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(54) **Multiple gas curtain**

Mehrschichtiger Gasvorhang

Rideau multiple de gaz

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(56) References cited:
EP-A- 0 447 314 **US-A- 3 211 078**
US-A- 3 756 038

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Description

[0001] The invention relates to a method for keeping separated the gas atmospheres on either side of an opening according to the introductory part of claim 1.

[0002] Such a method is known from US-A-3 211 078. The two parallel gas flows mix only with great difficulty, whereby little mixing occurs at the position of the interface and the gas flow therefore retains its energy and composition for a relatively long time. Accordingly, a rather good separation of the two atmospheres is obtained.

[0003] The invention has for its object to provide a method as set forth above, in which the separation of the two atmospheres on either side of an opening is further effectively improved.

[0004] This is obtained with the method according to the invention, having the characterizing features of claim 1. The intermediate gas flow or flows is or are bounded on either side by parallel gas flows so that this intermediate gas flow(s) can extend practically undisturbed to the opposite end of for example the passage opening. A very good separation of the gas atmospheres is hereby obtained on both sides.

[0005] Preferably the step of claim 2 is applied herein. The outer gas flows form "protective" gas flows for the inner gas flow or flows. Turbulence and intermixing occur at the interfaces between the outer gas flows and the adjacent gas atmospheres, although this has no adverse effect on the energy content and composition of the inner gas flow or flows. This remains or these remain practically undisturbed.

[0006] Claim 4 gives an exceptionally suitable application of the method according to the invention. It is hereby possible to keep a deep-freeze area with a temperature in the order of magnitude of -20°C effectively separated from the outside atmosphere with a temperature for instance of $+20^{\circ}\text{C}$. Due to the low temperature the air in the deep-freeze area contains only very little moisture in the absolute sense. By forming the at least one intermediate gas flow from heated air extracted from the deep-freeze area, this intermediate gas flow thus acquires a very low relative humidity. This prevents moisture from condensing in the interface between the outer gas flow adjoining the outside atmosphere and the inner gas flow adjacent thereto, so that mist formation is prevented in effective manner.

[0007] The invention likewise relates to and provides a gas curtain device as characterized in claim 6. Favourable embodiments of the gas curtain device according to the invention are characterized in the further sub-claims.

[0008] The invention will be further elucidated in the following description with reference to the annexed schematic figure of an embodiment.

[0009] The figure shows the application of the method by means of a device 4 according to the method at the location of a passage opening 3 between a deep-freeze

area 1 and an outside atmosphere 2.

[0010] The gas atmosphere in deep-freeze area 1 is representatively an air atmosphere of -20°C . The water content of the air is, in view of the low temperature, extremely low.

[0011] The gas atmosphere in the outside area 2 is the usual outside air atmosphere. In view of the high temperature the air contains a considerably larger quantity of water per unit of volume.

[0012] It is self-evident that it is undesired for air from the outer space 2 to enter the deep-freeze area 1 and, vice versa, for air from deep-freeze area 1 to escape to the outside space 2. Loss of air from the deep-freeze area 1 would in the first place mean a heat loss since the replacement air must first be cooled again to the desired low temperature and infiltration of air from the outside area into the deep-freeze area 1 would moreover result in mist and frost formation in this deep-freeze area 1.

[0013] In order now to mutually separate the gas atmospheres in deep-freeze area 1 and the outside space 2 the method according to the invention is applied. At the location of the passage opening 3 a gas curtain is formed, in this case an air curtain, which is composed of a number of parallel gas flows 5, 6 and 7 extending adjacently of each other.

[0014] These three parallel gas flows 5-7 are formed by means of a gas curtain device 4 which comprises gas transporting means 12-14 which debouch on the underside into elongate gas blow-out members (not further shown).

[0015] In the preferred embodiment shown the gas transporting means 12, 13 and 14 are dimensioned and adjusted such that the gas flows 5, 6 and 7 have substantially the same speed and direction. The gas flow 5 which borders on deep-freeze area 1 is formed from air extracted directly from deep-freeze area 1. Gas flow 7 bordering on the atmosphere of the outside area 2 is likewise formed by air extracted directly from the outside area 2. The inner gas flow 6 is formed in this embodiment from air which is likewise drawn from deep-freeze area 1 via the suction aperture 16. Incorporated in the gas transporting means 13 are gas conditioning means which are formed here by heating means. The cold dry air from the deep-freeze area is heated by these heating means to a temperature intermediate that of the deep-freeze area 1 and the outside area 2. The heated air in gas flow 6 has a very low relative humidity.

[0016] The parallel gas flows 5, 6 and 7 have substantially the same speed and direction. Only a small turbulence and mixing hereby occurs at the position of the interfaces 9 and 10 between respectively gas flows 5 and 6 and gas flows 6 and 7. The middle gas flow 6 retains its energy and composition practically down to the underside of opening 3, whereby an effective separation is obtained.

[0017] At the position of the interfaces 8 and 11 between respectively the gas flow 5 with the deep-freeze

area 1 and the gas flow 7 with the outside area 2 a speed difference occurs resulting in a stronger turbulence and intermixing. This is not disadvantageous however, since in terms of composition and conditioning the gas flow 5 is the same as the gas atmosphere of deep-freeze area 1 and in terms of conditioning and composition the gas flow 7 is the same as the gas atmosphere of the outside area 2. The air for gas flow 7 is drawn in from the area 2 via suction aperture 15 and emitted from the blow-out opening on the underside by the gas transporting means 14.

[0018] Because the middle gas flow 6 consists in the manner described of conditioned dry air, mist formation is prevented. During movement of for instance a fork-lift truck through the passage opening 3 there occurs a stronger mixing of the different gas flows at the position of the interfaces 9 and 10, although transport of air out of the outside area 2 to deep-freeze area 1 is minimal, so that the said mist formation does not occur.

[0019] Although an embodiment is discussed above for keeping separate the atmosphere in a deep-freeze area and an outside atmosphere, the method and device according to the invention are also suitable for other applications. The invention can likewise be appropriately used in the usual application of air curtains for keeping separated the indoor and outdoor atmosphere of a building, as applied in typical manner for store premises and the like. The heat loss due to escape of warm air to the outside is very small with the invention.

[0020] The method and device are not limited to use with air as gas in the gas flows. Other gas atmospheres can suitably be kept separated. An example of an application can be in a production process in which particular operations must take place in particular gas atmospheres. The different gas atmospheres for the different operational steps can be kept well separated with the method and device according to the invention.

[0021] Gas can optionally be drawn off on the side of the opening toward which the gas flows are directed. In particular the middle gas flow or flows can then be drawn off so that no or only little gas which is otherwise conditioned can enter the adjoining gas atmospheres.

Claims

1. Method for keeping separated the gas atmospheres on either side (1, 2) of an opening (3), extending transversely to a closed surface, such as floor surface, comprising of forming a gas curtain, such as an air curtain across said opening and directed to said closed surface, comprising of two parallel gas flows (5, 7) having the same speed and direction and which are differently conditioned, **characterized in that** the air curtain comprises at least one intermediate gas flow (6) extending in between and parallel to the two gas flows (5, 7) and having substantially the same speed as the two gas flows.

2. Method as claimed in claim 1, wherein the outer gas flows (5, 7) each have the same conditioning as the directly adjoining gas atmosphere (1, 2).
3. Method as claimed in claim 2, wherein the outer gas flows (5, 7) are formed from gas extracted directly from the adjoining gas atmospheres (1, 2).
4. Method as claimed in claim 3 for keeping separated the atmosphere in a deep-freeze area (1) and an outside atmosphere (2), wherein the at least one intermediate gas flow (6) is conditioned such that condensation forming on the interface with the outer gas flow (5) formed from air extracted from the atmosphere in the deep-freeze area (1) is prevented.
5. Method as claimed in claim 4, wherein the at least one intermediate gas flow (6) is formed from heated air extracted from the deep-freeze area (1).
6. Gas curtain device comprising gas transporting means having at least two gas blow-out members (12, 14) extending mutually parallel and adjacently for generating two parallel gas flows (5, 7) with substantially the same speed and comprising mounting means for mounting the gas blow-out members adjacent a wall opening (3) **characterized by** at least one intermediate gas blow-out member (13) arranged in between and parallel to the two gas blow-out members (12, 14) for generating at least one intermediate gas flow (6) in between and parallel to the two parallel gas flows (5, 7) and with substantially the same speed and direction.
7. Gas curtain device as claimed in claim 6, comprising gas conditioning means for conditioning at least one of the gas flows (5, 6, 7).
8. Gas curtain device as claimed in either of the claims 6 or 7 for keeping separated the atmosphere in a deep-freeze area (1) and an outside atmosphere (2), wherein the gas conditioning means comprise heating means in a gas duct leading to the at least one intermediate gas blow-out member (13).
9. Gas curtain device as claimed in any of the claims 6-8, wherein the gas transporting means are dimensioned and adjusted such that the generated parallel gas flows (5, 6, 7) have the same speed and direction.

Patentansprüche

1. Verfahren zur Aufrechterhaltung der Trennung der Gasatmosphären auf jeder Seite (1, 2) einer Öffnung (3), die sich quer zu einer geschlossenen Fläche erstreckt, wie einer Bodenfläche, umfassend

die Bildung eines Gasvorhangs, wie eines Luftvorhangs, der sich über die genannte Öffnung erstreckt und der zu der genannten geschlossenen Fläche hin gerichtet ist, umfassend zwei parallele Gasströme (5, 7), die dieselbe Geschwindigkeit und Richtung aufweisen und die unterschiedlich konditioniert sind,

dadurch gekennzeichnet, daß der Luftvorhang zumindest einen Zwischen-Gasstrom (6) umfaßt, der zwischen den beiden Gasströmen (5, 7) und parallel zu diesem verläuft und der im wesentlichen dieselbe Geschwindigkeit wie die beiden Gasströme aufweist.

2. Verfahren nach Anspruch 1, wobei die äußeren Gasströme (5, 7) jeweils dieselbe Aufbereitung bzw. Konditionierung wie die unmittelbar benachbarte Gasatmosphäre (1, 2) aufweisen.

3. Verfahren nach Anspruch 2, wobei die äußeren Gasströme (5, 7) aus Gas gebildet werden, das unmittelbar aus den benachbarten Gasatmosphären (1, 2) extrahiert wird.

4. Verfahren nach Anspruch 3, zur Aufrechterhaltung der Trennung der Atmosphäre in einem Tiefkühlbereich (1) und einer Außenseiten-Atmosphäre (2), wobei der zumindest eine Zwischen-Gasstrom (6) derart konditioniert wird, daß eine an der Grenzfläche mit dem äußeren Gasstrom (5), der aus Luft gebildet ist, welche aus der Atmosphäre im Tiefkühlbereich (1) extrahiert ist, sich bildende Kondensation verhindert ist.

5. Verfahren nach Anspruch 4, wobei zumindest ein Zwischen-Gasstrom (6) aus erwärmter Luft gebildet wird, die aus dem Tiefkühlbereich (1) extrahiert ist.

6. Gasvorhangvorrichtung, umfassend Gastransporteinrichtungen mit zumindest zwei Gasabblasteilen (12, 14), die zueinander parallel und einander benachbart verlaufen zur Erzeugung zweier paralleler Gasströme (5, 7) mit im wesentlichen derselben Geschwindigkeit, und umfassend eine Befestigungseinrichtung zur Befestigung der Gasabblasteile neben einer Wandöffnung (3),

dadurch gekennzeichnet, daß zumindest ein Zwischen-Gasabblasteil (13) zwischen den beiden Gasabblasteilen (12, 14) und parallel zu diesen so angeordnet ist, daß zumindest ein Zwischen-Gasstrom (6) zwischen den beiden parallelen Gasströmen (5, 7) und parallel zu diesen und mit im wesentlichen derselben Geschwindigkeit und Richtung erzeugt wird.

7. Gasvorhangvorrichtung nach Anspruch 6, umfassend Gaskonditionierungseinrichtungen zur Aufbereitung bzw. Konditionierung zumindest eines der

Gasströme (5, 6, 7).

8. Gasvorhangvorrichtung nach einem der Ansprüche 6 oder 7 zur Aufrechterhaltung der Trennung der Atmosphäre in einem Tiefkühlbereich (1) und einer Außenseiten-Atmosphäre (2), wobei die Gaskonditionierungseinrichtung eine Heizeinrichtung in einer Gasleitung umfaßt, die zu dem zumindest bei einem Zwischen-Gasabblasteil (13) hinführt.

9. Gasvorhangvorrichtung nach irgendeinem der Ansprüche 6 bis 8, wobei die Gastransporteinrichtungen so dimensioniert und eingerichtet sind, daß die erzeugten parallelen Gasströme (5, 6, 7) dieselbe Geschwindigkeit und Richtung aufweisen.

Revendications

1. Procédé pour maintenir séparées les atmosphères gazeuses de chaque côté (1, 2) d'une ouverture (3) qui s'étend transversalement à une surface fermée, telle qu'une surface de plancher, comprenant la formation d'un rideau de gaz, tel qu'un rideau d'air, à travers ladite ouverture et dirigé vers ladite surface fermée, comprenant deux flux gazeux parallèles (5, 7) présentant les mêmes vitesse et direction et qui sont conditionnés différemment, caractérisé en ce que le rideau d'air comprend au moins un flux gazeux intermédiaire (6) s'étendant entre et parallèlement aux deux flux gazeux (5, 7) et ayant sensiblement la même vitesse que les deux flux gazeux.

2. Procédé selon la revendication 1, dans lequel les flux gazeux extérieurs (5, 7) présentent chacun le même conditionnement que l'atmosphère gazeuse (1, 2) directement contiguë.

3. Procédé selon la revendication 2, dans lequel les flux gazeux extérieurs (5, 7) sont réalisés à partir d'un gaz extrait directement des atmosphères gazeuses contiguës (1, 2).

4. Procédé selon la revendication 3 pour maintenir séparées l'atmosphère dans une zone frigorifique (1) et une atmosphère extérieure (2), dans lequel ledit au moins un flux gazeux intermédiaire (6) est conditionné afin d'empêcher l'apparition de condensation sur la surface de contact avec le flux gazeux intérieur (5) formé à partir de l'air extrait de l'atmosphère se trouvant dans la zone frigorifique (1).

5. Procédé selon la revendication 4, dans lequel ledit au moins un flux gazeux intermédiaire (6) est formé à partir d'air chauffé extrait de la zone frigorifique (1).

6. Dispositif formant rideau de gaz comprenant des

moyens de transport du gaz, ayant au moins deux éléments de soufflerie de gaz (12, 14) s'étendant parallèlement l'un à l'autre et de manière adjacente pour générer deux flux gazeux parallèles (5, 7) présentant sensiblement la même vitesse et comprenant des moyens de fixation pour fixer les éléments de soufflerie de gaz de manière adjacente à une ouverture de paroi (3), caractérisé par au moins un élément de soufflerie de gaz intermédiaire (13) disposé entre et parallèlement aux deux éléments de soufflerie de gaz (12, 14) pour générer au moins un flux gazeux intermédiaire (6) entre et parallèlement aux deux flux gazeux parallèles (5, 7) et présentant sensiblement les mêmes vitesse et direction.

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7. Dispositif formant rideau de gaz selon la revendication 6, comprenant des moyens de conditionnement de gaz pour conditionner au moins un des flux gazeux (5, 6, 7).

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8. Dispositif formant rideau de gaz selon la revendication 6 ou 7, pour maintenir séparées l'atmosphère dans une zone frigorifique (1) et une atmosphère extérieure (2), dans lequel les moyens de conditionnement de gaz comprennent des moyens de chauffage dans un conduit de gaz menant à au moins un élément de soufflerie de gaz intermédiaire (13).

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9. Dispositif formant rideau de gaz selon l'une quelconque des revendications 6 à 8, dans lequel les moyens de transport du gaz sont dimensionnés et ajustés de telle sorte que les flux gazeux parallèles (5, 6, 7) présentent les mêmes vitesse et direction.

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