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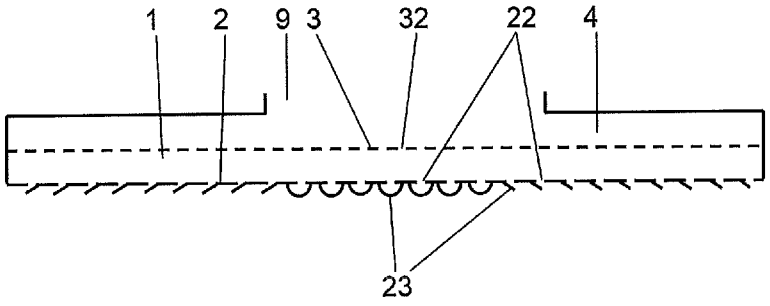

Fig. 1b

(57) Abstract: An air conditioning diffuser for distributing air inside a vehicle, said diffuser comprising an inlet (9) for supplying air and an outlet chamber (1) having an outlet wall (2) comprising a plurality of outlet orifices (22), the air conditioning diffuser is further provided with a permeable partition (3) comprising a plurality of pass-through orifices (32) for supplying air into the outlet chamber (1), and the outlet wall (2) of the outlet chamber (1) is provided with air deflecting pockets (23) for directing the air, which leaves the air conditioning diffuser through the outlet orifices (22), wherein at least some of the air deflecting pockets (23) are formed such that the air deflecting pocket (23) forms an open cavity on the outer side of the outlet wall (2) and covers at least one outlet orifice (22) spaced therefrom.

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AIR CONDITIONING DIFFUSER

Field of the invention

The invention relates to an air conditioning diffuser for distributing conditioned air inside a vehicle, particularly to a ceiling-mounted air conditioning diffuser for military vehicles, and to a vehicle comprising such air conditioning diffuser.

Background of the invention

The previously known air conditioning diffusers for distributing conditioned air inside a vehicle employ a sealable nozzle forming the necessary air outlet, the air passing through the nozzle being directed by the same in a single adjustable direction and in a single stream. A typical arrangement comprises multiple nozzles, each nozzle being assigned to one seat. Although the direction of the air blowing out of such nozzles can be adjusted, the use of the latter is usually perceived as uncomfortable by the passengers because the air stream created by such nozzles makes an impression of draught or, in other words, the passenger's head is exposed to a strong stream of cold air, when the cooling operation mode is selected, or to a strong stream of hot air, when the heating operation mode is selected.

Having the outlet openings in the form of micro-perforation does not provide a sufficient volume of distributed air in case of ceiling-mounted and wall-mounted textile diffusers for vehicles.

Hence, the objective of the present invention is to create a technical air-conditioning solution for vehicles, which technical solution would enable the air inside the passenger compartment of the vehicle to be cooled down or heated up more efficiently without being perceived uncomfortable by the passengers.

Summary of the invention

The above specified objective is substantially achieved by providing an air conditioning diffuser for distributing air inside a vehicle, said diffuser comprising an inlet for supplying air and an outlet chamber having an outlet wall comprising a plurality of outlet orifices, wherein the air conditioning diffuser is further provided with a permeable partition comprising a plurality of pass-through orifices for supplying air into the outlet chamber, and wherein the outlet wall of the outlet chamber is provided with air deflecting pockets for directing the air leaving the air conditioning diffuser

through the outlet orifices, wherein at least some of the air deflecting pockets are formed such that the air deflecting pocket forms an open cavity on the outer side of the outlet wall and covers at least one outlet orifice spaced therefrom.

Generally, the permeable partition is arranged between the inlet and the outlet chamber.

According to a preferred embodiment, the permeable partition has a surface area corresponding to 80 to 120% of the surface area of the outlet wall, preferably to 90 to 110% of the surface area of the outlet wall, and/or the permeable partition is arranged in parallel to the outlet wall.

According to particularly preferred embodiment, the diffuser further comprises an inlet chamber, into which an air supply mouths through the inlet and which is separated from the outlet chamber by means of the permeable partition. In that case it is advantageous, when the inlet has a smaller cross-sectional area than the inlet chamber, i.e. when the velocity of air flow is decreased when the air passes from the inlet into the inlet chamber.

Preferably, the air deflecting pockets assume a shape corresponding to a partial lateral area of a cone or truncated cone or pyramid and/or the air deflecting pockets widen towards their outlet openings.

Also preferably, each of the air deflecting pockets is assigned to one outlet orifice, the individual air deflecting pockets being arranged in groups, any of the groups comprising mutually adjacent air deflecting pockets, which direct the air in mutually parallel directions. Preferably there are at least 4 groups, preferably 6 groups, of the air deflecting pockets, each group of the air deflecting pockets directing the respective air flow in a different direction.

According to particularly preferred embodiment, the air conditioning diffuser is at least partially, preferably entirely, made of a woven or non-woven fabric or of a foil.

The drawbacks of prior art are substantially eliminated according to the invention by a vehicle comprising a passenger compartment and the above described air conditioning diffuser arranged inside the passenger compartment.

According to an advantageous embodiment the air conditioning diffuser is arranged along the ceiling of the passenger compartment of the vehicle and covers at least 6%, preferably at least 12%, of the ceiling surface area of the vehicle. Preferably, the vehicle comprises at least one seat with a backrest, generally a plurality of seats, arranged inside the passenger compartment, and each of the air deflecting pockets

directs the air to flow in an area which is outside the upper area of the respective nearest backrest, particularly which is outside the upper front area of the respective backrest, which is nearest to the particular air deflecting pocket.

Brief description of the drawings

For more detail, the present invention will be further described with reference to the accompanying drawings showing exemplifying embodiments, wherein Fig. 1a is a cross-sectional view of a first exemplifying embodiment of the air conditioning diffuser according to the invention, Fig. 1b is a similar cross-sectional view showing a second exemplifying embodiment, and Fig. 1c is another similar cross-sectional view showing the third exemplifying embodiment. Fig. 2 is a view illustrating an outlet wall of the air conditioning diffuser according to the invention, Figs. 3A, 3B and 3C show various embodiments of an outlet orifice along with an air deflecting pocket assigned thereto, Figs. 4A and 4B schematically show a side view and a rear view of a possible arrangement of the diffuser inside a passenger compartment of a vehicle, and Fig. 4C shows the diffuser of Fig. 4B in a plan view.

Description of exemplifying embodiments

The first exemplifying embodiment of the invention, which is schematically shown in Fig. 1a, comprises an inlet 9 for supplying air into the air conditioning diffuser, as well as an outlet chamber 1. A permeable partition 3, which is perforated or provided with pass-through orifices 32, is arranged between the inlet 9 and the outlet chamber 1. The individual pass-through orifices 32, i.e. the perforation holes, have preferably a surface area ranging between 3 and 500 mm^2.

Furthermore, the outlet chamber 1 comprises an outlet wall 2 which is preferably arranged opposite the permeable partition 3. The outlet wall 2 is provided with outlet orifices 22, the surface area of the individual outlet orifices 22 preferably ranging between 50 and 100 mm^2. The outlet orifices 22 are provided with air deflecting pockets 23 arranged outside the outlet chamber 1, i.e. on the outer side of the outlet wall 2, said pockets serving for adjusting the direction of the air flow leaving the air conditioning diffuser such that the direction of the air stream (i.e. the centreline of the cone-shaped outlet air stream) intersects the plane of the outlet wall 2 at an angle ranging between 1 to 70°, preferably between 20 to 60°.

Preferably, an air deflecting pocket 23 is assigned to each outlet orifice 22.

According to a further advantageous embodiment, the total surface area of the outlet orifices 22 corresponds to at least 10%, preferably at least 20%, of the total surface area of the outlet wall 2.

An air deflecting pocket 23 assigned to a corresponding outlet orifice 22 is attached to the outer side of the outlet wall 2 of the air conditioning diffuser and - when viewed in a projection which is perpendicular to the outlet wall 2 - the air deflecting pocket entirely covers the outlet orifice 22 from the outside. A cavity is formed between the air deflecting pocket 23 and the outlet wall 2, wherein the outlet orifice 22 leads into that cavity. The air deflecting pocket 23 widens towards its outlet orifice. Preferably, the air deflecting pocket 23 may assume the shape shown in Figs. 3A, 3B, 3C, namely a shape corresponding to a partial lateral area of a cone or of a truncated cone. Nevertheless, other shapes are also feasible, such as those corresponding to a partial lateral area of a pyramid, of a truncated pyramid, of sphere or the like. In order to ensure a stable shape and a proper function of the air deflecting pocket 23, the side parts of the same are attached to the outlet wall 2.

Preferably, one air deflecting pockets 23 is always assigned to a single outlet orifice 22. Some of the outlet orifices 22, particularly those arranged in the peripheral areas of the outlet wall 2, can be left without the air deflecting pockets 23 or, as the case may be, can be provided with another type of air deflecting pockets 23 assigned thereto.

In some particular cases, it may be also useful to make the cross-sectional areas of the outlet orifice 22 smaller than the area of the perpendicular projection of the corresponding air deflecting pocket 23 on the plane of the outlet wall 2, as shown in Figs. 3A and 3B.

An ideal spatial and directional arrangement of the air deflecting pockets 23 on the outlet wall 2 is largely dependent on the arrangement of the passenger compartment of the respective vehicle, on the location of the respective air conditioning diffuser inside the passenger compartment of the vehicle, as well as on the mutual spatial relationship between the seats of the vehicle and the installed air conditioning diffuser. Nevertheless, it is generally advantageous when the air deflecting pockets 23 are arranged in multiple groups, each group of air deflecting pockets directing the supplied air substantially in the same direction as indicated in Figs. 1A to 2. The symmetry axes of the perpendicular projections of the air deflecting pockets 23, which belong to one group of air deflecting pockets 23, into the

plane of the outlet wall 2 are substantially parallel to each other. Preferably, at least four groups or, more preferably, six groups of air deflecting pockets 23 are set up, the symmetry axes of the perpendicular projections of the air deflecting pockets 23 belonging to different groups into the plane of the outlet wall 2 being mutually concurrent or skew.

Fig. 1b shows a more preferred embodiment of the invention, the difference between the embodiments shown in Figs. 1a and 1b consisting in that the air conditioning diffuser according to the embodiment shown in Fig. 1b comprises an additional inlet chamber 4 arranged between the inlet 9 for supplying air and the permeable partition 3, the latter having its surface area substantially equal to that of the outlet wall 2. In other words, an additional expansion space (formed by the inlet chamber 4) is arranged downstream the inlet 9 of the air conditioning diffuser, said expansion space causing the supplied air to diffuse and decelerate before entering the outlet chamber 1. The remaining features of the embodiment shown in Fig. 1b are substantially identical to those of the embodiment shown in Fig. 1a.

According to the embodiments shown in Figs. 1A and 1b, the air stream is led into the air conditioning diffuser in a direction that is substantially perpendicular to the permeable wall 3.

The embodiment shown in Fig. 1c differs from those shown in Figs. 1A and 1b particularly in that the air stream is led into the air conditioning diffuser in a lateral direction, i.e. in a direction which is parallel to the permeable partition 3.

In the embodiments shown in Figs. 1b and 1c, the outlet wall 2 provided with the outlet orifices 22 and air deflecting pockets 23 is similar to that described above with reference to Fig. 1a.

Another advantageous improvement of the embodiments shown in Fig. 1b and/or 1c consists in that the volume of the inlet chamber 4 is equal to or greater than the volume of the outlet chamber 1.

In certain cases (particularly in the cases involving the embodiments shown in Figs. 1a and 1b) it may be advantageous to form pass-through orifices 32 and/or outlet orifices 22 having different sizes (surface areas). In a corresponding exemplifying embodiment, the pass-through orifices 32 (and/or outlet orifices 22), which are arranged closer to the inlet 9 for supplying air, are smaller than the pass-through orifices 32 (and/or outlet orifices 22) arranged in locations more distant from the inlet 9.

The air conditioning diffuser according to the present invention is advantageously built and installed into a vehicle such that the outlet wall 2 of the air conditioning diffuser forms / covers at least 6%, preferably at least 12% of the ceiling surface area of the vehicle, the outlet orifices 22 with the air deflecting pockets 23 being deployed substantially throughout the entire surface area of the outlet wall 2. Nevertheless, the air conditioning diffuser according to the present invention can be also arranged along the side or rear inner wall of the vehicle.

According to another advantageous embodiment, the air deflecting pockets 23 or the groups of air deflecting pockets 23 are arranged in such a way that they do not direct the air streams to the areas towards the heads of the passengers, i.e. towards the front areas of the upper parts of the backrests and/or headrests of the individual seats.

Preferably, the air-conditioning diffuser, including the permeable partition 3 and the air deflecting pockets 23, is made of a woven or non-woven fabric or foil. Thus, it is machine-washable and has a lower weight when compared to an air-conditioning ducting element made of a metallic material. Alternatively, the air conditioning diffuser or at least some parts thereof can be made of a thin plastic material.

The air conditioning diffuser shown in Fig. 1a works in the following manner: the conditioned air stream is led through the permeable partition 3, i.e. through the pass-through orifices 32 and into the outlet chamber 1. When passing through the pass-through orifices 32, the air stream flowing to the outlet chamber 1 is being equalized and diffused in the outlet chamber 1. Subsequently, the air stream leaves the outlet chamber 1 through the outlet orifices 22, the air deflecting pockets 23 causing the air stream to be distributed in different directions, each direction extending at an angle less than 90°, particularly at an angle ranging between 20 and 60°, with respect to the plane of the outlet wall 2 of the air conditioning diffuser. According to an exemplifying advantageous embodiment, the majority of groups of air deflecting pockets 23 can be arranged in a manner enabling the individual outlet air streams to flow to the respective nearest side, front and rear walls / windows of the vehicle.

The embodiments shown in Figs. 1b and 1c work in a similar manner, the only difference consisting in that the air is initially supplied into the inlet chamber 4, where the velocity of the air stream decreases, and then it is led through the pass-through

orifices 32 into the outlet chamber 1 and afterwards through the outlet orifices 22 out of the air conditioning diffuser, e.g. into the interior of the vehicle. In comparison with the embodiment shown in Fig. 1a, the embodiments shown in Figs. 1b and 1c are advantageous in that it is accompanied by less noise and there is a lower pressure drop when the air passes through the permeable partition 3.

An exemplifying preferred arrangement of an air conditioning diffuser inside a passenger compartment 10 of a vehicle is shown in Figs. 4A and 4B. The air conditioning diffuser is arranged on the ceiling 11 of the passenger compartment 10, the latter further comprising seats 12 with backrests 13. In the above figures, the representation of the air deflecting pockets 23 is replaced by the indication of the directions along which the air streams are directed by the air deflecting pockets. Finally, Fig. 4C shows the air conditioning diffuser of Fig. 4B in a plan view where the arrangement of the air deflecting pockets 23 on the outlet wall 2 is marked out.

The air conditioning diffuser according to the present invention is particularly useful when installed in the cabins of transportation vehicles, preferably in the cabins of military vehicles used for transporting multiple passengers. Nevertheless, it is also usable for the cabins of other types of vehicles or for mobile homes, provided that it can be connected to a source of conditioned (usually cooled or heated) air. The air stream leaving the outlet chamber through the outlet orifices 22, which are arranged in the outlet wall 2, is directed by the air deflecting pockets into the areas out of the assumed positions of the heads of the passengers occupying the seats 12 and reclining against the backrests 13 inside the cabin 10 of the respective vehicle. This means that each air deflecting pocket 23 primarily causes the corresponding outlet air stream to flow in a direction away from the upper area of the backrest 13 that is situated closest to the respective air deflecting pocket 23.

Although multiple exemplary embodiments are described above, it is obvious that those skilled in the art would easily appreciate further possible alternatives to those embodiments. Hence, the scope of the present invention is not limited to the above exemplary embodiments, but it is rather defined by the appended claims.

CLAIMS

1. An air conditioning diffuser for distributing air inside a vehicle, said diffuser comprising an inlet (9) for supplying air and an outlet chamber (1) having an outlet wall (2) comprising a plurality of outlet orifices (22), **characterized in that** the air conditioning diffuser is further provided with a permeable partition (3) comprising a plurality of pass-through orifices (32) for supplying air into the outlet chamber (1), and in that the outlet wall (2) of the outlet chamber (1) is provided with air deflecting pockets (23) for directing the air, which leaves the air conditioning diffuser through the outlet orifices (22), wherein at least some of the air deflecting pockets (23) are formed such that the air deflecting pocket (23) forms an open cavity on the outer side of the outlet wall (2) and covers at least one outlet orifice (22) spaced therefrom.

2. The air conditioning diffuser according to claim 1, **characterized in that** the permeable partition (3) has a surface area corresponding to 80 to 120% of the surface area of the outlet wall (2), preferably to 90 to 110% of the surface area of the outlet wall (2), and/or the permeable partition (3) is arranged in parallel to the outlet wall (2).

3. The air conditioning diffuser according to claim 1 or 2, **characterized in that** it further comprises an inlet chamber (4), into which an air supply mouths through the inlet (9) and which is separated from the outlet chamber (1) by means of the permeable partition (3).

4. The air conditioning diffuser according to any of the preceding claims, **characterized in that** the air deflecting pockets (23) assume a shape corresponding to a partial lateral area of a cone or truncated cone or pyramid and/or the air deflecting pockets (23) widen towards their outlet openings.

5. The air conditioning diffuser according to any of the preceding claims, **characterized in that** each of the air deflecting pockets (23) is assigned to one outlet orifice (22), the individual air deflecting pockets (23) being arranged in groups, any of the groups comprising mutually adjacent air deflecting pockets (23), which direct the air in mutually parallel directions.

6. The air conditioning diffuser according to claim 5, **characterized in that** it comprises at least 4 groups, preferably 6 groups, of the air deflecting pockets (23), each group of the air deflecting pockets (23) directing the respective air flow in a different direction.

7. The air conditioning diffuser according to any of the preceding claims, **characterized in that** it is at least partially, preferably entirely, made of a woven or non-woven fabric or of a foil.

8. A vehicle comprising a passenger compartment (10), **characterized in that** an air conditioning diffuser according to any of the preceding claims is arranged inside the passenger compartment (10).

9. The vehicle according to claim 8, **characterized in that** the air conditioning diffuser is arranged along the ceiling (11) of the passenger compartment (10) of the vehicle and covers at least 6%, preferably at least 12%, of the ceiling surface area of the passenger compartment (10) of the vehicle.

10. The vehicle according to claim 8 or 9, **characterized in that** it comprises at least one seat (12) with a backrest (13) arranged inside the passenger compartment (10), each of the air deflecting pockets (23) directs the air to flow in an area which is outside the upper area of the respective nearest backrest (13), particularly which is outside the upper front area of the respective nearest backrest (13).

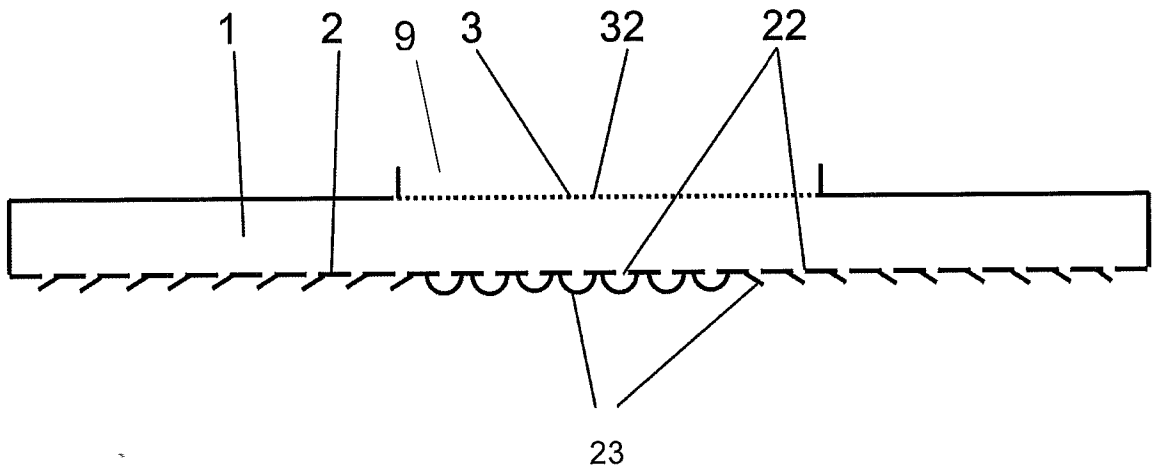

Fig. 1a

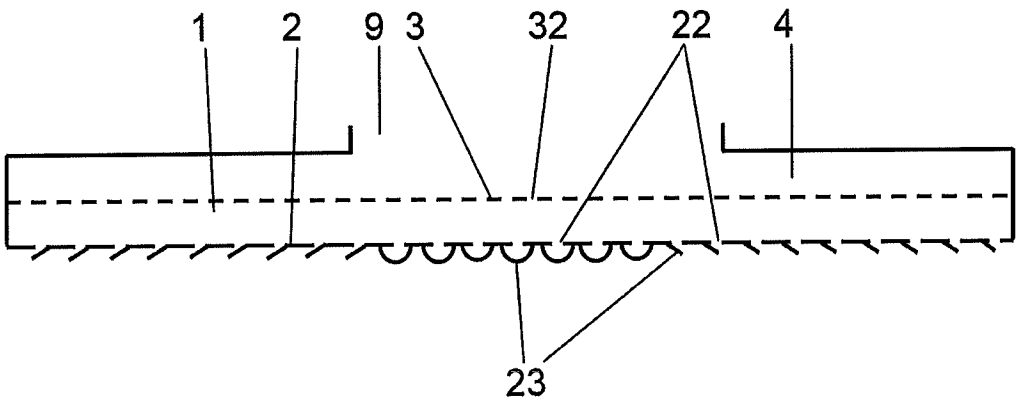

Fig. 1b

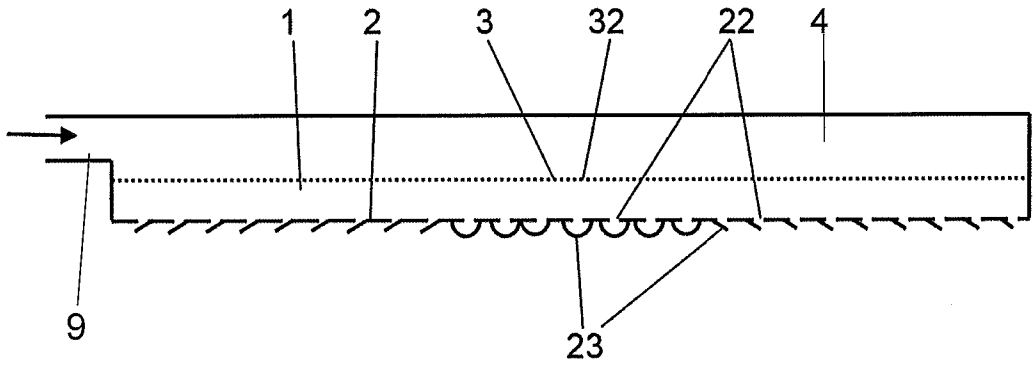

Fig. 1c

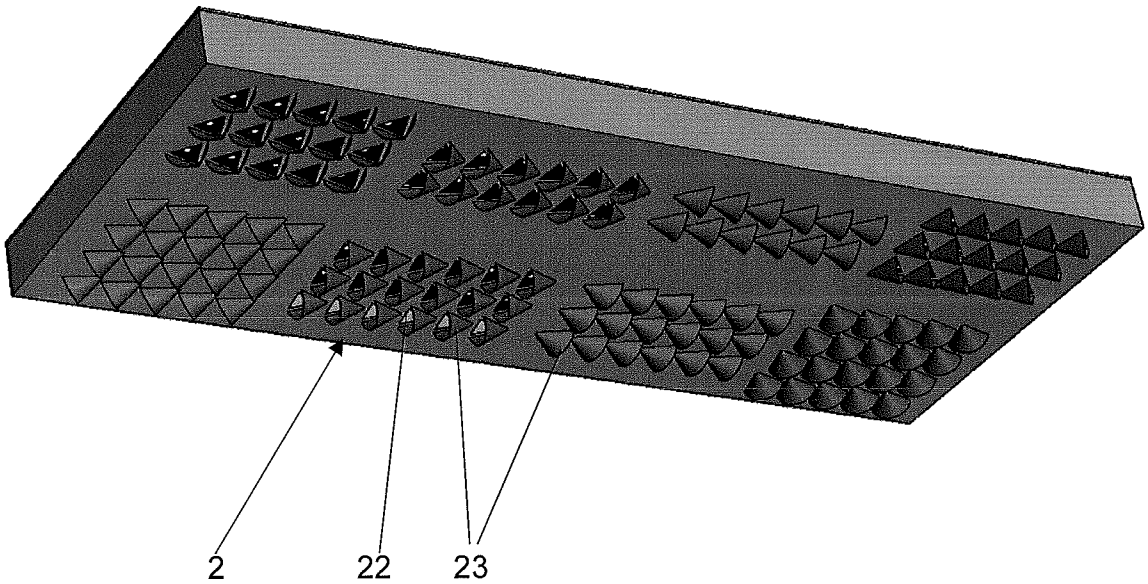

Fig. 2

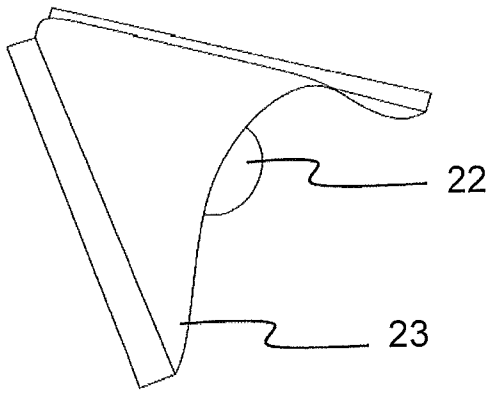

Fig. 3A

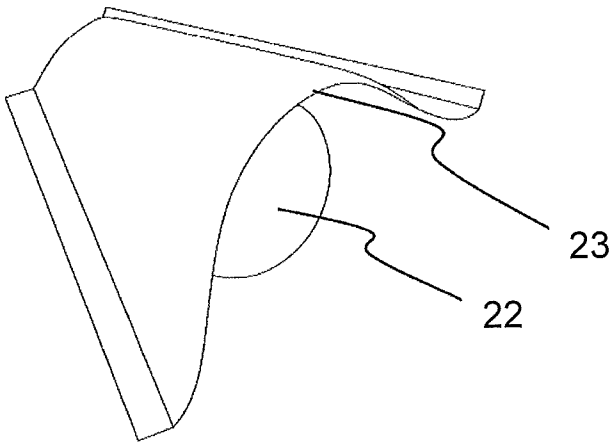

Fig. 3B

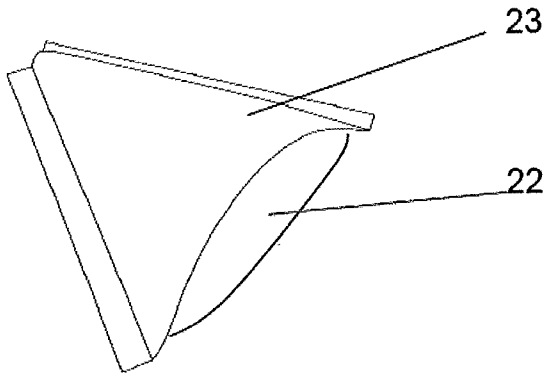

Fig. 3C

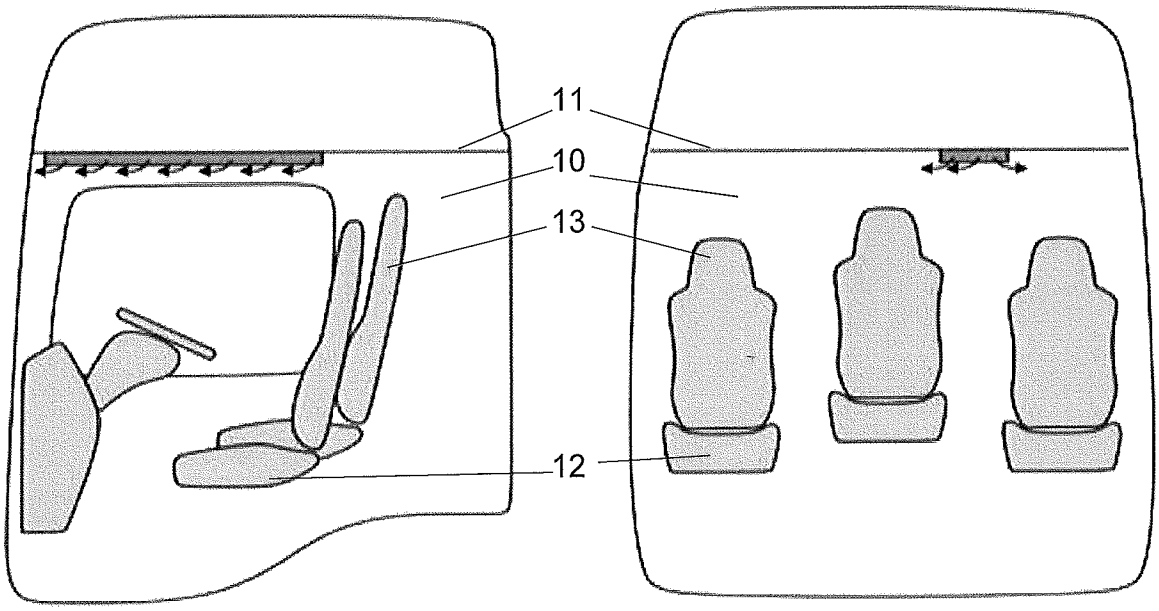

Fig. 4A

Fig. 4B

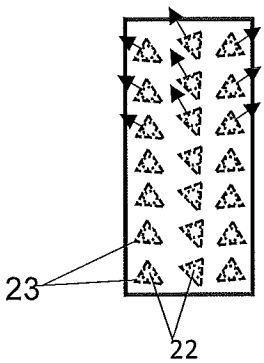

Fig. 4C

INTERNATIONAL SEARCH REPORT

International application No
PCT/CZ2018/050029

A. CLASSIFICATION OF SUBJECT MATTER
INV. B60H1/00 B60H1/24 B60H1/34
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
B60H F24F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 2 172 944 A (FORBUSH NORRIS RALPH) 12 September 1939 (1939-09-12) column 1, line 33 - column 4, line 32; figures 1-6	1-10
Y	US 2014/113536 A1 (GOENKA LAKHI NANDLAL [US] ET AL) 24 April 2014 (2014-04-24) paragraphs [0013] - [0026]; figures 1-3	1-10
Y	US 2017/030608 A1 (PRIHODA ZDENEK [CZ] ET AL) 2 February 2017 (2017-02-02) paragraphs [0023] - [0043]; figures 1-9	1-10
Y	FR 2 468 076 A1 (AIR IND [FR]) 30 April 1981 (1981-04-30) page 4, line 10 - page 8, line 5; figures 1-7	1-10

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[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
5 October 2018	18/10/2018

Name and mailing address of the ISA/	Authorized officer
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Form PCT/ISA/210 (second sheet) (April 2005)

INTERNATIONAL SEARCH REPORT

International application No
PCT/CZ2018/050029

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
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