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(54) **Air supply device**

(57) An air supply device (1) comprises an inlet (2) and an outlet and a chamber arranged therebetween. It further comprises a diffuser element (4), an airflow guide (5) and, arranged therebetween, a chamber, the diffuser element (4) and the airflow guide (5) being arranged in said first chamber. The device (1) further comprises an air distributor (6) arranged downstream of the airflow guide (5).

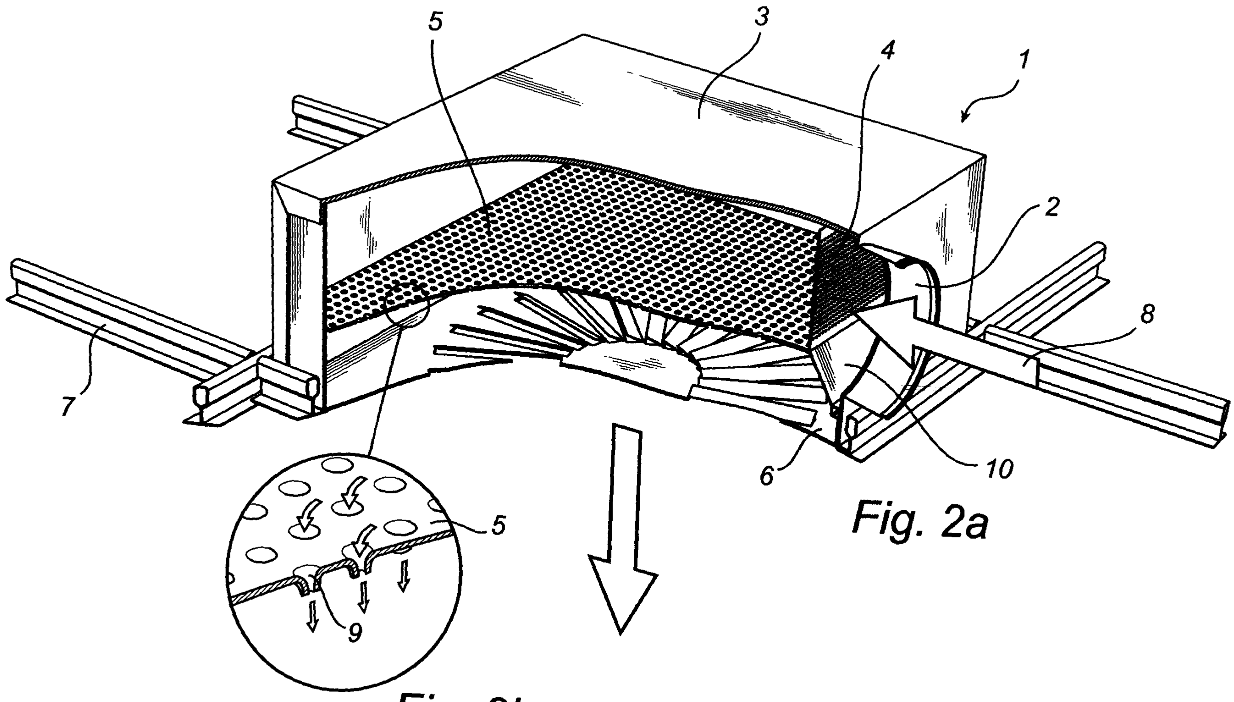

Fig. 2a

Fig. 2b

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## Description

Field of the Invention

**[0001]** The present invention relates to an air supply device comprising an inlet and an outlet and a chamber arranged therebetween.

Background Art

**[0002]** In installations where a large number of air supply devices are to be arranged, it is desirable to be able to have a maximum pressure in the duct up to the air supply device in order to simplify adjustment. A high final pressure drop across the device, i.e. high relative to the pressure drop in the duct system, implies that the effect of the pressure drop in the duct system between the devices will be less important. High pressure drops, however, increase the risk of noise problems. Airflow rates are usually controlled by dampers, which may produce acoustic nuisances. Such noise is normally eliminated by the dampers being combined with sound absorbers. Preferably the construction is simple and it should be possible to easily clean the duct system and clean components for devices etc. At high pressures, such as 100 Pa, no air supply devices are available on the market to satisfy all the above-mentioned requirements.

Summary of the Invention

**[0003]** The object of the present invention therefore is to provide an air supply device that solves the above-described problems.

**[0004]** According to the invention, this object is achieved by the air supply device of the type mentioned by way of introduction being given the features that are stated in claim 1. Preferred embodiments of the air supply device are defined in the dependent claims.

**[0005]** The inventive air supply device comprises an inlet and an outlet and, arranged therebetween, a chamber. It further comprises a diffuser element, an airflow guide and, arranged therebetween, a chamber, the diffuser element and the airflow guide being arranged in said first chamber, the device further comprising an air distributor arranged downstream of the airflow guide. Thus air first flows to the diffuser element which decreases the air velocity and ensures that the air is evenly distributed over the diffuser element. Subsequently the air flows through the diffuser element and into the intermediate chamber and is there distributed over the airflow guide which directs the airflow on to the air distributor. Between the airflow guide and the air distributor there is a third chamber which reduces the influence of the impulse from the individual nozzles. This solution involving a diffuser element and an airflow guide has been found to resist high pressure drops without the normally ensuing problems in the form of noise. As a result, sound absorbers can be excluded. The high pressure drop also implies that fire dampers need not be installed (provided that the current rules do not require a special solution). The difference in flow between the air supply devices decreases with a high pressure drop, which results in a smaller need for individual adjustment of each device. The overall height of an air supply device with dampers according to prior-art technique with a duct having a diameter of 160 mm usually is about 30 cm. With an air supply device according to the present invention it has been found possible to reduce this overall height by more than 20%.

**[0006]** The diffuser element is preferably a perforated plate. The perforations should have an area corresponding to that of circular holes where the diameter is greater than or equal to 2 mm and smaller than or equal to 5 mm. If the holes of the perforations are too small, problems may arise by, for instance, filter fibres clogging the perforations and thus causing a lower airflow rate. If instead the perforations are too large, there is a risk that the equalising effect of the air velocity along the plate does not occur.

**[0007]** In a preferred embodiment of the present invention, the airflow guide comprises nozzles, which preferably are distributed on a plate. By nozzles is meant anything from openings and holes to nozzles through which air can flow and which more or less can affect the direction of the air when passing and the flow direction out of the nozzles. The advantage of nozzles thus is that the air direction can be affected, and by distributing the nozzles on a plate, a uniform velocity distribution along the entire plate is achieved. When smaller flow rates are desired, small groups of nozzles can be arranged on the airflow guide, for instance, in the centre of the airflow guide.

**[0008]** The airflow guide and the diffuser element are preferably removably arranged. This is a great advantage when the duct is to be cleaned for instance. Also elements can be removed for cleaning in, for instance, a dishwasher. As a rule, a damper is arranged upstream of the air supply device, which must be removed for good access to the duct. The present invention renders easy access to the duct possible by the airflow guide and the diffuser element being dismounted.

**[0009]** In a further preferred embodiment of the present invention, the airflow guide is arranged in operation to direct air flowing therein at right angles to the plane of the outlet, an air distributor being arranged at the outlet. Preferably, the air distributor is arranged at a distance from the airflow guide and arranged to deflect the airflow. In a mixing ventilation, the air supply devices are often arranged in the suspended ceilings and then the air supply ducts extend in most cases horizontally along the ceiling. Air supply devices are normally arranged with the opening directed downwards. To make the airflow to the outlet as uniform as possible, the airflow guide should therefore in a preferred embodiment be arranged to direct the air to the outlet. To prevent the air from flowing straight out of the outlet and cause draught, i.e. straight down if the air supply device is arranged in the ceiling, an air distributor should be arranged at the outlet to distribute the air over a larger surface. For the airflow to hit the air distributor as uniformly as possible, the air distributor should therefore be arranged at a distance from the airflow guide. The air distributor preferably deflects the air so as to prevent high air velocities and, thus, draught. Without the air being deflected, there is a risk that the air is concentrated into a concentrated flow with high velocity due to the induction effect.

**[0010]** In an alternative embodiment, the air supply device is designed as a module in a suspended ceiling, i.e. designed so that it may replace one of the plates in a suspended ceiling. Preferably the air distributor is then arranged flush with the suspended ceiling so that the air is directed away from the air supply device along the suspended ceiling while at the same time, in terms of appearance, it does not project from the rest of the suspended ceiling.

**[0011]** Preferably, at least a portion of the diffuser element is arranged at an angle to the airflow guide, which angle is smaller than 90°. The airflow guide requires "quiet" surroundings, which means that it is better to have an inwardly angled diffuser element which owing to an angle deviating from 90° has a larger surface, said inwards angling besides implying that the diffuser element will extend further into the pressure chamber, i.e. into the chamber between the diffuser element and the airflow guide, thus resulting in better distribution of air in the pressure chamber.

**[0012]** In another alternative embodiment, a cooling-coil battery is arranged adjacent to the air supply device to be able to cool air flowing through the cooling-coil battery, and is most preferably arranged in such a manner that indoor air is drawn through the cooling-coil battery by induction. The induction effect arises in consequence of the static pressure being lower as air flows out of the air supply device, which thus draws in indoor air due to this negative pressure.

**[0013]** In one embodiment, a cooling-coil battery is arranged parallel to the plane of the outlet and the airflow guide comprises nozzles arranged in the centre of the airflow guide and nozzles arranged along the periphery of the airflow guide. The nozzles in the centre ensure that the indoor air flowing through the cooling-coil battery is directed to the periphery of the airflow guide downstream of the airflow guide, and the nozzles along the periphery direct the air on to the air distributor.

**[0014]** In an alternative embodiment, a cooling-coil battery is arranged perpendicular to the plane of the outlet and at a distance from the centre of the air distributor, nozzles being arranged along the periphery of the airflow guide. In this embodiment, the indoor air, after passing through the cooling-coil battery, flows towards the periphery of the airflow guide, which means that nozzles are only necessary along the periphery of the airflow guide to direct the air to the air distributor.

**[0015]** Preferably, the air distributor spreads the air 360°. The more the air is spread, the smaller the risk of draught. The absolutely major part of all air supply devices that are manufactured today are provided with elements that spread the air effectively all around, such as rotating means with fins.

**[0016]** In an alternative embodiment, a damper is arranged between the inlet and the diffuser element. A damper can in this position take a smaller flow variation. For instance, the damper can be formed with perforations corresponding to those of the diffuser element. In a position where the damper is arranged adjacent to the diffuser element, the throttling is minimal, in which case throttling increases when the damper is moved towards the inlet of the air supply device. Alternatively, the damper can be laterally displaced relative to the diffuser element and, thus, change the size of the openings.

## Brief Description of the Figures

**[0017]** The invention will now be described in more detail with reference to the accompanying schematic Figures which for the purpose of exemplification illustrate a currently preferred embodiment of the invention.

**[0018]** Fig. 1 is an exploded view in perspective of an air supply device according to the present invention.

**[0019]** Fig. 2a is a cross-sectional view of an air supply device according to the present invention.

**[0020]** Fig. 2b shows an enlarged portion of the air supply device in Fig. 2a.

**[0021]** Fig. 3a is a side view of an air supply device according to the present invention.

**[0022]** Fig. 3b shows an enlarged portion of the air supply device in Fig. 3a.

**[0023]** Fig. 4 is a side view of an air supply device according to an alternative embodiment of the present invention.

**[0024]** Fig. 5 is a side view of an air supply device with a cooling-coil battery according to the present invention.

## Description of Preferred Embodiments

**[0025]** The air supply device in Fig. 1 comprises an inlet 2, a casing 3, a perforated plate 4 (diffuser element), an airflow guide 5 and an air distributor 6. The air supply device shown in Fig. 1 is adapted to be mounted in a suspended ceiling 7.

**[0026]** Fig. 2a is a cross-sectional view of an air supply device 1. The air flows into the air supply device as indicated by the arrow 8 and enters a first chamber, distribution chamber. The air flows on through the perforated plate 4 and into a second chamber, pressure chamber, from which the air flows on through the airflow guide 5. Fig. 2b shows an enlarged portion of the airflow guide 5 where the design of the nozzles 9 is more evident. This design of the nozzles 9 has been found to give a smooth transition from static pressure to dynamic pressure without great losses, compared with, for instance, the perforated plate 4. The purpose of the perforated plate 4 differs, however, from the purpose of the airflow guide 5.

The perforated plate 4 is above all intended to distribute the airflow uniformly in the intermediate chamber whereas the airflow guide 5 is rather intended to generate a pressure drop without noise and at the same time direct the airflow in the desired direction. After passing through the airflow guide 5, the air enters a further chamber, impulse chamber, before it flows out in the room that is to be ventilated via an air distributor 6 which initially spreads the air along the suspended ceiling 7. The distance between the airflow guide 5 and the air distributor 6 depends on the size of the nozzles 9. With a nozzle size where the diameter is 6 mm, the distance should be about 10 cm and preferably more than 8 cm. If instead the diameter is 8 mm, the distance should be at least 12 cm and most preferably 15 cm. Thus, the more holes, the smaller distance is necessary between the airflow guide 5 and the air distributor 6.

**[0027]** Fig. 3a is a side view of the air supply device in Fig. 2a, in which it is illustrated more distinctly how the air flows in the device. Fig. 3b shows an enlarged portion of the air supply device in Fig. 3a and shows an embodiment of the suspension of the continuous sheet metal portion 10 which is arranged at an angle to the perforated plate 4. Preferably the perforated plate and the continuous metal sheet portion 10 are made in one piece. The airflow guide 5 is further also releasably mounted and replaceable by other airflow guides in order to adjust the device to various desiderata regarding pressure and/or flow rate. By removing the air distributor 6 and after that the airflow guide 5 and the perforated plate 4 with the continuous sheet-metal portion, the air supply device and/or the air supply duct can be fully cleaned. In traditional air supply devices, dampers are frequently arranged, which normally require much work to allow removal in connection with, for instance, cleaning of the air ducts.

**[0028]** Fig. 4 shows an alternative embodiment where the diffuser element 11 is angled inwards over the airflow guide 5. With this solution, the distribution of air will be still more uniform since air does not have to flow very far from the diffuser element 11 through the pressure chamber to reach the far end of the airflow guide seen from the diffuser element 11. Moreover, in Fig. 4 the continuous sheet metal portion 15 is elongated so that it extends a distance up between the distribution chamber and the pressure chamber. This results in a quieter flow pattern adjacent to the nozzles in the airflow guide 5 which are arranged next to the sheet metal portion 15.

**[0029]** Fig. 5 illustrates an air supply device 1 according to the present invention which also comprises a cooling-coil battery 14. In the embodiment shown, the cooling-coil battery 14 is arranged horizontally, which means that indoor air will flow up through the cooling-coil battery 14 by induction and be directed to the sides of the device by the air which flows out through the airflow guide 5 through the nozzles 12 closest to the centre of the airflow guide 5. When the mixture of cooled indoor air and supply air from the centre nozzles 12 flows to the sides of the device 1, the air is further directed down to the air distributor 16 by supply air flowing out of the nozzles 13 along the periphery of the airflow guide 5. In an alternative embodiment (not shown), a vertically arranged cooling-coil battery is arranged at a distance from the centre of the air distributor and preferably extends between the air distributor 16 and the airflow guide 5, i.e. in the impulse chamber. This solution thus allows indoor air to first flow up in the centre of the cooling-coil battery and after that flow horizontally out of the cooling-coil battery. This solution requires only that supply air flows out of nozzles 13 along the periphery of the airflow guide 5 in order to direct the cooled indoor air down to the air distributor 16.

**[0030]** It will be appreciated that many modifications of the embodiment of the invention as described above are conceivable within the scope of the invention, as defined by the appended claims. For instance, as described above, the air supply device can be designed to be arranged in ceilings without suspended ceilings or alternatively to be mounted on a wall. Moreover the cooling-coil battery can advantageously be mounted with flexible tubes for increased dismountability of the air supply device and increased accessibility to the cooling-coil battery and other parts of the air supply device.

## Claims

1. An air supply device (1) comprising an inlet (2) and an outlet and, arranged therebetween, a chamber, characterised in that
it further comprises a diffuser element (4), an airflow guide (5) and, arranged therebetween, a chamber, the diffuser element (4) and the airflow guide (5) being arranged in said first chamber, the device (1) further comprising an air distributor (6) arranged downstream of the airflow guide (5).

2. An air supply device (1) as claimed in claim 1, in which said diffuser element (4) is a perforated plate.

3. An air supply device (1) as claimed in claim 2, in which said perforations have an area corresponding to that of circular holes where 2 mm ≤ d ≤ 5 mm.

4. An air supply device (1) as claimed in claim 1, in which said airflow guide (5) comprises nozzles (9).

5. An air supply device (1) as claimed in claim 4, in which said nozzles (9) are distributed on a plate (5).

6. An air supply device (1) as claimed in claim 1, in which said airflow guide (5) and diffuser element (4) are removably arranged.

7. An air supply device (1) as claimed in claim 1, in which the airflow guide (5) is arranged in operation to direct air flowing therein at right angles to the plane

of the outlet, the air distributor (6) being arranged at the outlet.

**8.** An air supply device (1) as claimed in claim 7, in which the air distributor (6) is arranged at a distance from the airflow guide (5).

**9.** An air supply device (1) as claimed in claim 7, in which the air distributor (6) is arranged in operation to deflect the airflow.

**10.** An air supply device (1) as claimed in claim 1, which is designed as a module in a suspended ceiling (7).

**11.** An air supply device (1) as claimed in claim 10, in which the air distributor (6) is arranged flush with the suspended ceiling (7).

**12.** An air supply device (1) as claimed in claim 1, in which at least a portion of the diffuser element (11) is arranged at an angle to the airflow guide (5), which angle is smaller than 90°.

**13.** An air supply device (1) as claimed in claim 1, in which a cooling-coil battery (14) is arranged.

**14.** An air supply device (1) as claimed in claim 13, in which the cooling-coil battery (14) is arranged in such a manner that indoor air in operation of the air supply device (1) is drawn through the cooling-coil battery (14) by induction and mixed with supply air.

**15.** An air supply device (1) as claimed in claim 14, in which a cooling-coil battery (14) is arranged parallel to the plane of the outlet and in which the airflow guide (5) comprises nozzles (12) arranged in the centre of the airflow guide (5) and nozzles (13) arranged along the periphery of the airflow guide.

**16.** An air supply device (1) as claimed in claim 14, in which a cooling-coil battery (14) is arranged perpendicular to the plane of the outlet and at a distance from the centre of the air distributor (6), nozzles (13) being arranged along the periphery of the airflow guide (5).

**17.** An air supply device (1) as claimed in any one of the preceding claims, in which the air distributor spreads the air 360°.

**18.** An air supply device (1) as claimed in any one of the preceding claims, in which a damper is arranged between the inlet and the diffuser element (4, 11).

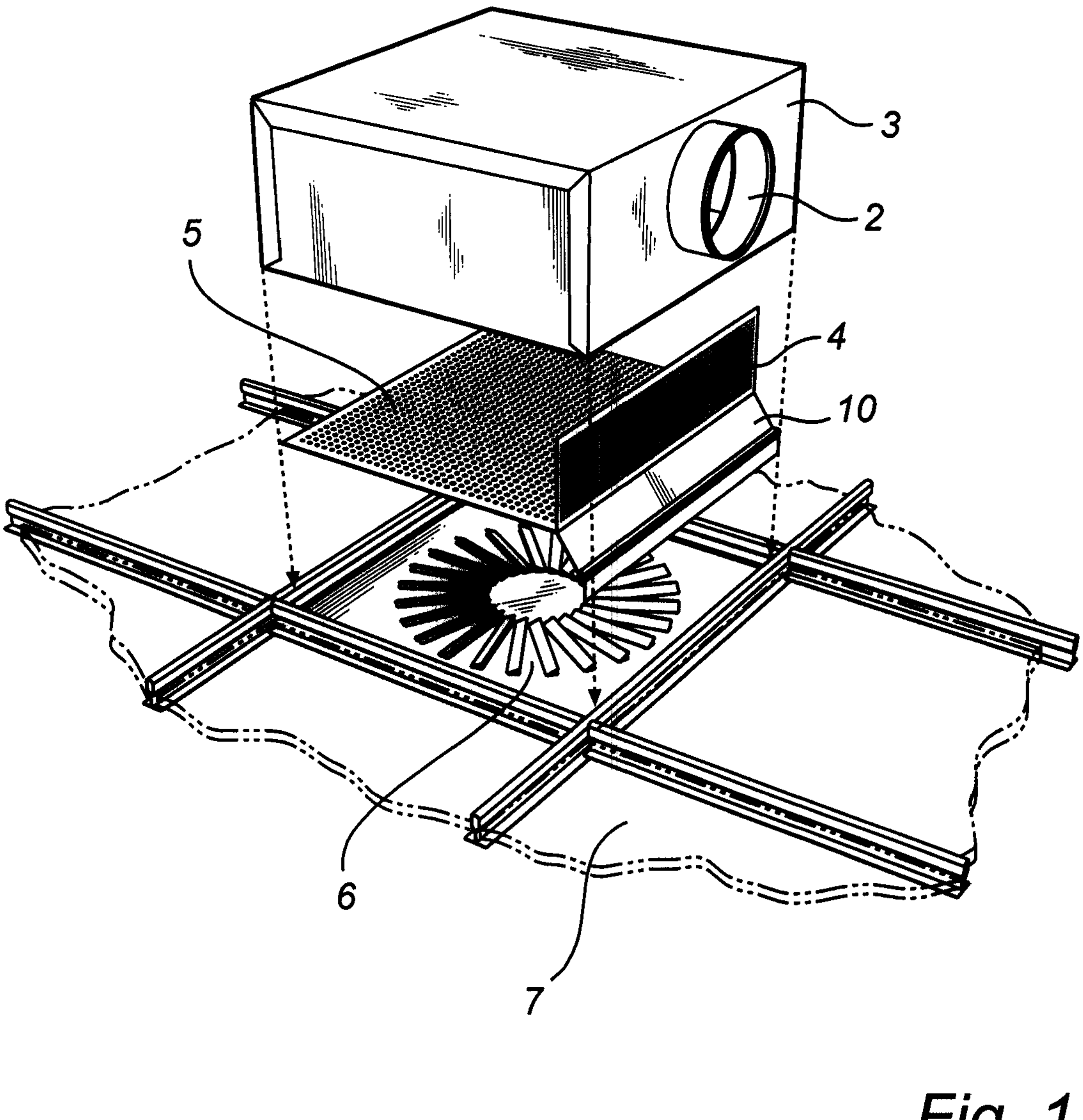


Fig. 1

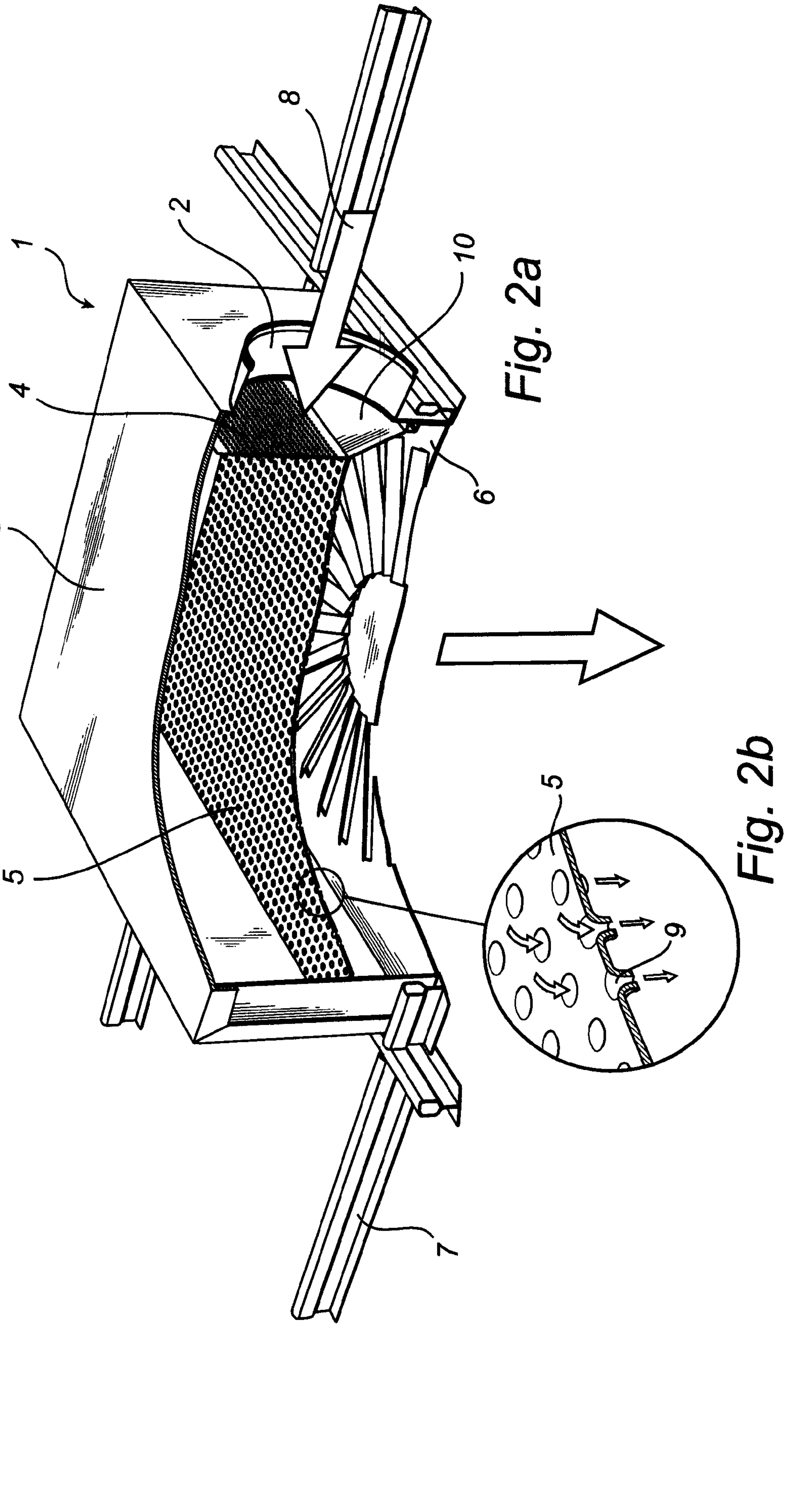


Fig. 2a

Fig. 2b

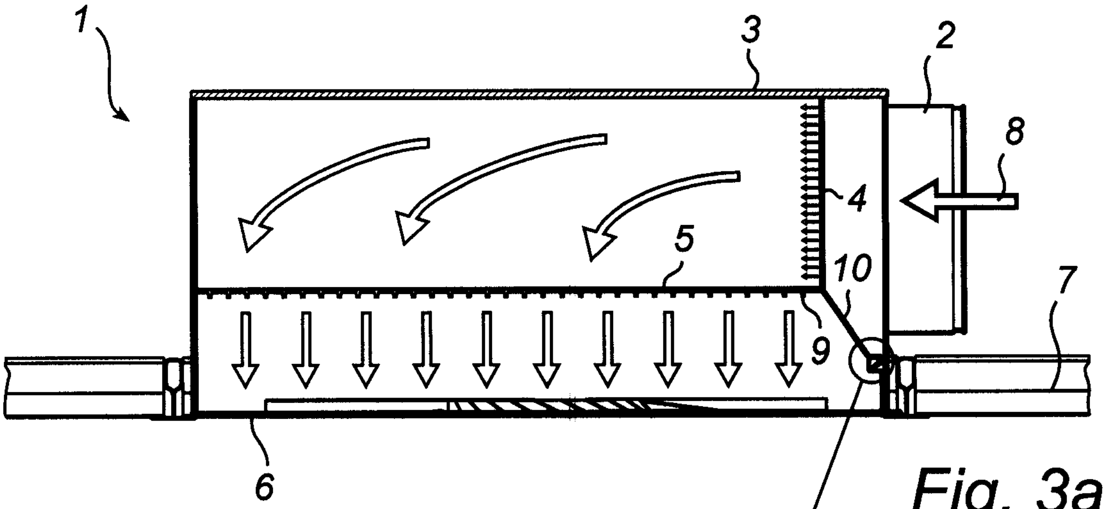


Fig. 3a

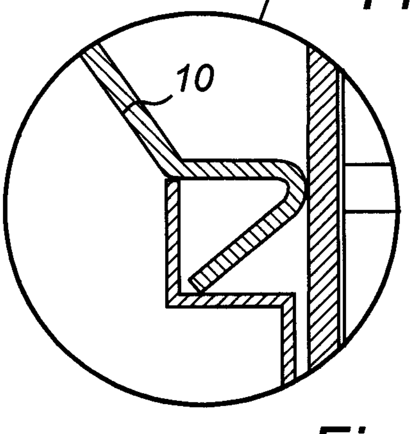


Fig. 3b

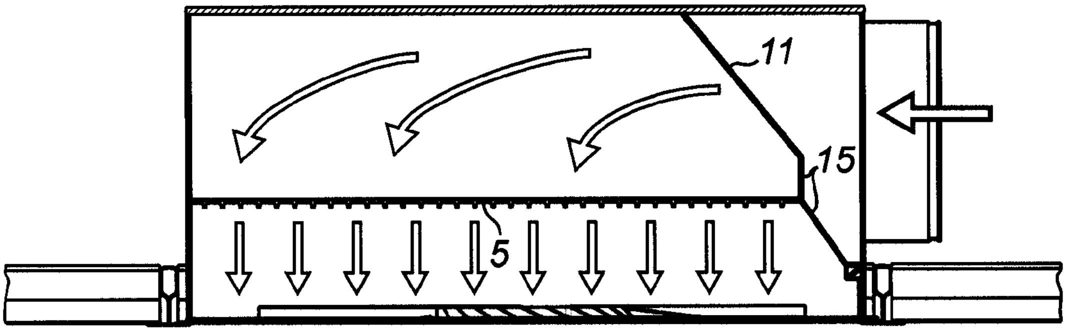


Fig. 4

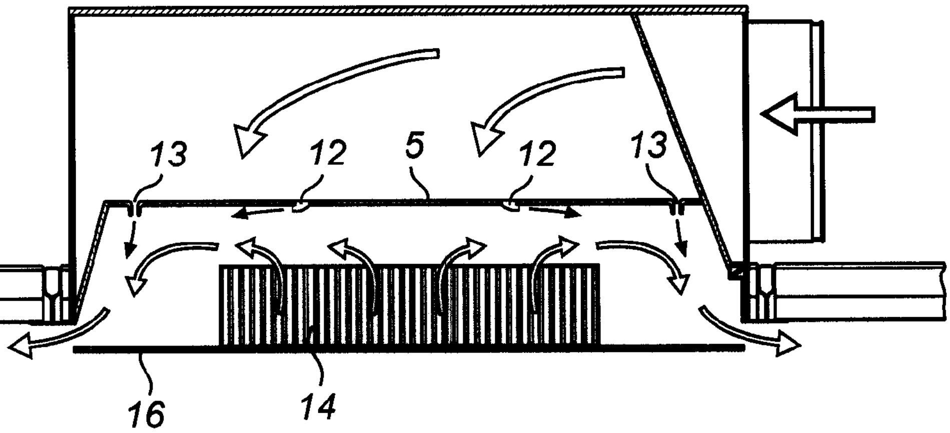


Fig. 5

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Application Number
EP 05 10 4844

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|---|---|---|
| Munich | 26 October 2005 | Lienhard, D |

CATEGORY OF CITED DOCUMENTS

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