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(54) **Bed ventilation device**

(57) Bed ventilation device comprising a flexible inflatable envelope (2) for permanent placement between a bed (1) and bed covers (7, 8, 9) and an air supply unit (6) connected on an air inlet (4) of the envelope for supplying air to the envelope, the inflatable envelope comprising air-flow channels (2) with air outlet holes (3) distributed over the air-flow channels, characterised in that

the air-flow channels (2) have a predetermined air permeability which is chosen such that upon activation of the air supply unit (6), the channels are substantially completely inflated before air escapes through the air outlet holes.

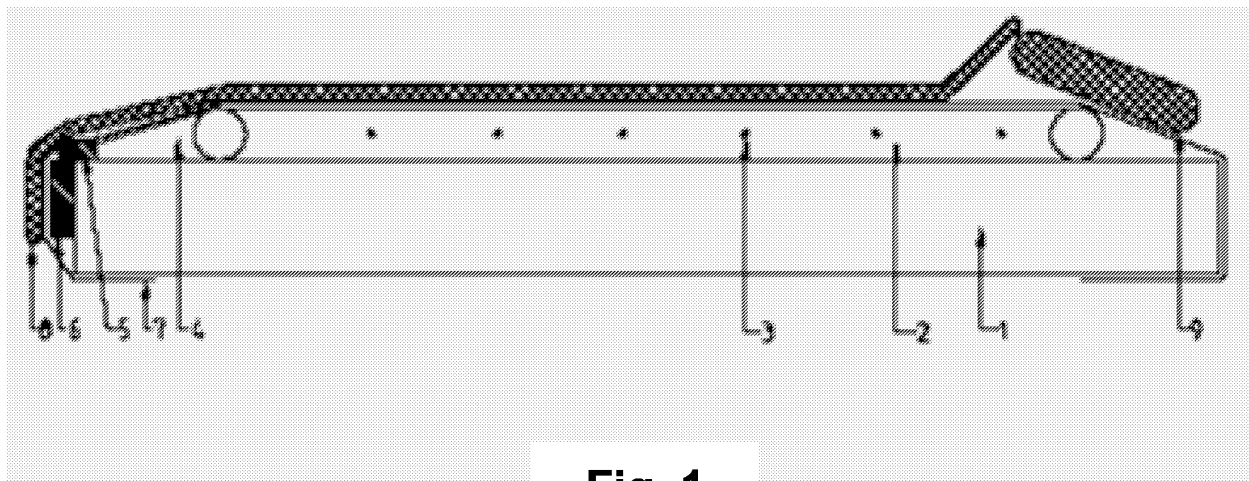


Fig. 1

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Description

[0001] The invention relates to a bed ventilation device according to the preamble of the first claim.

[0002] From US-A-4,959,877 a bed ventilation device is known which comprises a small blower unit which supplies air to an air-flow channel network which makes up the central portion of the bed covers. The air-flow channel network comprises a plurality of air flow channels of which a bottom layer is air permeable. The air flows from the blower through a conduit into the air-flow network and finally through the bottom layer. This causes a region of higher pressure under the bed covers, thus causing the formation of a cavity between the bed covers and the bed.

[0003] The bed ventilation device known from US-A-4,959,877 has the disadvantage that a high air flow rate and consequently a high energy consumption is needed for achieving sufficient ventilation.

[0004] It is an aim of the invention to provide a bed ventilation device which ventilates sufficiently at a lower air flow rate.

[0005] This aim is achieved according to the invention with the bed ventilation device showing the technical characteristics of claim 1.

[0006] The bed ventilation device of the invention comprises a flexible inflatable envelope for permanent placement between a bed and bed covers. With "permanent placement" is meant that the envelope is designed to be left in place and not to be removed after each use, which would for example be necessary with a rigid construction so as not to hinder the user. The permanent bed ventilation device of the invention is thus intended for placement directly on top of the mattress and below the mattress cover or mattress covering sheet, or on top of the mattress cover in case it is an impermeable incontinent mattress cover, or below the mattress tick directly on top of the mattress core when the mattress tick can be unzipped and removed from the core, or incorporated in a mattress with a non-removable tick during production on top of the mattress core.

[0007] The bed ventilation device according to the invention further comprises an air supply unit connected on an air inlet of the envelope for supplying air to it. The inflatable envelope comprises air-flow channels which communicate with the inlet and have air outlet holes distributed over their surface. These air-flow channels have a predetermined air permeability which is chosen such that upon activation of the air supply unit, the channels are substantially completely inflated before air escapes through the air outlet holes.

[0008] An analysis of the problem of the prior art device has shown that a high air flow rate is needed because the air pressure underneath the covers has to be increased to such an extent that the covers are lifted from the bed. Since the cavity which is created is not closed and a lot of air can escape along the sides of the bed, a high air supply rate is required to create sufficient air pressure and also to maintain the air pressure underneath

the covers. With the device of the invention, the covers are lifted by the expansion of the air-flow channels. Since the air permeability of these channels is such that air only escapes once they are substantially fully inflated, less air flow is required in order to build up the pressure. Furthermore, once inflated the channels form walls which separate the cavity underneath the covers into chambers from which less air escapes in comparison with the single cavity which is created in the prior art. As a result, also the air flow required to maintain the air pressure underneath the covers is reduced.

[0009] In other words, with the device of the invention the ventilation procedure is split up into two stages: first the air flow is used to build up pressure and lift the covers from the bed and only then the air flow is used to ventilate the space between the covers and the bed. An additional advantage of the device of the invention is that the bed covers, although they are lifted from the bed, remain in contact with the inflated channels, so that it can be prevented that the covers are blown off from the bed. Furthermore, the ventilation can be improved: Because of the division of the cavity into chambers, more air escapes through the bed covers themselves instead of along the sides of the bed.

[0010] In a preferred embodiment of the bed ventilation device of the invention, the envelope is constructed in an air impermeable material with the air outlet holes being provided in a predetermined number and having a predetermined size according to the desired air permeability.

[0011] In an alternative embodiment of the bed ventilation device of the invention, the envelope is at least partly constructed in an air permeable material. This entails that the air outlet holes are provided by the permeability of the material itself, which is chosen such to achieve the effect of inflating before ventilating.

[0012] Preferably, a majority of the air outlet holes are directed such that the air escapes through them in a direction substantially parallel to the plane of the bed. In other words, it is preferred that when the envelope is inflated, a majority of the air outlet holes are directed towards a space which is created between top and bottom planes defined by the inflated envelope. With "a majority" is meant that most or all of the air outlet holes are directed in this way.

[0013] In a preferred embodiment of the bed ventilation device of the invention, the envelope is constructed as a two-layered structure comprising a flat bottom layer and a top layer in which the channels are provided. This has the advantage that the ventilation occurs above the envelope, so that the envelope itself does not need to be lifted from the bed. As a result, the air flow rate can be further reduced.

[0014] The air permeability of the envelope of the invention is preferably chosen such that the outlet speed through the air outlet holes is about 5 to 15 m/s, more preferably 10 to 12 m/s. This has the advantage that turbulence is created in the space between the covers and the bed, which can enhance the ventilation.

[0015] The air supply unit is preferably provided to supply air at a flow rate of 20 to 40 m³/h, preferably 25 to 35 m³/h for a single bed and 30 to 50 m³/h, preferably 35 to 45 m³/h for a double bed.

[0016] The invention will be further elucidated by means of the following description and the appended drawings.

[0017] Figure 1 shows a cross-sectional view of a first embodiment of the bed ventilation device of the invention.

[0018] Figure 2 shows a top view of the first embodiment of the bed ventilation device of the invention.

[0019] Figure 3 shows a top view of a second embodiment of the bed ventilation device of the invention.

[0020] Figure 4 shows a top view of a third embodiment of the bed ventilation device of the invention.

[0021] The bed ventilation device of figures 1 and 2 comprises a flexible inflatable envelope with air-flow channels 2 in which a plurality of perforations 3 is provided. As can be seen in figure 2, these perforations 3 are distributed substantially uniformly over the channels 2. The channels 2 are connected to an air inlet 4, on which a supply duct 5 coming from an air supply unit 6 is connected. The whole is inserted between a mattress 1 and a mattress cover 7 and is provided for lifting a bed cover 8 and a pillow 9 from the mattress 1 and for ventilating the space which is created in between.

[0022] The number and size of the perforations 3 is chosen such that the channels 2 have a predetermined air permeability. This air permeability is in turn chosen such that substantially no air escapes through the perforations as long as the air pressure inside the channels is below a given threshold. As a result, when the air supply unit 6 is activated, first pressure is built up inside the channels 2, which causes the channels 2 to expand and to lift the mattress cover 7, the bed cover 8 and the pillow 9 from the mattress 1. Once the channels are fully inflated, the pressure builds up further until a given threshold is exceeded and air starts to escape through the perforations 3 and ventilates the space between the bed covers and the mattress 1.

[0023] The fact that the envelope 2 is made in a flexible material has the advantage that it can be left permanently between the mattress cover 7 and the mattress 1. While the bed ventilation device is not in use, the bed can be used for sleeping while the presence of the envelope is substantially unnoticeable to the user.

[0024] By using the bed ventilation device, the user can make the bed in the morning without having to first lay it open for ventilation. After rising, the user can directly make the bed and switch on the bed ventilation device, after which the bed is actively ventilated. As a result, the user saves time and the bed is better ventilated than in case of passive ventilation by simply laying it open.

[0025] The bed ventilation device of figures 1 and 2 is intended for a single bed. Accordingly, the air supply unit 6 is ideally provided for supplying air at a flow rate of about 30 m³/h. If desired, control means (not shown) may be provided for enabling the user to control the flow rate.

The number and the size of the perforations 3 is chosen such that air escapes through them at a speed of 10 to 12 m/s. This air speed is advantageous since it creates turbulence and improves the ventilation.

[0026] Because of the plurality of channels 2, the cavity which is created underneath the bed covers 7, 8, 9 during ventilation is divided into different chambers. This has the advantage that the bed covers remain supported and are prevented from being blown off. Furthermore, the division into chambers leads to a higher air escape rate through the bed covers, which improves their ventilation.

[0027] The perforations 3 are located on the sides of the channels 2, as a result of which the air is injected into the space in a direction parallel to the plane of the bed.

In other words, the air is injected between a top and a bottom plane which are defined by the inflated channels 2: in figure 1 the mattress cover 7 forms the top plane and the top side of the mattress 1 forms the bottom plane. Directing the perforations 3 in this way has the advantage that the air is injected in the optimal direction for ventilation. However, the envelope 2 may be provided with a small number of perforations on the top side and/or the bottom side if desired.

[0028] The envelope 2 of the device of figures 1 and 2 is constructed in an air impermeable material with perforations to achieve the desired air permeability. Alternatively, the envelope 2 may also be constructed partly or fully in an air permeable material, the desired air permeability then being provided by the material itself.

[0029] In figures 1 and 2, the envelope 2 and the air supply unit 6 are placed directly on top of the mattress 1 and below the mattress cover 7. Alternatively, they could also be placed on top of the mattress cover 7 underneath a mattress covering sheet (not shown), especially if the mattress cover 7 is an impermeable incontinent mattress cover. Furthermore, the envelope 2 and the air supply unit 6 can also be incorporated in the mattress between the mattress tick (not shown) and the mattress core (not shown). This can be done after production of the mattress, in case the mattress tick can be unzipped and removed from the core, or during the production stage in a mattress with a non-removable tick.

[0030] The bed ventilation device of figure 3 differs from that of figures 1 and 2 only in that it is sized for a double bed. Hence, it will only be described briefly here. The envelope 2 is sized for a double bed and consequently has a larger width and more channels 2 in width direction. Another difference is that the air supply unit 6 is ideally provided for supplying air at a flow rate of about 40 m³/h.

[0031] The bed ventilation device of figure 4 differs from that of figure 3 in that it is intended for a double bed with two separately adjustable bed bases (not shown). Here, the envelope is in fact composed of two envelopes for a single bed with an interconnecting channel in between them. The interconnecting channel is provided at a location where the adjustable bed bases have a part which is fixed or which does not move a great deal. The

air supply unit 6 is here intended to be mounted at the head end of the bed, whereas in the embodiments of figures 1-3, the air supply unit 6 is intended to be mounted at the foot end of the bed. Of course, the bed ventilation devices shown could be easily adapted to have the air supply unit on one of the lateral sides of the bed or to have more than one air supply unit.

Claims

1. Bed ventilation device comprising a flexible inflatable envelope (2) for permanent placement between a bed (1) and bed covers (7, 8, 9) and an air supply unit (6) connected on an air inlet (4) of the envelope for supplying air to the envelope, the inflatable envelope comprising air-flow channels (2) with air outlet holes (3) distributed over the air-flow channels, **characterised in that** the air-flow channels (2) have a predetermined air permeability which is chosen such that upon activation of the air supply unit (6), the channels are substantially completely inflated before air escapes through the air outlet holes. 5
2. Bed ventilation device according to claim 1 **characterised in that** the envelope (2) is constructed in an air impermeable material and that the air outlet holes (3) are provided in a predetermined number and have a predetermined size, the number and the size of the air outlet holes being chosen according to the air permeability. 10
3. Bed ventilation device according to claim 1, **characterised in that** the envelope (2) is at least partly constructed in an air permeable material, the air outlet holes being provided by the permeability of the material itself. 15
4. Bed ventilation device according to any one of the claims 1-3, **characterised in that** a majority of the air outlet holes (3) are directed such that the air escapes through them in a direction substantially parallel to the plane of the bed. 20
5. Bed ventilation device according to any one of the claims 1-3, **characterised in that** when the envelope (2) is inflated, a majority of the air outlet holes are directed towards a space which is created between top and bottom planes defined by the inflated envelope. 25
6. Bed ventilation device according to any one of the claims 1-5, **characterised in that** the envelope (2) is constructed as a two-layered structure comprising a flat bottom layer and a top layer in which the channels are provided. 30
7. Bed ventilation device according to any one of the claims 1-6, **characterised in that** the air permeability is chosen such that air escapes through the air outlet holes at a speed of 5 to 15 m/s, preferably 10 to 12 m/s. 35
8. Bed ventilation device according to any one of the claims 1-7, **characterised in that** the envelope is sized for a single bed and that the air supply unit is provided for supplying air at a flow rate of 20 to 40 m³/h, preferably 25 to 35 m³/h. 40
9. Bed ventilation device according to any one of the claims 1-7, **characterised in that** the envelope is sized for a double bed and that the air supply unit is provided for supplying air at a flow rate of 30 to 50 m³/h, preferably 35 to 45 m³/h. 45
10. A mattress comprising a core and a tick surrounding the core, **characterised in that** a bed ventilation device according to any one of the claims 1-9 is provided between the core and the tick. 50

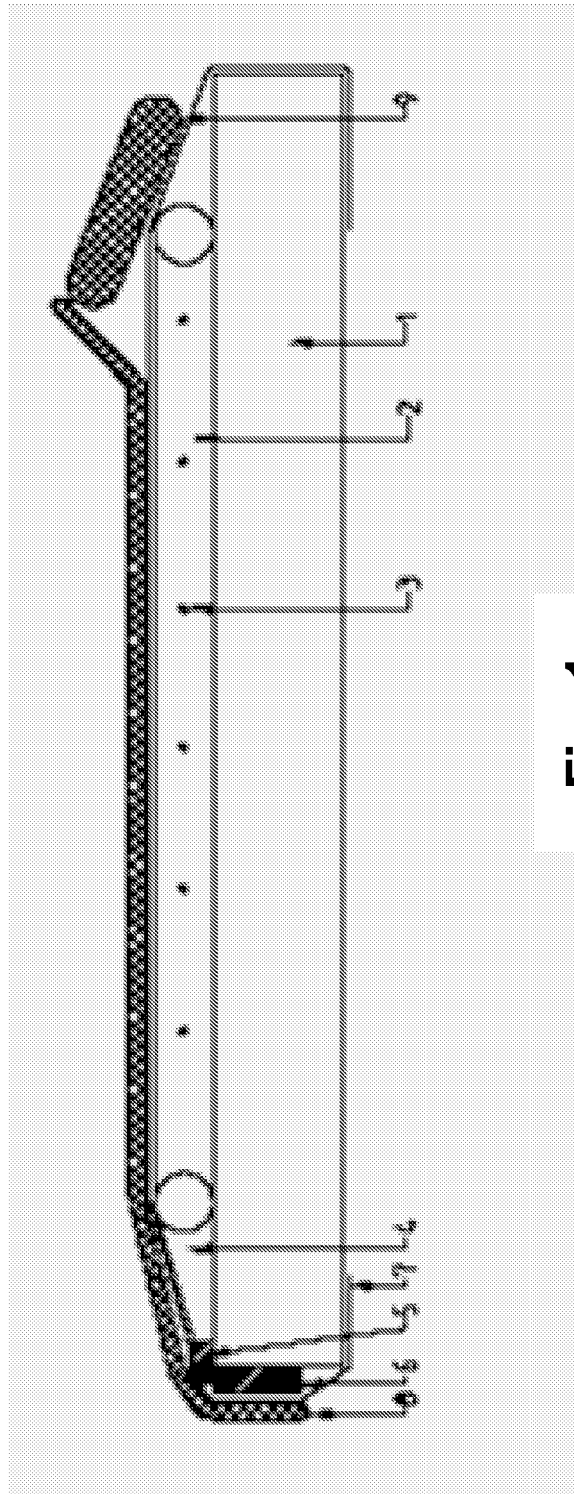


Fig. 1

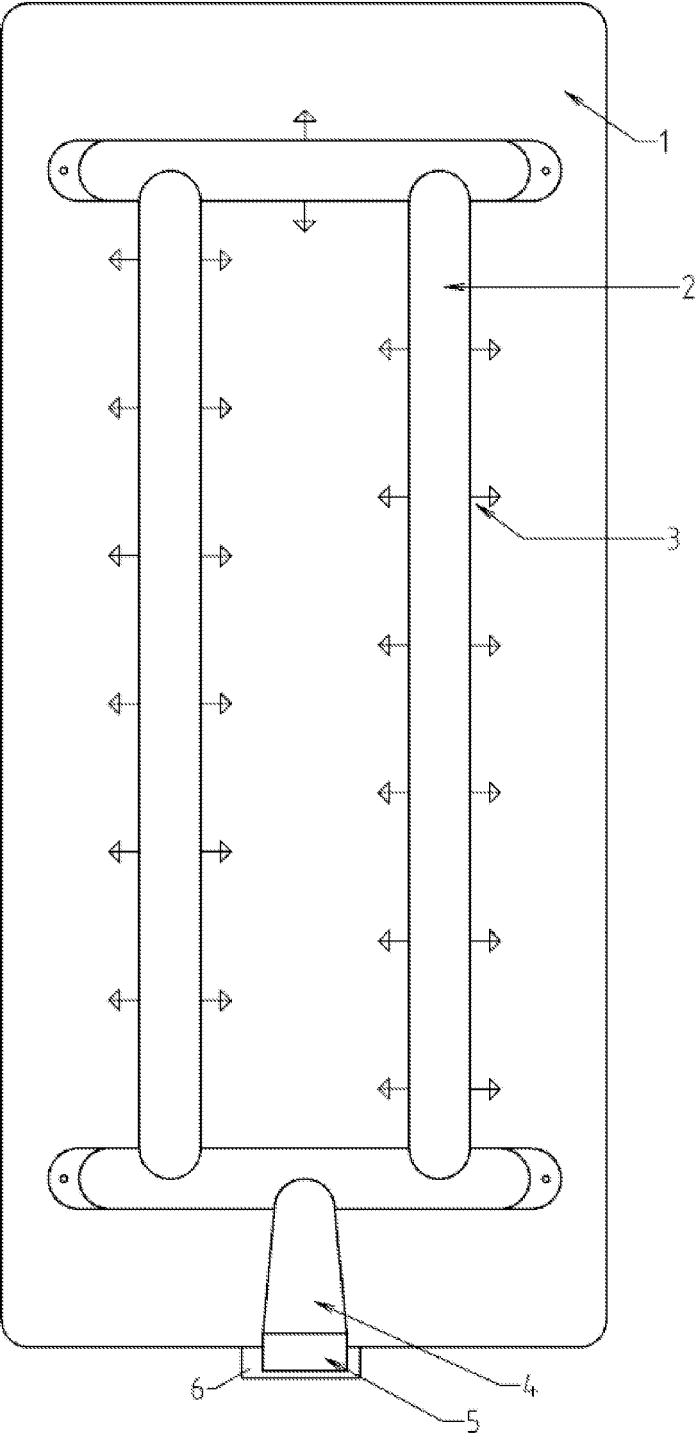


Fig. 2

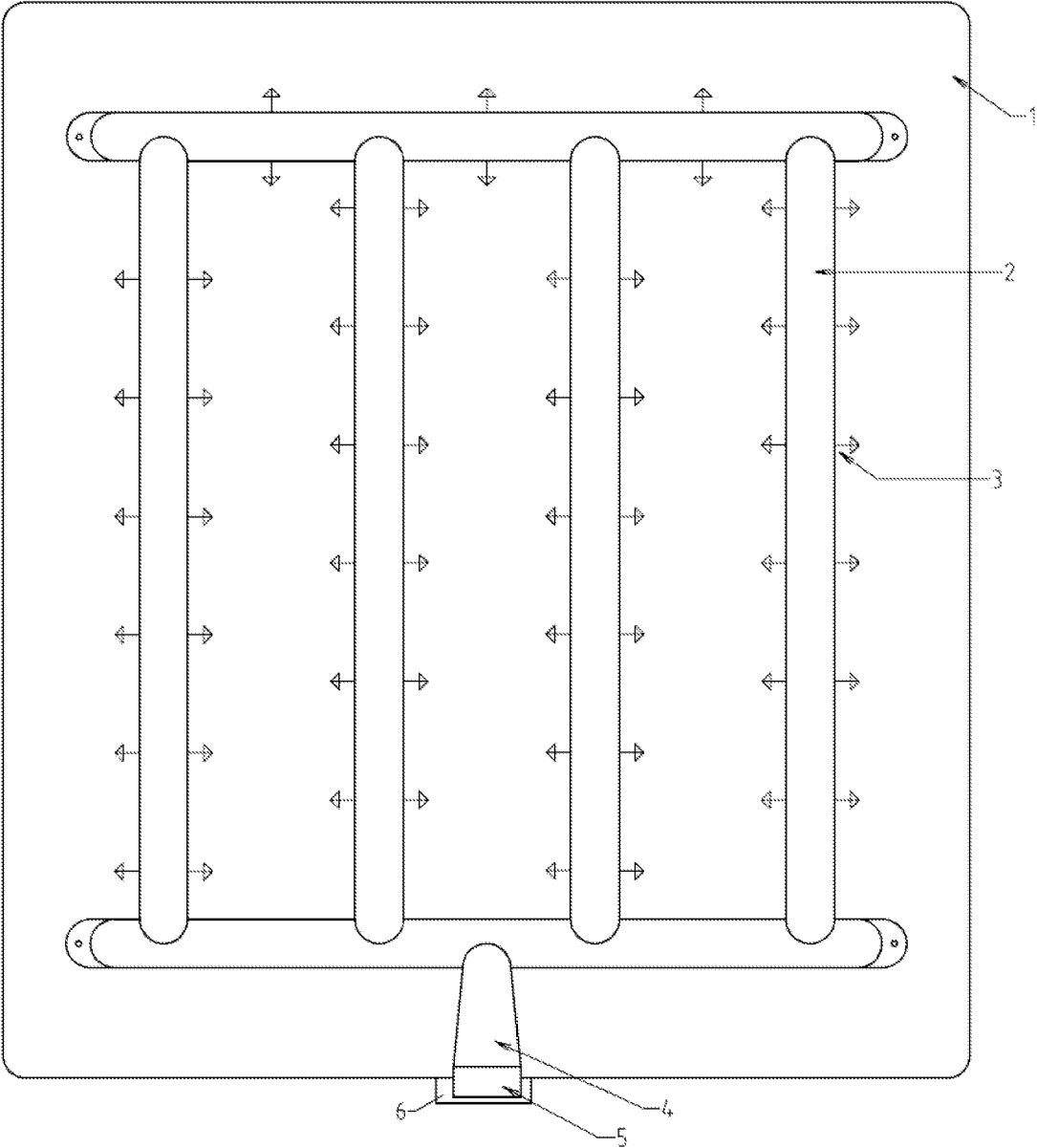


Fig. 3

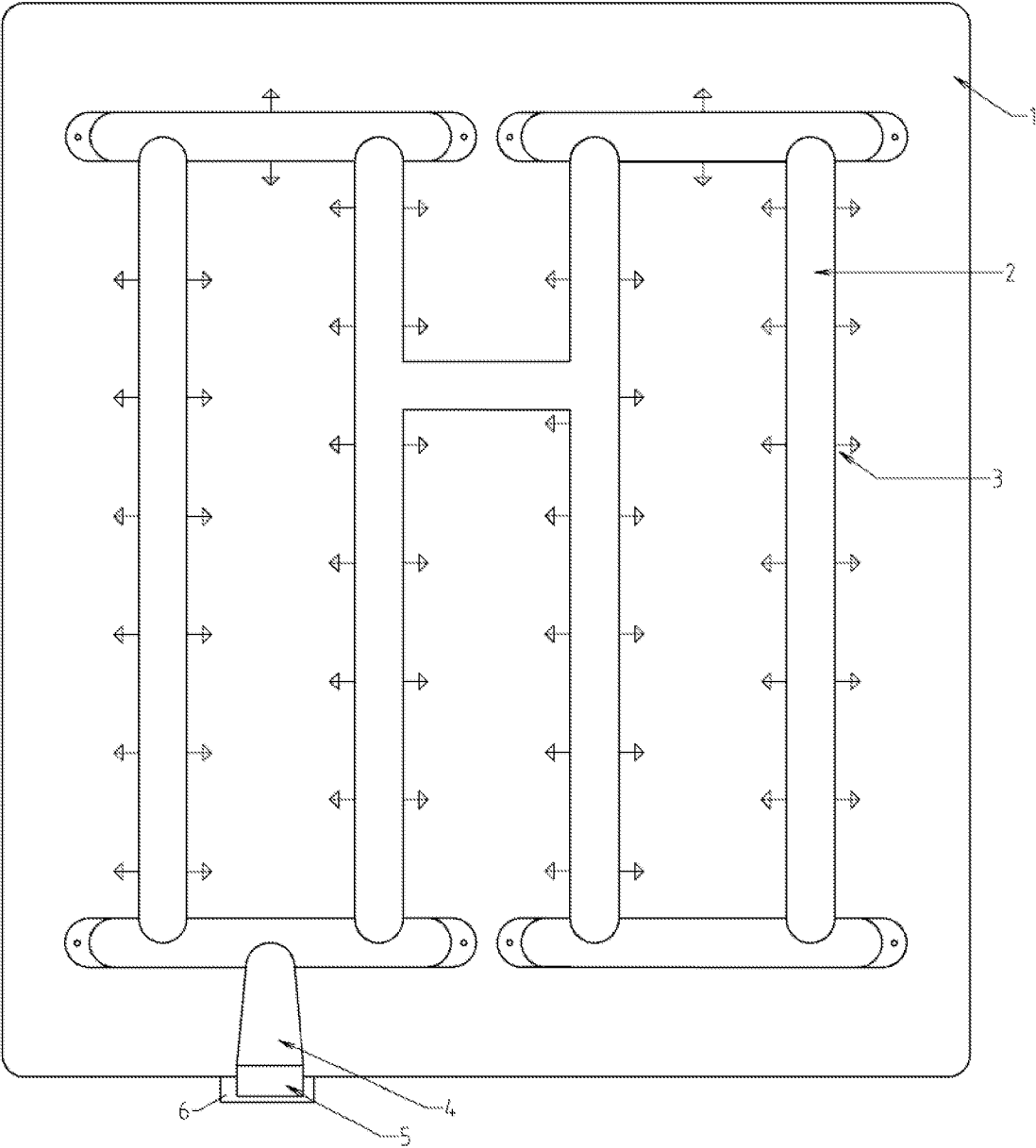


Fig. 4



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EUROPEAN SEARCH REPORT

Application Number
EP 05 10 4311

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X	US 5 051 673 A (GOODWIN ET AL) 24 September 1991 (1991-09-24) * column 11, line 30 - column 12, line 8 * * column 14, line 9 - line 44 * * figures 1,2,4,5 * -----	1,2,6,8	A47C21/04
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Place of search The Hague		Date of completion of the search 9 November 2005	Examiner Kus, S
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EPO FORM 1503 (03.02 (P04C01))

**ANNEX TO THE EUROPEAN SEARCH REPORT
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