(54) METHOD TO MAKE SNOW FOR INSECT CONTROL AND DEVICE FOR MAKING THE SAME
VERFAHREN ZUR HERSTELLUNG VON SCHNEE ZUR INSEKTENBEKÄMPFUNG UND
VORRICHTUNG ZU DEREN HERSTELLUNG
PROCEDE DE FABRICATION DE NEIGE POUR LA DESTRUCTION D’INSECTE ET DISPOSITIF
ASSOCIE

(84) Designated Contracting States:
AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE

(30) Priority: 10.07.1998 SE 9802499
16.10.1998 SE 9803530

(43) Date of publication of application:
09.05.2001 Bulletin 2001/19

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Description

[0001] The present invention relates to a method for bringing about the transformation of a medium such as carbon dioxide or other gases or mixtures thereof into snow for the purpose of being able effectively to cool surfaces and different spaces of varying size and nature the aforementioned medium and the snow produced from it are caused to interact with the surfaces of a snow-producing nozzle extending from a discharge orifice for the medium, in that the aforementioned medium, after exiting from the discharge orifice, is permitted to act against a number of obstructions.

[0002] When using carbon dioxide (CO₂) or other gases or mixtures thereof for the purpose of being able effectively to cool surfaces and other spaces of varying size and nature, for example in order to kill harmful insects or other undesirable animals, it is important to be able to achieve a low temperature rapidly and effectively and to minimize the quantity of gas used. Previously disclosed methods, in which existing snow tubes are used, have not proved to be so effective, and an unacceptable cooling effect has accordingly been achieved. See, for example, US,A, 4,911,362; 5,027,546 and 5,349,778. In order to cool surfaces and spaces effectively so that harmful insects and other undesirable animals are cooled rapidly to kill them, it is necessary for the largest possible proportion of the gas used to be converted into snow, which, at the time of spraying, exhibits a low temperature, a good adhesive capacity and a high ability to cover the surfaces in question so that the insects are killed effectively.

[0003] The principal object of the present invention is thus, in the first instance, to identify a method which effectively solves the aforementioned problems efficiently and simply.

[0004] The aforementioned principal object is achieved by means of a method in accordance with the present invention, which is characterized essentially in that, the obstructions are in the form of a number of layers of hair, thin strips or a rotating device situated along the flow path of the medium as it flows out between the discharge orifice and the outlet for the formed snow, the produced carbon dioxide snow is intended to cool harmful insects or other undesirable animals for the purpose of animal pest decontamination.

[0005] There are no previously disclosed means which permit the aforementioned desired object to be achieved, and use is made of snow tubes, which are seen to be not so effective from the patents referred to above, for example.

[0006] US, 4413756A presents insect control with snow formed by spraying through spaces whose width, and thus their volume, vary.

[0007] EP 0 891 945 A2 presents a snow spray nozzle which is formed by an obstruction in the form of a metal disc. This component is already present at the start of spraying of the medium in liquid form and accordingly only one side of it is in contact with the liquid phase, as distinct from bristles, which thus function in a different way in the snow forming process.

[0008] A further object of the present invention is thus also to identify means that are suitable for use in the performance of a method in accordance with the present invention wherein a snow-producing nozzle comprises an orifice for the supply of medium at its inlet end, and a number of obstructions for the medium as it flows through are situated in the interior of the nozzle between the orifice for the out flow of the medium to the nozzle and the snow outlet from the nozzle.

[0009] The aforementioned further object is achieved by means in accordance with the present invention, which is characterized by the features of the characterizing portion of claim 5.

[0010] The invention is described in detail below, in conjunction with which reference is made to the accompanying drawings, in which:

Fig. 1 shows in schematic form a first proposed illustrative example of a nozzle in accordance with the invention viewed in perspective and partially sectioned;

Fig. 2 shows a second illustrative example of a nozzle viewed in cross section in its longitudinal extent;

Fig. 3 shows a cross section through the aforementioned nozzle viewed along the line III-III in Fig. 2; and

Fig. 4 shows a third illustrative example of a nozzle viewed from the side.

[0011] The invention, which now permits effective insect pest decontamination without the use of dangerous poisons and other undesirable substances, is based on the principle of cooling intended areas that it is wished to decontaminate with carbon dioxide snow which exhibits a very low temperature, in the first instance in the food industry and in other areas of activity, such as bakeries and restaurants.

[0012] Traditional animal pest decontamination involves the use of poisons in the first instance. This type of decontamination has many disadvantages. Traditional poisons are expensive, require careful cleaning and cause lengthy operating shut-downs, which together result in costly decontamination. The poisons create an unsafe working environment and pose the risk of contamination of foodstuffs. Confined spaces are often difficult or impossible to treat. Increasingly stringent environmental requirements from the authorities and competitive advantages associated with environmental certification, when combined with the aforementioned disadvantages, create a major need for new methods of decontamination.

[0013] It has emerged from investigations carried out at the University of Arhus (Skytte, T., 1993) that rapid cooling is an effective way of killing insects. Trials of the invention have been conducted in secret involving de-
contamination with a first prototype in areas which were previously on the whole impossible to decontaminate by conventional means. Subsequent checks have now revealed the result to be the one hundred percent elimination of insect pests.

[0014] It emerged in the course of practical trials with a new prototype that the cooling of a test surface is increased from the -27°C achieved with a conventional snow tube to -58°C, using the same quantity of gas. This new method also provides an opportunity to direct and distribute the carbon dioxide snow onto the surface or into the area that it is wished to cool.

[0015] Decontamination equipment should contain approx. 5 kg of gas in order to be manageable. This quantity of gas is equivalent to the carbon dioxide exhaled by seven persons over a 24-hour period or produced by a car that is driven for approx. 20 kilometres. Five kg of gas in an airtight room with dimensions of 10 m x 10 m x 3 m will increase the gas concentration from the natural level of 0.03% to approx. 1%. Its concentration should not exceed the concentration of the exhaled air, i.e. 4%. The method is thus non-toxic and environmentally friendly. Carbon dioxide is very inexpensive, furthermore, and carbon dioxide is collected as a by-product of processing industry. The equipment can be fitted with some form of carbon dioxide detector. Other alternative gases or mixtures thereof can also be considered for the aforementioned purpose. Apart from portable equipment, consideration can also be given to permanent installations in critical areas.

[0016] In the course of experiments conducted in order to demonstrate cooling effects with different methods, it emerged that the cooling effect of the gas being used increases dramatically if it is possible to ensure that the largest possible proportion of the gas that is used forms carbon dioxide snow with the appropriate characteristics. This is possible by causing the gas and the snow produced from it to interact with surfaces. This affects the quantity and quality of the snow. The larger the area with which the emerging carbon dioxide is permitted to interact, the greater is the yield of snow produced. Trials have also shown that snow formation increases if the emerging carbon dioxide is allowed to interact with snow that has already been formed. Temperatures below -78°C were achieved when the snow was allowed to flow into a narrow channel after snow formation. This drop in temperature is achieved through the associated increased velocity and the resulting drop in temperature.

[0017] A series of trials demonstrated that this method functioned very well when the cooling effect of a nozzle on a surface was measured over a certain period. The trial conditions were kept constant. The fitment of a curtain approx. 8 mm thick (see Fig. 1) consisting of simple bristles of the painter's brush type produces an instantaneous increase in the cooling effect from -15°C to -58°C.

[0018] The method described above (see Fig. 2) was developed in a second series of trials. A significantly greater cooling effect and snow with good adhesion characteristics were achieved.

[0019] The method that it is wished to patent consists of first permitting the fluid flowing from a gas cylinder, for example, after it has emerged from one or more discharge orifices, to expand inside one or more small chambers. The next space has a greater volume, which increases the opportunity for small particles of snow to agglomerate into larger particles on the surfaces provided for the purpose. These surfaces also give rise to an accumulation of snow, which further increases the cooling effect of the device. The surfaces may have different appearances and may exhibit a varying degree of flexibility. The supplied medium is led through or past obstructions, which may consist of hairs, such as those of a painter's brush, thin strips, a rotating device, tubes or some other arrangement. The material of these obstructions can be selected to give the desired characteristics. They are preferably also flexible.

[0020] As a first application, a portable apparatus will be designed for the environmentally friendly control of insect pests. This apparatus can be executed so that it is ergonomically portable and with a pistol grip for regulation of the gas flow.

[0021] It will then be necessary to provide the ability to direct the carbon dioxide snow and distribute it on the surface or into the space that it is wished to cool.

[0022] Bristles or some other obstruction can also be used to control the flow of snow particles. This is an important aspect, in view of the importance of achieving spherical distribution in certain confined spaces. In the example illustrated in Fig. 1, the particles are directed at the measuring surface of the bristles. The aforementioned bristles may also have a mechanical effect, for example in conjunction with the decontamination of insect pests, when any impurities can be brushed away in conjunction with the decontamination.

[0023] More specifically, the invention relates to a method of bringing about the transformation of a medium 1 such as carbon dioxide or other gases or mixtures thereof into snow 2. The aforementioned medium 1 and the snow 2 formed from it are then allowed to interact with surfaces on a snow-producing nozzle 4 extending away from a discharge orifice 3 for the medium 1. The aforementioned medium 1 can then be permitted, after exiting from the discharge orifice 3 in a nozzle 41, to expand inside an elongated space 5 which exhibits a uniform cross section, as illustrated in Fig. 4.

[0024] As a further alternative, it is also possible to permit the medium 1 flowing out to the nozzle 4 to act against a number of obstructions 9; 10, 11, which are situated along the flow path of the outflowing medium 1 between the discharge orifice 3 for the medium 1 in the nozzle 4, 42 in question and an outlet 12 for the formed snow, in conjunction with which the produced carbon dioxide snow 2 is intended for the decontamination of animal pests.
The formed snow \(2\) should preferably be allowed to flow into a narrow, elongated channel after the snow has formed, in conjunction with which the temperature of the aforementioned snow \(2\) is lowered further. The outflowing medium \(1\) can also be allowed to interact with snow \(2\) that has already formed in order to bring about its effective cooling.

Illustrated in Fig. 2 is a nozzle \(4^2\), in which the medium \(1\), which flows out through a control valve \(16\) at one end \(4A\) of the nozzle and into a number of chambers \(6, 7\) in the nozzle \(4^2\), in which the space increases from a previous chamber \(6\) to a following chamber \(7\), is caused to expand. At the rear end \(4A\) of the nozzle \(4^2\), the outflowing medium \(1\) is caused to expand inside a chamber \(6\), which exhibits a successively increasing volume, for example by the chamber \(6\) exhibiting conical form. A narrower discharge tube \(17\) is present at the front end \(4B\) of the nozzle \(4^2\).

In the embodiments in accordance with Figs. 1 and 2, the outflowing medium \(1\) is caused to pass obstructions in the form of an accumulation of hairs \(13\), for example like the bristles of a painter's brush, in a single execution \(9\) or a double execution \(10, 11\) fixed at a mutual distance \(A\) from one another. The medium \(1\) can also be caused to pass obstructions in the form of thin strips, not illustrated here, or in the form of a tube or a rotating obstruction which effectively brings about the aforementioned transformation of the snow.

A means for achieving the aforementioned effective transformation of a medium \(1\) in the form of carbon dioxide, other gases or mixtures thereof into snow \(2\), which is intended to be used for the decontamination of vermin and other undesirable animal pests, comprises a snow-producing nozzle \(4, 4^1, 4^2\). This nozzle comprises an orifice \(3\) for the supply of the aforementioned medium \(1\) at the inlet end \(4A\) of the nozzle. The design of the nozzle \(4, 4^1, 4^2\) can also vary as follows. The aforementioned nozzle \(4^1\) can exhibit an elongated narrow space \(5\) leading from it, which exhibits a uniform cross section, or the nozzle \(4^2\) can exhibit several spaces \(6, 7, 8\) located one after the other, which exhibit varying volume. The aforementioned spaces \(5; 6-8\) extend towards the discharge end \(4B\) of the nozzle.

Variants of the nozzle \(4, 4^2\) are also possible, in which a number of obstructions \(9; 10, 11\) for the medium \(1\) as it flows through are situated in the interior of the nozzle between its aforementioned inlet orifice \(3\) for the medium \(1\) and the nozzle's discharge orifice \(12\) for snow \(2\).

The aforementioned obstruction \(9; 10, 11\) in the nozzle can be in the form of a number of layers of flexible bristles \(13\) arranged more or less transversely and/or longitudinally, similar to the bristles of a paint brush, a brush or a broom, which permit the medium \(1\) to pass straight through the layers of bristles or along the bristles at the same time as snow \(2\) is being formed.

The equipment is executed ergonomically with a pistol grip for regulating the gas flow, and Fig. 1 shows an embodiment with an appropriate design of one of the nozzles \(4\), which has been subjected to practical testing and is referred to in the text above. Advantage is taken of the aerodynamic effect by keeping the areas \(15\) and \(18\) on the front edge \(4B\) and the rear edge \(4A\) of the nozzle the same size, which means that the nozzle \(4\) is caused to be forced against the substrate \(19\) along which it is working.

The invention is not restricted to the illustrative embodiments described above and shown in the drawings, but may be modified within the scope of the Patent Claims without departing from the idea of invention.

Claims

1. Method for bringing about the transformation of a medium \(1\) such as carbon dioxide or other gases or mixtures thereof into snow \(2\) for the purpose of being able effectively to cool surfaces and different spaces of varying size and nature, the aforementioned medium \(1\) and the snow \(2\) produced from it are caused to interact with the surfaces of a snow-producing nozzle \(4, 4^1, 4^2\) extending from a discharge orifice \(3\) for the medium \(1\), in that the aforementioned medium \(1\), after exiting from the discharge orifice \(3\), is permitted to act against a number of obstructions \(9; 10, 11\), characterized in that the obstructions are in the form of a number of layers of hair \(13\), thin strips or a rotating device situated along the flow path of the medium \(1\) as it flows out between the discharge orifice \(3\) for the medium \(1\) and an outlet \(12\) for the formed snow \(2\), the produced carbon dioxide snow \(2\) is intended to kill harmful insects or other undesirable animals for the purpose of animal pest decontamination.

2. Method in accordance with Patent Claim 1, characterized in that the outflowing medium \(1\) is also allowed to interact with snow \(2\) that has already formed.

3. Method in accordance with Patent Claim 1, characterized in that formed snow \(2\) is allowed to flow into a narrow, elongated channel after the snow has formed, in conjunction with which the temperature of the snow \(2\) is lowered further.

4. Method in accordance with Patent Claim 1, characterized in that the aforementioned medium \(1\) is led through or along the number of obstructions \(9; 10, 11\), which are situated along the flow path of the outflowing medium \(1\) between the discharge orifice \(3\) for the medium \(1\) and an outlet \(12\) for the formed snow \(2\), which consist of hairs, similar to those of a paint brush \(13\), at the same time as snow \(2\) is being formed.
5. Means for achieving the transformation of a medium (1), such as carbon dioxide or other gases or mixtures thereof, into snow (2) in accordance with one or other of the above Patent Claims, a snow-producing nozzle (4, 41 , 42) comprises an orifice (3) for the supply of medium (1) at its inlet end (4A), and a number of obstructions (9; 10, 11) for the medium (1) as it flows through or along the hairs, and are situated in the interior of the nozzle (4, 42) between its orifice (3) for the outflow of the medium (1) to the nozzle (4, 42) and the snow outlet (12) from the nozzle.

6. Means in accordance with one or other of the above Patent Claims, characterized in that the aforementioned obstructions (9; 10, 11) are in the form of a number of layers of transverse bristles (13).

7. Means in accordance with one or other of Patent Claims 5-6, characterized in that the bristles (13) are flexible.

8. Method in accordance with one or other of Patent Claims 6-7, characterized in that the bristles (13) are elongated.

Patentansprüche

1. Verfahren zum Umwandeln eines Mediums (1), wie beispielsweise Kohlendioxid oder anderer Gase oder deren Mischungen, in Schnee (2), um damit Flächen und verschiedene Räume mit variierender Größe und Beschaffenheit effektiv zu kühlen, wobei das vorher erwähnte Medium (1) und der Schnee (2), der daraus hergestellt wird, mit den Flächen einer Schnee erzeugenden Düse (4, 41, 42) in Wechselwirkung stehen, die sich von einer Austragsöffnung (3) für das Medium (1) erstreckt, wobei das vorher erwähnte Medium (1) nach einem Verlassen der Austragsöffnung (3) auf eine Anzahl von Hindernissen (9; 10, 11) auftrifft, dadurch gekennzeichnet, dass die Hindernisse in der Form einer Anzahl von Lagen aus Haaren (13), dünnen Streifen oder einer Rotationsvorrichtung bestehen, die entlang des Durchflusspfades des Mediums (1) angeordnet sind bzw. ist, wenn dieses zwischen der Austragsöffnung (3) für das Medium (1) und einem Auslass (12) für den gebildeten Schnee (2) herausfließt, wobei der erzeugte Kohlendioxidschnee (2) dazu bestimmt ist, schädliche Insekten oder andere unerwünschte Tiere zu tötten und damit eine Schädlingsdekontamination zu bewirken.

2. Verfahren nach Anspruch 1, dadurch gekennzeichnet, dass das herausfließende Medium (1) auch mit Schnee (2) wechselwirken kann, der bereits gebildet ist.

3. Verfahren nach Anspruch 1, dadurch gekennzeichnet, dass die gebildete Schnee (2) in einen schmalen länglichen Kanal fließt, nachdem der Schnee gebildet ist, wobei in Verbindung damit die Temperatur des Schnees (2) weiter abgesenkt wird.

4. Verfahren nach Anspruch 1, dadurch gekennzeichnet, dass das vorher erwähnte Medium (1) gleichzeitig dazu, wenn der Schnee (2) gebildet wird, durch oder entlang der Anzahl von Hindernissen (9; 10, 11) geführt wird, die entlang des Durchflusspfades des herausfließenden Mediums (1) zwischen der Austragsöffnung (3) für das Medium (1) und einem Auslass (12) für den gebildeten Schnee (2) angeordnet sind und die aus Haaren bestehen, die ähnlich denjenigen eines Pinsels (13) sind.

5. Mittel zur Umwandlung eines Mediums (1), wie beispielsweise Kohlendioxid oder anderer Gase oder deren Mischungen, in Schnee (2) gemäß einem der oben beschriebenen Ansprüche, wobei eine Schnee erzeugende Düse (4, 41, 42) eine Öffnung (3) für die Lieferung von Medium (1) an ihr Einlassende (4A) umfasst, und eine Anzahl von Hindernissen (9; 10, 11) für das Medium (1), wenn dieses hindurch fließt, in dem Innern der Düse (4, 42) zwischen der Öffnung (3) für den Ausfluss des Mediums (1) zu der Düse (4, 42) und dem Schneeausschluss (12) von der Düse angeordnet sind, dadurch gekennzeichnet, dass die vorher erwähnten Hindernisse (9; 10, 11) in der Form einer Anzahl von Haarlagen, wie beispielsweise denjenigen in einem Pinsel (13), für das Medium (1) vorgesehen sind, wenn es durch oder entlang der Haare fließt, und in dem Innern der Düse (4, 42) zwischen ihrer Öffnung (3) für den Ausfluss des Mediums (1) zu der Düse (4, 42) und dem Schneeausschluss (12) von der Düse angeordnet sind.

6. Mittel nach einem der vorhergehenden Ansprüche, dadurch gekennzeichnet, dass die vorher erwähnten Hindernisse (9; 10, 11) in der Form einer Anzahl von Lagen aus Querborsten (13) ausgebildet sind.

7. Mittel nach einem der Ansprüche 5 bis 6, dadurch gekennzeichnet, dass die Borsten (13) flexibel sind.

8. Verfahren nach einem der Ansprüche 6 bis 7, dadurch gekennzeichnet, dass die Borsten (13)
Revendications

1. Procédé pour la mise en œuvre de la transformation en neige (2) d’un fluide tel que du dioxyde de carbone ou d’autres gaz ou des mélanges de ceux-ci en vue de le rendre efficace pour le refroidissement de surfaces et de différents espaces de dimensions et de nature diverses, dans lequel on fait réagir ledit fluide (1) et la neige (2) en résultant avec les surfaces d’une buse de production de neige (4, 4¹, 4²) s’étendant à partir d’un orifice de décharge (3) du fluide (1), et dans lequel on fait agir ledit fluide (1), après sa sortie de l’orifice (3) de décharge, contre un nombre d’obturations (9; 10, 11) caractérisé en ce que ces obturations sont réalisées sous la forme d’un nombre de couches de soies (13), de fines bandes ou d’un dispositif rotatif situé le long du chemin d’écoulement du fluide (1) alors qu’il s’écoule vers l’extérieur entre l’orifice de décharge (3) du fluide (1) et un orifice de sortie (12) pour la neige (2) ainsi formée, la neige (2) de dioxyde de carbone produite étant destinée à tuer des insectes nuisibles ou d’autres animaux indésirables pour réaliser la désinfection par rapport aux animaux nuisibles.

2. Procédé selon la revendication 1, caractérisé en ce que le flux du fluide (1) sortant est également amené à interagir avec la neige (2) qui s’est déjà formée.

3. Procédé selon la revendication 1, caractérisé en ce que la neige formée (2) est amenée à s’écouler le long d’un canal étroit et allongé après sa formation, abaissant ainsi davantage la température de la neige (2).

4. Procédé selon la revendication 1, caractérisé en ce que ledit fluide (1) est conduit à travers ou le long des obstructions (9; 10, 11) situées le long du chemin d’écoulement du fluide (1) sortant entre l’orifice de décharge (3) du fluide (1) et un orifice de sortie (12) pour la neige (2) formée, qui consistent en des soies, analogues à celles d’un pinceau (13), simultanément à la formation de la neige.

5. Moyen pour la réalisation de la transformation en neige (2) d’un fluide (1) tel que du dioxyde de carbone ou d’autres gaz ou des mélanges de ceux-ci selon l’une quelconque des revendications précédentes, une buse (4, 4¹, 4²) de production de neige comprenant un orifice (3) pour l’alimentation en fluide (1) à son orifice d’entrée d’extrémité (4A) et un nombre d’obturations (9; 10, 11) pour le flux du fluide (1) les traversant étant situés à l’intérieur d’une buse (4, 4²) entre l’orifice (3) pour le flux sortant du fluide (1) vers la buse (4, 4²) et l’orifice pour la sortie de la neige (12) hors de la buse, caractérisé en ce que ces obturations (9; 10, 11) sont réalisées sous la forme d’un nombre de couches de soies telles que celles d’un pinceau (13), pour le fluide (1) s’écoulant à travers ou le long des soies, et en ce qu’elles sont situées à l’intérieur de la buse (4, 4²) entre son orifice (3) pour le flux sortant du fluide (1) vers la buse (4, 4²) et la sortie (12) de neige de la buse.

6. Moyen selon l’une quelconque des revendications précédentes, caractérisé en ce que lesdites obturations (9; 10, 11) sont réalisées sous la forme d’un nombre de couches de poils transversaux.

7. Moyen selon l’une quelconque des revendications précédentes, caractérisé en ce que les poils (13) sont flexibles.

8. Moyen selon l’une quelconque des revendications précédentes, caractérisé en ce que les poils (13) sont allongés.