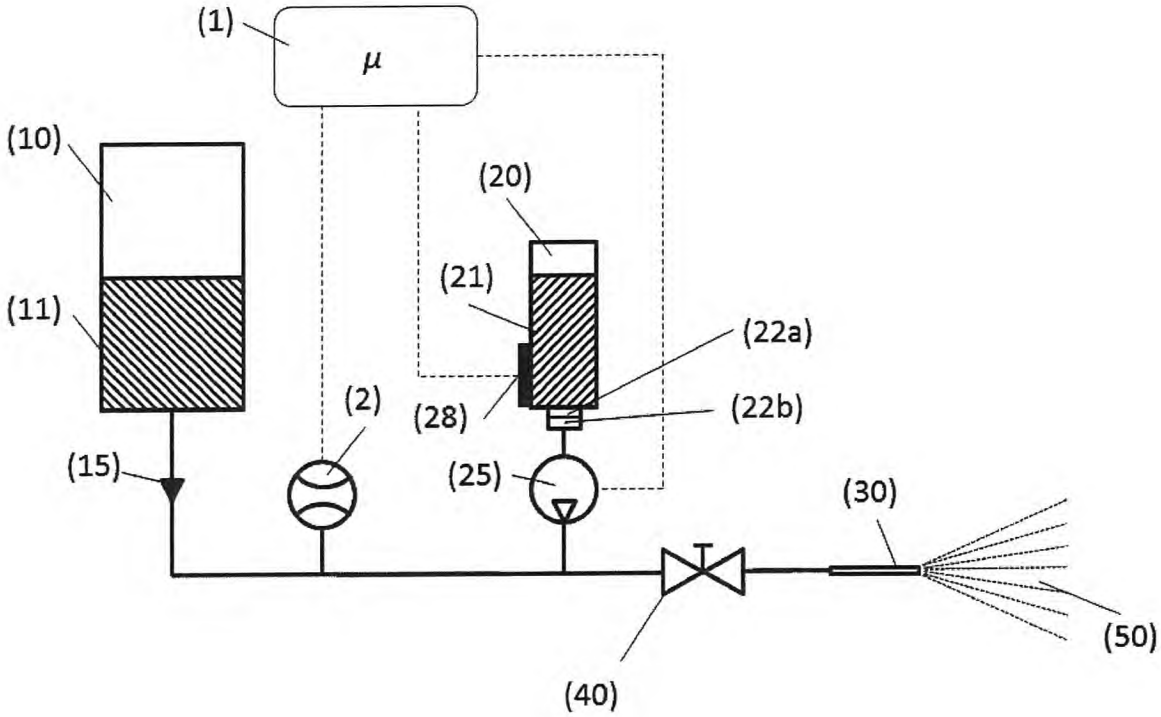
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Fig. 1

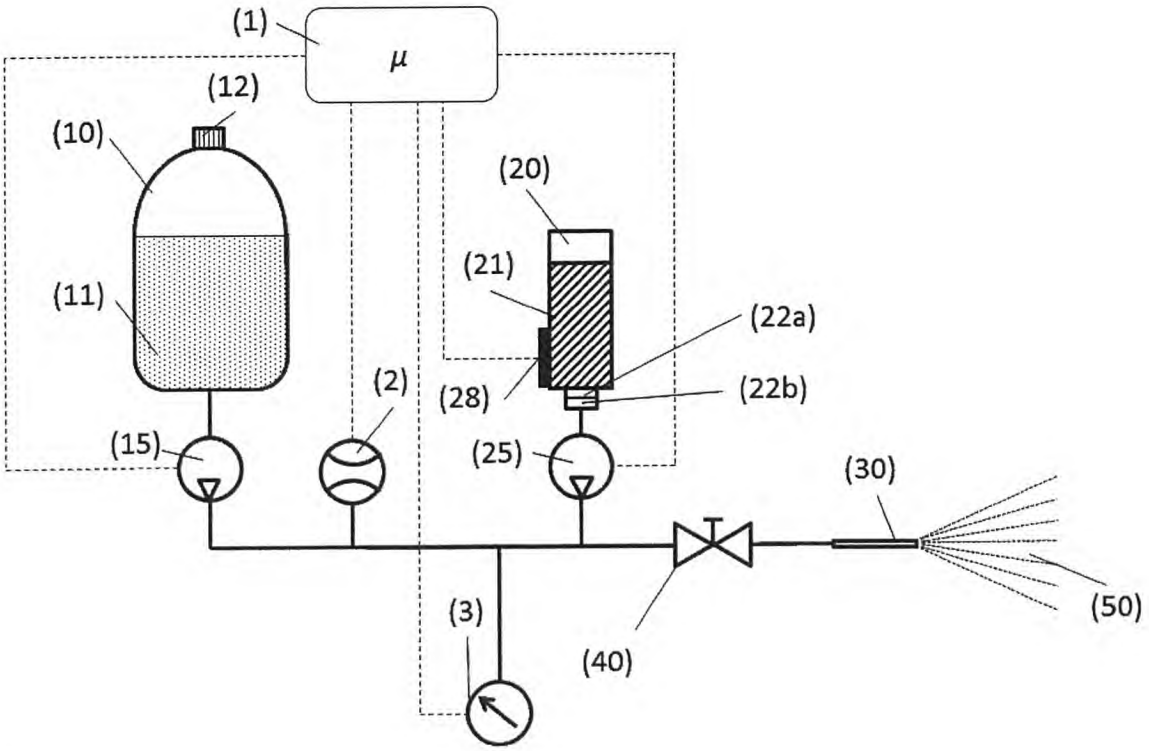
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Fig. 2