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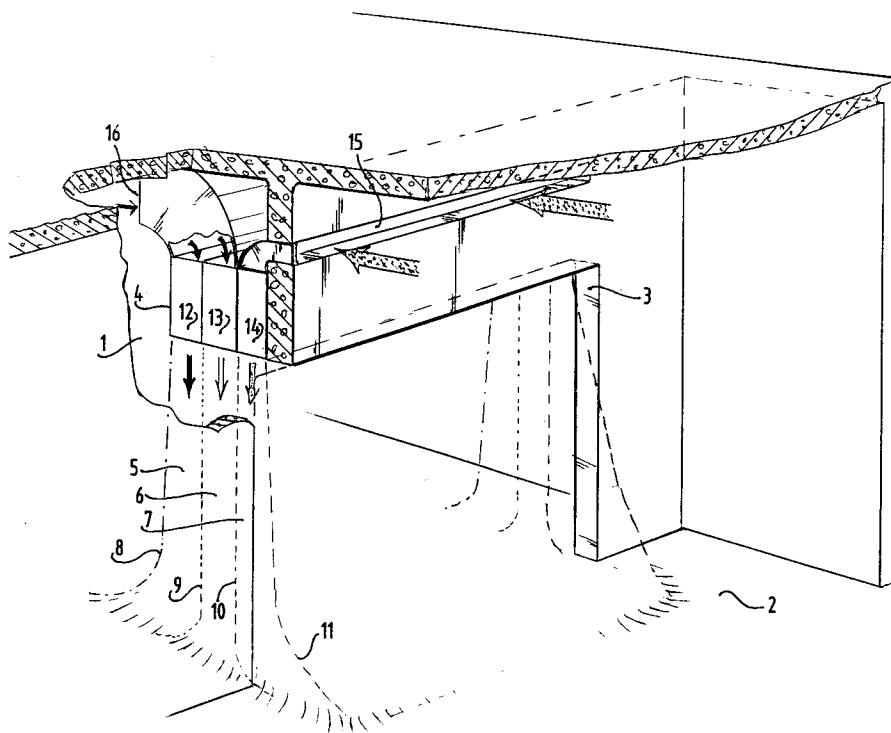
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(57) The invention relates to a method for keeping separated the gas atmospheres, for instance at the location of a passage opening in a building, comprising of forming a gas curtain, such as an air curtain, between the gas atmospheres, wherein the gas cur-

tain is composed of a number of parallel gas flows which extend adjacently of each other. The gas curtain is composed of at least three gas flows with the same speed and direction which are differently conditioned.

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The invention relates to a method for keeping gas atmospheres separated. Such a method is for instance known for keeping separated the indoor and outdoor atmosphere of a building at the location of the entrance by means of an air curtain. An air curtain device wherein the above stated method is applied is known from EP-A-0 362 958 of applicant.

With such an air curtain the air flow must extend as far as possible over the whole passage opening down to the bottom in order to obtain good operation. In the prior art this is achieved by a good alignment of the air flow whereby minimum turbulence occurs at the position of the interface between the air flow and the ambient air, so that the air flow retains its energy and composition for as long as possible.

With the invention as characterized in claim 1 a further improvement is achieved. 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. When there is for instance a temperature difference in the gas atmospheres on either side, the parallel gas flows can be conditioned such that a gradual temperature transition takes place.

The step of claim 2 is preferably applied. The inside gas flow or flows is or are bounded on either side by parallel gas flows so that this inner gas flow or gas flows can extend practically undisturbed to the opposite end of for example a passage opening. A very good separation of the gas atmospheres is hereby obtained on both sides.

In preference the step of claim 3 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.

Claim 5 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.

The invention likewise relates to and provides a gas curtain device as characterized in claim 7. Favourable embodiments of the gas curtain device according to the invention are characterized in the further sub-claims.

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

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.

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.

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.

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.

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.

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).

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.

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.

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.

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.

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.

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.

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 of an opening, comprising of forming a gas curtain, such as an air curtain, wherein the gas curtain is composed of a number of parallel gas flows which extend adjacently of each other, have the same speed and direction and which are differently conditioned.
2. Method as claimed in claim 1, wherein the gas curtain is composed of at least three parallel gas flows.
3. Method as claimed in claim 1 or 2, wherein the outer gas flows each have the same conditioning as the directly adjoining gas atmosphere.
4. Method as claimed in claim 3, wherein the outer gas flows are formed from gas extracted directly from the adjoining gas atmospheres.
5. Method as claimed in claim 4 for keeping separated the atmosphere in a deep-freeze area and an outside atmosphere, wherein the at least one intermediate gas flow is conditioned such that condensation forming on the interface with the outer gas flow formed from air extracted from the atmosphere in the deep-freeze area is prevented.
6. Method as claimed in claim 5, wherein the intermediate gas flow is formed from heated air extracted from the deep-freeze area.
7. Gas curtain device comprising gas transporting means having a number of gas blow-out members extending mutually parallel and adjacently for generating a number of parallel gas flows extending mutually adjacently.
8. Gas curtain device as claimed in claim 7, comprising at least three parallel gas blow-out members.
9. Gas curtain device as claimed in claim 7 or 8, comprising gas conditioning means for conditioning at least one of the gas flows.

10. Gas curtain device as claimed in either of the claims 8 or 9 for keeping separated the atmosphere in a deep-freeze area and an outside atmosphere, wherein the gas conditioning means comprise heating means in a gas duct leading to the at least one intermediate gas blow-out member. 5
11. Gas curtain device as claimed in any of the claims 7-10, wherein the gas transporting means are dimensioned and adjusted such that the generated parallel gas flows have the same speed and direction. 10

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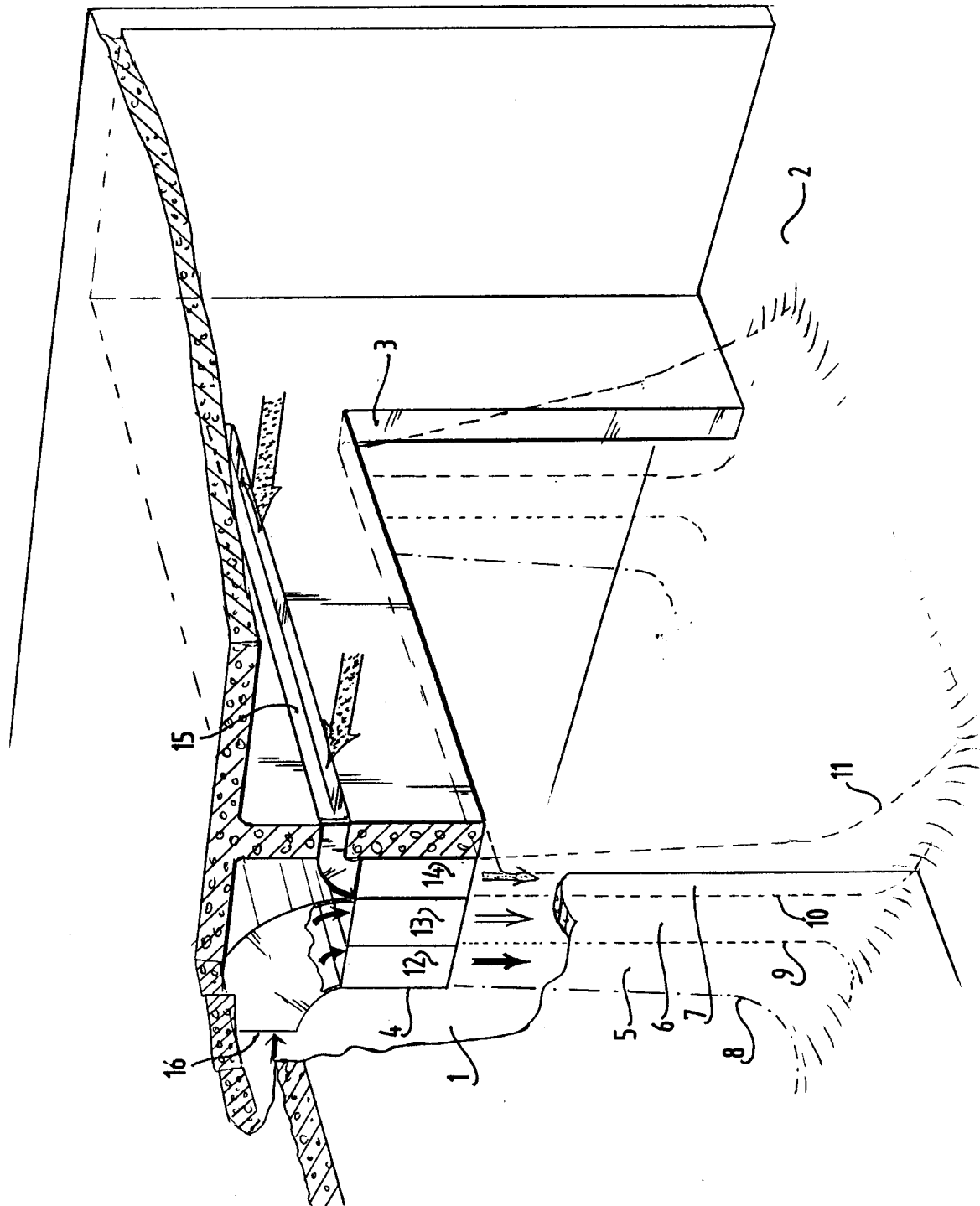
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EUROPEAN SEARCH REPORT

Application Number
EP 94 20 2691

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
X	US-A-3 211 078 (GUNNAR)	1,3,4,7,9	F24F9/00 F25D23/02
A	* column 2, line 1 - line 27; figures 1,2 *	11	
X	EP-A-0 447 314 (SOCIETE GENERALE POUR LES TECHNIQUES NOUVELLES) -----	1,2,8	
			TECHNICAL FIELDS SEARCHED (Int.Cl.6)
			F24F F25D
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 30 December 1994	Examiner Peschel, G
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