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(54) Benævnelse: **FREMGANGSMÅDE TIL BEDØVELSE AF DYR UNDER INVÆRKSÆTELSE AF EN RECIRKULERING AF GASSERNE**

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WO-A2-2004/098297
FR-A1- 2 914 864

Description

The present invention relates to the field of animal anaesthesia, particularly the anaesthesia of mammals or game birds prior to slaughter. Anaesthesia makes it possible to have an animal that is unconscious while being slaughtered.

Just as the question of animal welfare and of personnel welfare is one of the key concerns of regulatory bodies, so too is the cost of the method of anaesthesia one of the key concerns of the slaughterhouse.

It is known that, in this industry, there are essentially 3 methods of anaesthesia: electrical anaesthesia, stunning by mechanical impact, and anaesthesia through the supply of gas, usually CO2 in gaseous form.

Documents FR-2 914 864, WO2004/098297, WO2016/193368 and WO2008/128027 illustrate the prior art for the anaesthesia of animals prior to slaughter.

Anaesthesia through the supply of CO_2 is commonly performed under the following conditions:

- the species, particularly game birds, are processed in "batch" mode;
- the cages of live animals arrive at the place of slaughter in crates;
- each crate (which therefore contains an arrangement of cages) is removed from the lorry, conveyed into the place of slaughter, introduced into a processing airlock (or cell) for processing using an anaesthetizing gas, removed from the airlock once the processing has been performed, directed towards the animal slaughtering line (the animals are positioned head down on travelling hooks, etc.) etc., all this being done by automated handling means.

The main advantages of CO_2 can be summarized as follows:

- group anaesthesia reduces the stress to the animal;

- reduced petechial haemorrhages;
- absence of physical intervention by personnel on the animal in order to cause it to lose consciousness;
- the animals are handled while they are unconscious.

The main disadvantages of CO_2 can be summarized as follows:

- CO_2 is lost when the doors to the airlocks are opened;
- there are continual demands to optimize the length of time for which the animal experiences discomfort;
- the throughputs are lower than those of the other known methods of anaesthesia;
- admittedly, there are solutions whereby the CO_2 is recirculated by filtering and concentrating it, but these then generate high investment costs and high electrical energy costs.

What is therefore proposed in the context of the present invention is an anaesthesia method that employs a gas or gas mixture, which will be recirculated, so as to optimize the consumption of the gas while at the same time reducing the stress on the animal. In order to do that, the proposal is for the gas to be recirculated using temporary storage means (which may be referred to as capacities), the storage means being, as will be seen, of variable volume.

Specifically, for the welfare of the animal and the quality of the end product, the anaesthesia cycle generally comprises a number of steps: for example, loading the animals then progressively raising the gas content to achieve a loss of consciousness, followed by a higher content to achieve lethal levels, and then stabilizing at these levels for a predetermined length of time (determined notably according to the species being processed) before unloading to proceed to slaughtering.

Because each of these steps employs different gas contents, and for example different CO_2 contents, it is advantageous for the recirculated gas to be stored in specific reserves.

To illustrate that, use may, for example, be made of the following storage facilities:

- a gas reserve made up of ambient air or else a composition similar to ambient air;
- a gas reserve containing approximately 20% CO_2;
- a gas reserve containing approximately 40% CO_2;
- a gas reserve containing approximately 60% CO_2;

the rest of the composition being, for example, air.

The attached figure 1 illustrates one of the preferred embodiments of the invention and shows the following elements:

- the reference 1 denotes an airlock or cell in which the cages containing the animals that are to be anaesthetized are positioned;
- the reference 2 denotes an assembly, here (although this is merely one example) made up of 5 variable-capacity gas-storage compartments (or "capacities") (these capacities can also be referred to as "concertinas" or "bellows");
- the detail view 3 on the right-hand side of the figure details the system that allows the volume of a capacity to be modified (in the instance illustrated here: a pneumatic tube (cylinder));
- the reference 4 denotes a store of gas, for example liquid CO_2;
- and in order to better visualize the various movements of gas involved in this embodiment of the invention, use has been made of the following symbols:
    - on the extreme left of the figure, the big black arrow denotes the arrival of air "alone" or "pure" air to the airlock 1 (circuit D);
    - the letter A (thick dashed line) denotes the arrival (or addition) of pure CO_2 to the airlock 1;
    - the letter B (thin dashed line) denotes the pressurization of the tubes with pure CO_2 and the depressurization of the tubes to the airlocks;
    - the letter C (dotted line) denotes the recirculation circuit recirculating the CO_2 between the airlock and the assembly 2 of capacities.

One example of the implementation of the installation of figure 1 will now be described hereinafter in order better to understand the contribution made by the invention, while of course bearing in mind the fact that the gas exposure times and levels will need to be adapted according to the species of animal processed, or according to their weight, their age, etc. An example using CO_2 is illustrated hereinbelow.

Upon entry into service, i.e. upon first use, the CO_2 is injected progressively into the airlock 1 (circuit A).

During this 1st use anaesthesia is performed using non-recirculated ("pure") gas and therefore not using gas which may have been stored in the assembly 2, but of course this gas injected for the 1st use will not be lost, it will, as will be seen, be stored in the capacities 2 for use in the next cycle etc.

At this stage, the airlock therefore contains a high content of CO_2 and the objective is to draw out this high concentration as well as possible. In order to segment the various desired gas contents, use is made of several gas storage compartments (in the example given here, from No1 to No5).

For example, compartment No1 is first to perform drawing out (in order to draw out, CO_2 is injected into the corresponding tube 3 (circuit B)), the concertina rises and generates a reduced pressure which draws out the gas contained in the airlock (circuit C).

A better understanding is gained here of the extremely advantageous nature of the technical proposal of the invention, of a variable-volume capacity thus enabling the creation of the reduced pressure and the drawing-out of the gas contained in the airlock.

A gas analyser may advantageously enable the drawn-out gas to be qualified. By way of illustration, when the gas in compartment No1 reaches a CO_2 content of 50%, the method switches over to compartment No2 according to the procedure described hereinabove.

A compartment is oversized in terms of volume so as not to disturb the method and underfill compartments by switching over to the next compartment without having reached the target value.

Once a compartment is sufficiently full, it is shut off using a fluidtight valve.

When the method switches over to compartment No2, the aim is, for example, to fill this compartment with a gas having a lower content than No1. To do that, ambient air is injected into the airlock or else a valve is opened to allow fresh air to be drawn in.

In order to make tube No2 rise again, CO_2 is injected into this tube.

As a preference, air is injected at an opposite point to the drawing-out point. In the case of a high-density gas such as CO_2, it is preferable for gas to be drawn out from the bottom of the airlock and for air to be injected into the top of the airlock.

Once compartment 2 is full, the method moves on to 3, then 4 and finally 5.

Once the processing has been performed, and therefore after the airlock has been opened in order to remove the animals and introduce a new batch, the airlock 1 therefore contains a low content of anaesthetizing gas (and in fact this gas is close to ambient air). It is therefore preferable to inject gas into the airlock progressively.

It is therefore preferable to begin with the compartment with the lowest concentration of anaesthetizing gas (here in the example described hereinabove, compartment No5).

Because the anaesthetizing process is based on a time/gas content pair, an analyser, coupled to a time controller, may advantageously govern the opening of the various compartments in order to conform to the gas levels required (the opening of tubes No5 to No1).

In order to release gas from a compartment, the corresponding valve needs to be opened and the tube needs also to be purged, and given that the gas used to actuate the cylinder is precisely the anaesthetizing gas it will advantageously be released into the airlock so that it can be put to work.

This astute measure means that the so-called “cost-free” pressure (the pressure available typically being between 11 and 20 bar) can be put to use to actuate the cylinders without employing additional energy (which would be electrical energy or compressed air).

In order to replace the air present in the processing airlock with the anaesthetizing gas, a purge valve needs to be opened (circuit D).

For safety reasons, it is preferable to employ an arrangement whereby the injection of gas is possible only if the airlock is filled with the crates that make up the batch, so that no individual can be present in the airlock at the time of injection.

Let us consider in what follows the example of poultry used for meat:

- remove the previous cages and introduce a batch (2 min without injection);
- then 1 min to raise to 20%;
- then 2 min to reach 35%;
- then 2 min to reach approximately 75%;

- 1 min 30 s to stabilize at this content of around 75%
- one minute to drop back down to 0% CO_2.

The present invention therefore relates to a method for anaesthetizing animals prior to slaughter, through the anaesthetizing action of a gas or gas mixture, the method operating in “batch” mode in which live animals, preferably grouped together in one or more cages, are positioned in a processing airlock where the animals are brought into contact with the anaesthetizing gas or gas mixture, according to a cycle comprising several steps which are characterized by different anaesthetic-gas contents, characterized in that at least one of the steps is carried out using gas recovered from the airlock and stored in at least one temporary storage capacity of variable volume, said at least one variable-volume capacity being able to generate a reduced pressure enabling it to draw out the gas contained in the airlock and store the gas thus recovered temporarily so that it can be used in a subsequent anaesthetizing operation.

According to one of the embodiments of the invention, the recovery of the gas contained in the airlock is performed using a drawing-out system of the bellows (or concertina) type, which bellows system is responsible for the variable nature of the volume of the capacity, where anaesthetizing gas is injected into a tube (cylinder) associated with the capacity concerned, causing the bellows to rise, thus generating a reduced pressure that will allow the gas present in the airlock to be drawn out, the gas used for actuating the tube preferably being released later into the airlock in order thus to be put to use (not lost).

According to one of the embodiments of the invention, there are several storage capacities enabling the storage of different contents of anaesthetizing gas in a carrier gas, for example air, ranging from the lowest content to a highest content.

Patentkrav

1. Fremgangsmåde til bedøvelse af dyr inden slagtning gennem den bedøvende virkning af gas eller gasblandinger (4), hvilken fremgangsmåde fungerer "batchvis", hvor de levende dyr, fortrinsvis samlet i et eller flere bure, anbringes i et behandlingsslusekammer (1), hvor dyrene bringes i kontakt med bedøvende gas eller gasblanding ifølge en cyklus, som omfatter flere trin, **kendetegnet ved** forskellige koncentrationer af bedøvelsesgas, **kendetegnet ved, at** mindst et af trinnene iværksættes ved hjælp af gas, der er indsamlet i slusekammeret og opbevaret i mindst et reservoir ((2), No1, No2, No3....) med variabelt volumen til midlertidig opbevaring, idet det mindst ene reservoir med variabelt volumen er i stand til at frembringe et undertryk, som gør det muligt at indsuge gas, som er indeholdt i slusekammeret (1), og at opbevare den således indsamlede gas midlertidigt med henblik på en senere anvendelse til bedøvelse.

2. Fremgangsmåde ifølge krav 1, **kendetegnet ved, at:**
- det mindst ene reservoir, der er beregnet til at modtage den indsamlede gas, har et variabelt volumen i kraft af at være forsynet med et bælgsystem, som er i stand til at løfte sig; og
- indsamlingen af gassen, der er indeholdt i slusekammeret, iværksættes ved hjælp af dette bælgsystem i kraft af, at:
i) det betragtede reservoir er forsynet med en vulst (3);
j) der indsprøjtes bedøvelsesgas i vulsten (3), som er knyttet til det betragtede reservoir, hvorved bælgen løfter sig, hvilket frembringer et undertryk, som gør det muligt at indsuge gas, der er til stede i slusekammeret, idet den gas, der bruges til at aktivere vulsten, fortrinsvis senere frigives ind i slusekammeret for således at blive udnyttet.

3. Fremgangsmåde ifølge krav 1 eller 2, **kendetegnet ved, at** der anvendes flere reservoirer med variabelt volumen til midlertidig opbevaring, som gør det muligt at opbevare forskellige koncentrationer af bedøvelsesgas i en bæregas.

4. Anlæg til bedøvelse af dyr inden slagtning gennem den bedøvende virkning af gas eller gasblandinger (4), hvilket anlæg fungerer "batchvis" og omfatter et behandlingsslusekammer (1), hvor dyrene bringes i kontakt med bedøvende gas eller gasblanding, **kendetegnet ved, at** det omfatter mindst et reservoir ((2), No1, No2, No3....) med variabelt volumen til midlertidig opbevaring af gas, idet reservoiret er i stand til at indsamle gas i slusekammeret og opbevare den midlertidigt, idet det mindst ene reservoir med variabelt volumen er i stand til at frembringe et undertryk, som gør det muligt at indsuge gas, som er indeholdt i slusekammeret (1), og at opbevare den således indsamlede gas midlertidigt med henblik på en senere anvendelse til bedøvelse.

5. Anlæg ifølge krav 4, **kendetegnet ved, at**:
- det mindst ene reservoir, der er beregnet til at modtage den indsamlede gas, har et variabelt volumen i kraft af at være forsynet med et bælgsystem, som er i stand til at løfte sig; og
- det betragtede reservoir er forsynet med en vulst (3); og
- indsamlingen af gassen, der er indeholdt i slusekammeret, iværksættes ved hjælp af dette bælgsystem i kraft af, at indsprøjtningen af bedøvelsesgas i vulsten (3), der er knyttet til det betragtede reservoir, gør det muligt at få bælgen til at løfte sig, hvorved der frembringes et undertryk, der gør det muligt at indsuge gas, som er til stede i slusekammeret.

6. Anlæg ifølge krav 4 eller 5, **kendetegnet ved, at** det omfatter flere reservoirer med variabelt volumen til midlertidig opbevaring, som gør det muligt at opbevare forskellige koncentrationer af bedøvelsesgas i en bæregas.

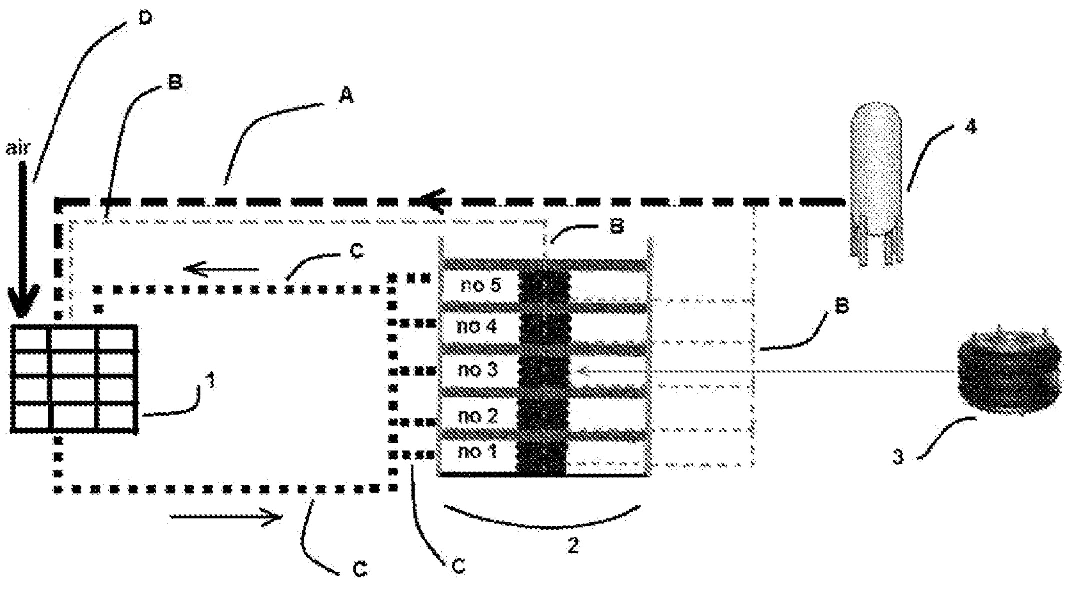

Figure 1